Dental Infections And the Degenerative Diseases

(Volume II)
(Part II)

BEING A CONTRIBUTION TO THE PATHOLOGY OF FUNCTIONAL AND DEGENERATIVE ORGAN AND TISSUE LESIONS

BY

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THIS IS THE CLINICAL ASPECT OF VOLUME 1
"DENTAL INFECTIONS, ORAL AND SYSTEMIC"
VOLUME I
PARTS 1 AND II
PRESENTS

RESEARCHES ON FUNDAMENTALS OF ORAL AND SYSTEMIC EXPRESSIONS OF DENTAL INFECTIONS

VOLUME II
PARTS I AND II
PRESENTS
RESEARCHES ON CLINICAL EXPRESSIONS OF DENTAL INFECTIONS

CHAPTER LXV.

ALIMENTARY TRACT AND ASSOCIATED ORGANS.

DISCUSSION.

We are grouping together the lesions of the various organs and tissues of the alimentary tract, both because of the biologic classification and because our various studies have shown that susceptibility to the rheumatic group lesions of these tissues seem to show a definite relationship between them. For example, individuals and their families will frequently show susceptibilities in digestive tract only, sometimes as gall-stones, other times as appendicitis, both associated with attacks of indigestion not accounted for by the food, or the latter only. This was illustrated in Chapter 22. Very frequently attacks of acute indigestion, or chronic digestive disturbances affecting either the stomach or the large or small intestines, will be associated with acute nervous disturbances. We have thought of these as being largely due to irritation of the sympathetic nervous system. This view, however, does not explain some strange things that have come out in our animal inoculations. One of these is illustrated in Case No. 965.

Case No. 965.—This woman, age forty-three, virtually had been an invalid for about six years, her affiiction expressing itself chiefly as nervousness, neuritis, nervous indigestion, associated with neuralgic pains at the waist-line. There was marked evidence of a susceptibility of these tissues from the mother's side, as shown in the susceptibility chart Figure 380. The father is still living at eighty-four and the father's side of the ancestry has been free from rheumatic group lesions. Her mother had died at seventy-seven and her mother's father and mother were ninety-four and seventy respectively, indicating that there had been a great deal of endurance in the mother's family. The difference between the actual conditions and those indicated in the roentgenograms was very great. In Chapter 1, Figure 4, we used a tooth from this case to illustrate the inability of the roentgenogram to disclose even an extensive granuloma if it is surrounded by a zone of dense condensing osteitis. The complete set of

Form No. 13—Serial No. 965

RESISTANCE AND SUSCEPTIBILITY CHART

PATIENT S.W.R. Case No 965 AGE 43

ADDRESS DATE Dec 9, 1920

CHIEF COMPLAINT Nervousness. Indigestion. Neuralgia Neuritis

Pt. has now	Pt. has had	Rheumatic Group Lesions and Complications	Own: Brothers	Own: Sisters	Own: Sons	Own: Daughters	Own: Husband Wf	Fathers Side: Father	Fathers Side: Grandfthr	Fathers Side: Grandmthr	Fathers Side: Uncles	Fathers Side: Aunts	Mothers Side: Mother	Mothers Side: Grandfthr	Mothers Side: Grandmthr	Mothers Side: Uncles	Mothers Side: Aunts
		No.	2	2.	4											7	5
		Tonsillitis	#														
#?	#?	Rheumatism	#														
		Swollen or Deformed Joints													Not Know		
#	##	Neck-back or Shoulders															
#	#	Lumbago						#									
#	##	Neuritis	#	#									##		#		
		Sensitizations															
		Sciatica															
		Chorea or St. Vitus's Dance															
#	##	Nervous Breakdown											##		#		
#	#	Mental Cloud							Extreme				##		#		
		Persistent Headache															
		Heart Lesions						+									
		Dropsy															
		Kidney Lesions, Brights						#					#				
		Liver or Gall Lesions															
		Appendicitis							?								
##	##	Stomach pain or Ulcer											##				
		Eye, Ear, Skin, Shingles															
	#?	Pneumonia															
#	#	Anemia															
		Goiter															
#	#	Lassitude, Chilliness															
		Hardening of Arteries															
		Stroke															
		Age if Living						84									
		Age at Death											77	94	70		
		Flu with Complications															
	#	Flu without Complications															
##	##	Neuralgia		##									##		#		
	#	Persistent Constipation															
	#	Spinal Meningitis															
	#	Extensive Tooth Decay						Growth inside ⊕									
	#	Abscessed Teeth															
		Loosening Teeth															

Years: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73

Duration of Dental Infection

Duration of chief Affection

KEY FOR CHART: + HAD LESION; # FREQUENTLY; #? VERY SEVERELY; +? PROBABLY; ✳ OPERATION; ⊕ FATAL ATTACK

PRESENT STATUS

CARIES	LOKD.	CONDSNG.	SL. HG.
#	#	#	
PYRRH.	OPEN	REVING +	RA. HG.

SYST. RELF.	COMP.	PART.	RECR.	NONE
	#			
SUSC. TBLT.	INHT. ##	ACQD.	ABST.	SC. NO

FACTOR OF SAFETY

V. HG.	HIGH	FAIR	LOW	V. LW.
				#

FIGURE 380. SUSCEPTIBILITY STUDY SHOWING MARKED INHERITED SUSCEPTIBILITY FROM MOTHER'S SIDE FOR NEURITIS, NERVOUS BREAKDOWN, AND STOMACH TROUBLE. CASE NO. 965.

FIGURE 381. ROENTGENOGRAPHIC APPEARANCE OF TEETH OF CASE NO. 965 WITH STOMACH AND NERVOUS DISTURBANCE.

FIGURE 382. ACUTE STOMACH ULCER WITH NEAR PERFORATION, OF A RABBIT INOCULATED WITH CULTURE FROM A TOOTH OF CASE NO. 965 WITH STOMACH INVOLVEMENT.

roentgenograms is shown in Figure 381. In few cases have we found so extreme condensing osteitis as about all these upper teeth, all of which were extracted, and all of which had conditions very much worse than could be anticipated from the roentgenograms. Continued low defense for a few years will practically always, in this type of case, produce marked condensing osteitis. In other chapters, we have discussed the relation of this calcium metabolism factor to disturbed defense. Doubtless, most all dentists, who do root-filling work, would have concluded, regarding the tooth shown in Figure 4, that they could safely fill this root and that there was no serious periapical involvement. They would be overlooking two fundamentals: First, that they are not correctly judging the condition about the apex from the appearance in the roentgenogram; and unless they have checked their work by other means than recording symptoms and comfort on the part of the patient, they would not know either their relative or actual efficiency in removing the infection from this root. The facts are that with the removal of these upper teeth, this woman, who had been an invalid for about six years, was so greatly improved in health, and that very rapidly, that she again took up her complete household duties and has had continued good health for the four years since these teeth were removed. A culture taken from these teeth and inoculated into a rabbit produced an acute stomach ulcer with perforation, shown at the point of the arrow in Figure 382. Two rabbits were inoculated, both of which developed lesions of the digestive tract which was the tissue involved in the patient. This one died in seven days, the principal lesion being this peptic ulcer with perforation. With no other treatment this patient gained fifteen pounds in weight in a few months' time. In about 1100 rabbits inoculated in the last two and one-half years, stomach perforation has not been found in ½ of 1 per cent of the rabbits.

The next case also shows a very marked elective localization for stomach tissue. As in the last case, other symptoms so overshadowed the digestive disturbance that the patient did not think of that as the chief trouble. This patient's chief affection was an involvement of her eyes with marked exophthalmos, not her chief eye trouble, however, which was attacks of pain which would be so severe that on several occasions a physician had to be summoned in the night to give her a hypodermic injection of morphine. The paroxysms of pain were so nearly unbearable that her health would be injured for days or weeks after an at-

tack, which would last for hours, unless morphine was injected. This phase of her case is reported in detail in the chapter on this subject. However, we wish to note here that the animals inoculated, as shown in that chapter, developed both rupture of blood vessels in the eyes and marked exophthalmos, as shown in the photographs. Three of the rabbits inoculated with the strain taken from her mouth developed very unusual and extreme lesions in the digestive tract with perforation, or near perforation; while several others, developed very acute colitis, dying from the inflammatory process of the digestive tract. Figure No. 383 shows the viscera from all of the three rabbits. A shows a complete perforation of the stomach and contiguous diaphragm with a bolus of food penetrating the rupture into the thorax. B, when posted, had such an extensive ulceration of the cardiac end of the stomach that it was almost ready to perforate. C shows an ulcer of the colon also nearly perforated.

It is very significant that, whereas 69 per cent of the rabbits inoculated with the cultures from this patient's teeth, developed lesions in the digestive tract, and in many instances in several tissues of the digestive tract, and, whereas, 62 per cent of these rabbits developed eye lesions, the percentage of rabbits developing lesions of the digestive tract in the group shown in Chart 143, Chapter 22, "Summary of Animal Reactions and Patients' Symptoms," which is a miscellaneous group involving affections of all kinds, including the stomach, was found to be 36, and in the group where the chief lesion of the patient was rheumatism, the percentage of digestive tract lesions is 18.

The marked improvement in this patient's health has emphasized the need of greater care in the study of the relation of old chronic periodontoclasia pockets to health. This patient at one time had had acute periodontoclasia, or pyorrhea alveolaris, which responded well to treatment; and she thought the disease was cured. At the time of her active reaction, visible pus was present about these teeth. This completely disappeared. The condition of the teeth is shown in Figure No. 439; and, in several, pulps were found degenerated and infected. Some of the old periodontoclasia pockets had necrotic bone and furnished a bad type of focal infection, the original active local reaction having entirely ceased, which, if present, would have protected the patient. The lower left first molar had a degenerated and infected pulp. Very slight evidence of it is shown in the roentgenogram.

FIGURE 383. POSTINGS FROM THREE RABBITS INOCULATED WITH A CULTURE FROM THE TEETH OF A PATIENT SUFFERING FROM SPONTANEOUS HEMORRHAGES. A SHOWS A COMPLETE PERFORATION OF A RABBIT'S STOMACH; B, A STOMACH JUST READY TO PERFORATE; C, A NEAR PERFORATION OF COLON.

The patient had such great relief from the removal of the first few infected teeth, expressing itself both in the absence from the attacks of acute pain and the reduction in the bulging of the eyes, that she became desperate in her determination to have all of her teeth extracted. Finally all of the uppers were extracted and such of the lowers as were found to be abnormal, both in the reactions of the pulp and the health of the supporting structures. In approximately two years, she has not had one single attack of the pain in her eyes. She had a few very slight ones during the early period while the teeth were being extracted. Her general health and digestive function are greatly improved. I question if all of the gifts of the world could induce this woman to have these teeth back. The remarkable change in the appearance of her eyes and the effect upon the rabbit's eyes should be read in connection with this chapter by turning to Chapter 66.

One of the most common of the disturbances of the digestive tract is the group affecting the gall-bladder and duct. There may be many contributing factors in the production of cholecystitis and cholelithiasis. A striking illustration of this is shown in Case No. 1048.

Case No. 1048.—This patient had been suffering from pain and nausea for which she had been advised to go to the hospital for operation. A lower molar tooth, with very marked condensing osteitis, as evidenced at the time of extraction, was removed and cultured and the organisms inoculated into rabbits. The effect on the patient of the extraction of this and two other teeth was that the distress of the gall-bladder quite rapidly disappeared. She soon gained twelve pounds in weight and for two and one-half years since the removal of her dental infection has had no return of the digestive and gall-bladder symptoms. The effect of the inoculation of this culture into rabbits is shown in Figure No. 384. It was to produce a very acute inflammatory involvement of the gall-bladder. It was enlarged and distended with a purulent fluid found to contain a strain of streptococcus similar to that inoculated, and the wall of the gall-bladder had a great many little ulcers, also shown in Figure 384. This rabbit also developed acute appendicitis, as shown in Figure 385, and a very unusual and remarkable lesion, an inflammatory invagination of the cecum into the colon, shown also in Figure 385 at B.

We have had many very striking illustrations of appendix and gall-bladder involvement and their relief by the removal of in-

FIGURE 384. MULTIPLE ABSCESSES IN THE WALL OF THE GALL-BLADDER OF A RABBIT, PRODUCED BY INOCULATION WITH THE CULTURE FROM A TOOTH OF A PATIENT SCHEDULED FOR GALL-BLADDER OPERATION. SYMPTOMS ENTIRELY DISAPPEARED AFTER REMOVAL OF DENTAL INFECTION. NO RETURN OF SYMPTOMS IN TWO AND ONE-HALF YEARS. CASE NO. 1048.

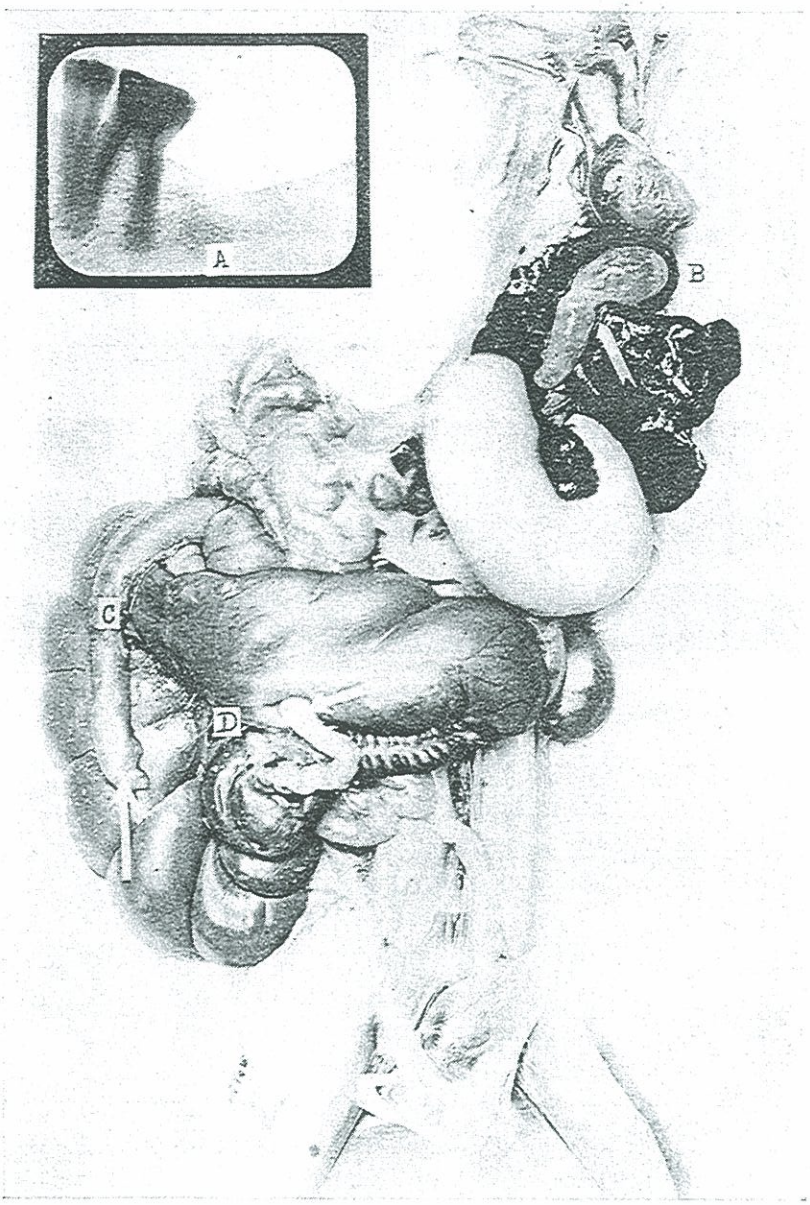


FIGURE 385. DIGESTIVE TRACT INVOLVEMENTS OF RABBIT OF PREVIOUS FIGURE: A, NON-VITAL MOLAR; B, GALL-BLADDER INVOLVEMENT; C, ACUTE APPENDICITIS; D, AN INFLAMMATORY INVAGINATION OF THE CECUM INTO THE COLON.

fected teeth. In one of these, Case No. 445, the patient was supposed to be dying from heart lesions. After she had been in extremely low condition for some weeks, she was taken with acute pain in the bile duct, tenderness over the liver, followed by the passage of a number of gall stones, after which her condition very rapidly improved. This condition repeated, though not quite so

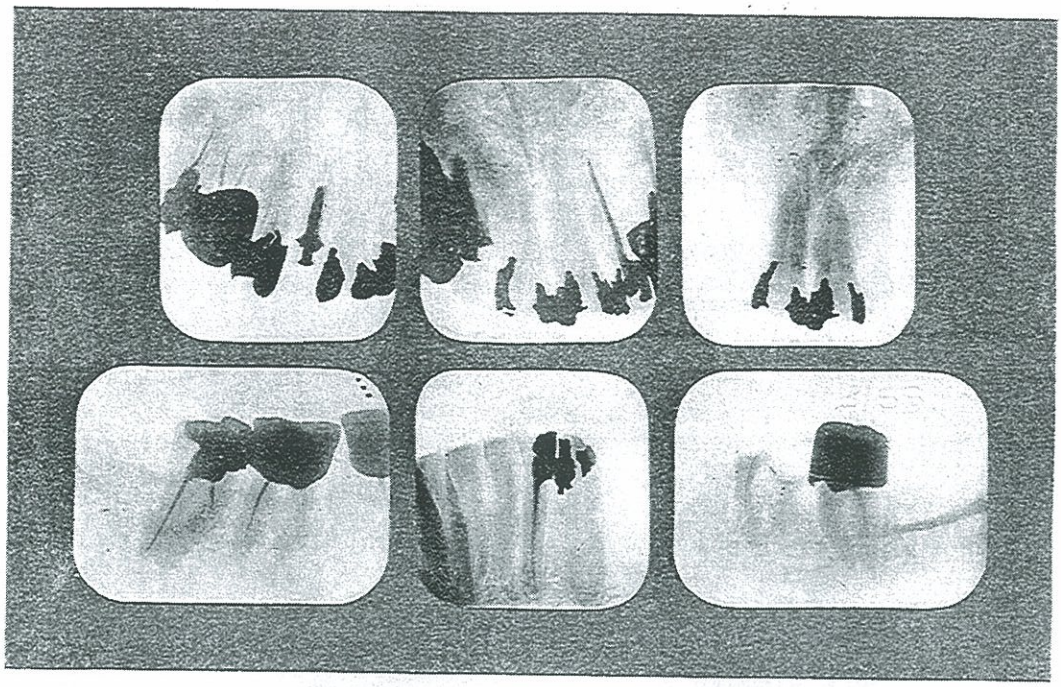


FIGURE 386. SERIOUS DENTAL INFECTIONS WITH LITTLE LOCAL EVIDENCE, WHICH CONTRIBUTED TO A VERY SEVERE CHOLECYSTITIS. CASE NO. 445.

severely, three times in about as many years. We finally removed several infected teeth, one of which is shown in Fig. 386 and which we have previously illustrated in connection with Chapter 3. This central incisor had a putrescent pulp which was not disclosed by the roentgenogram. For two and one-half years she has had no return of either the heart or gall-bladder disturbances, and is again doing her household duties, and apparently in splendid health. Her factor of safety is, however, small.

Case No. 525.—Some years ago, when I also was in the vigor of a mistaken confidence of my ability as an operator, and because I thought I could mechanically cleanse canals and could mechanically make restorations that were both serviceable and comfortable and therefore presumably safe, I undertook to repair a number of infected teeth for a patient who was loath to give them up, and particularly so, since they were so comfortable and efficient for mastication. The courage of a mistaken confidence is not less than when it is correctly placed. During one year while repairing this man's teeth, he had approximately twenty attacks of appendicitis; and on two occasions, arrangements were made to rush him to the hospital for removal of his appendix on nights following dental operations of the day before for treatments of his

teeth. During these months his appendix was so tender that it was painful and difficult for him to ride in an automobile. Fortunately, I discovered this relationship between his reactions and my operations, though they were not suspected by either the physician or the patient. We decided to remove the infected teeth. This entirely removed his appendix trouble and there has been no further suggestion of need for operation. This incident happened about fifteen years ago. Later, when he developed a questionable dental condition, he was suffering from a neuritis. In order to test a possible relationship between the dental condition and his neuritis, we purposely stirred up the infection slightly and did nothing else. For a week he was not able to put on or take off his own coat. The tooth was extracted and his neuritis promptly cleared up and has not returned.

Still another case of digestive tract lesion is particularly instructive. This patient had been suffering for years from gall-stones. On several periods she had gone to the hospital for treatment. We started to treat her teeth and she was not able to come to the office for a day or two because of an acute attack of inflammation of the gall-bladder. We decided to extract the teeth, which we did. This was followed that night by a very acute attack of pain in the gall-duct, requiring medical care, and arrangements were made for surgical interference. Within twenty-four hours, she passed fifty-two gall-stones. We, accordingly, removed all infected teeth. While this woman had not had a month for five years in which she had not had some trouble, (sometimes extremely severe, putting her in bed,) prior to the removal of those teeth, she has not had a single severe attack and very few symptoms in the six years that have intervened since. Figure 387 shows the condition of the teeth in this patient's mouth. The condition, however, as is so often the case, was worse than would be interpreted from the roentgenograms. Note the open canals above crowned teeth, with very slight apical absorption in centrals, lateral, and upper right first bicuspid. The apical reaction is much less than should occur with this quantity of infection if an adequate quarantine is being maintained about the tooth. In this case, as in all this type, the absence of this adequate local reaction means the absence of apical absorption of bone and the passage of this infection beyond this first natural barrier to all the tissues of the body, with the result that the most susceptible tissue breaks, in this case the bile bladder and duct.

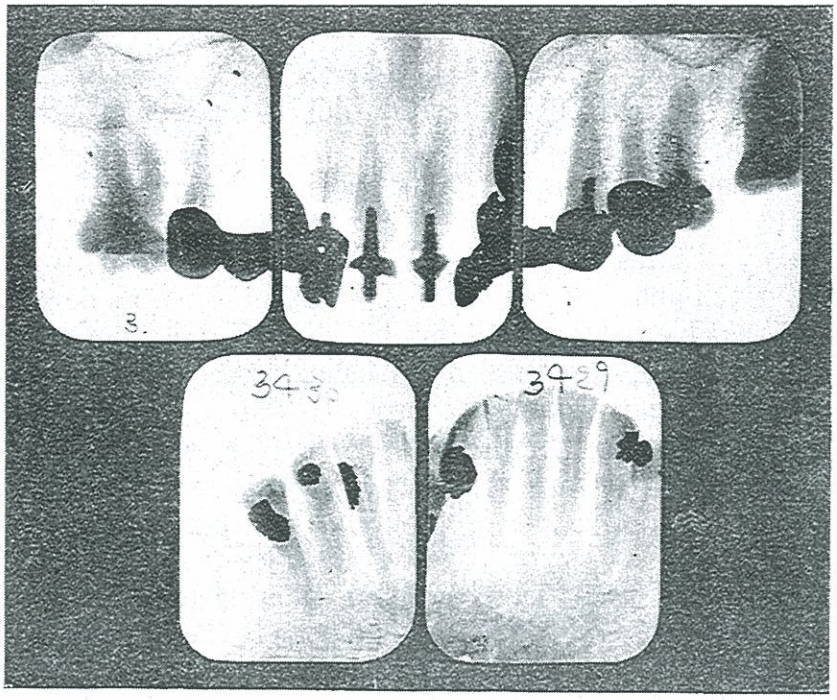


FIGURE 387. ROENTGENOGRAPHIC APPEARANCE OF DENTAL INFECTIONS OF A PATIENT SUFFERING FROM CHRONIC CHOLECYSTITIS. FOLLOWING EXTRACTIONS, PATIENT PASSED FIFTY-TWO GALL-STONES.

INTESTINES.

Of the disturbances of the digestive tract, probably none are more frequent or so obscure as to their etiology, than are the disturbances of the large and small intestines. Time after time, we have had as part of our patient's history the development of very acute diarrhea or constipation, preceding or following the treatment of dental infections. These symptoms relate to gingival infections as well as to apical involvements and they take on an entirely new interest and meaning in the light of our animal inoculations, since so often similar disturbances are produced in experimental animals. They are of interest also because the pathological changes produced by each animal inoculation with the organisms grown from the tooth culture, and from the toxic substance taken from teeth, are so similar to changes produced in the viscera by various types of deficiency diets. In the human, dental infections may produce many phases of intestinal disturbance; in some subacute colitis, acute colitis, a spastic condition of the bowel, acute or chronic constipation, which symptoms may be very markedly or completely relieved by the elimination of the

dental infection. These symptoms are frequently very definitely related to the nervous system, as is illustrated by the following case.

Case No. 752.—I was called to the hospital to see this patient by the physician in charge. He was in bed with a very acute neuritis and suffering from a constipation which was exceedingly persistent. According to his history, he had been in a hospital in a neighboring city for several months with a previous attack of acute digestive tract disturbance and constipation that was exceedingly resistant to treatment. The roentgenograms of his teeth are shown in Figure 388. The history of the dental condition

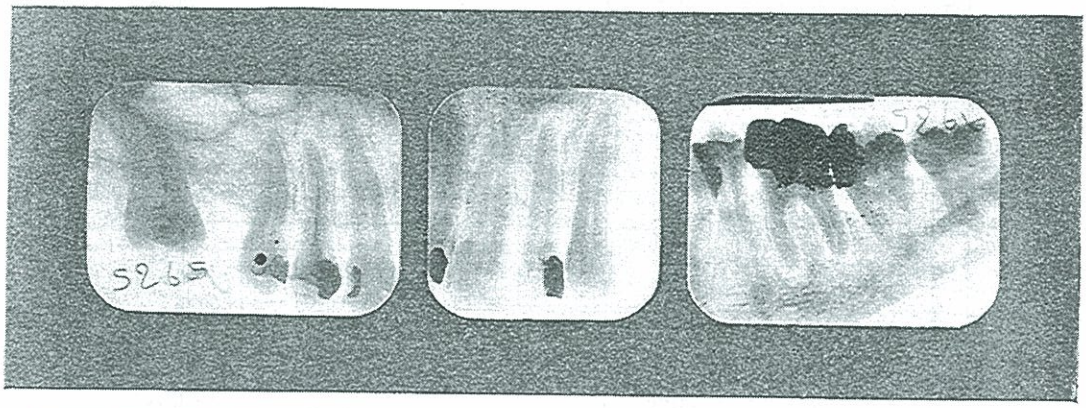


FIGURE 388. DENTAL INFECTIONS RELATED TO INTESTINAL STASIS AND NEURITIS. CASE NO. 752.

is as follows: The lower right first molar had been crowned thirteen years previously, and from its history and the roentgenogram, had been abscessed all these years without fistula. The upper right lateral had a putrescent pulp with a small area of apical rarefaction. There was a history of tenderness thirteen years ago following filling, but none of late years. It has not had a fistula. The upper left first bicuspid with an old root filling shows a periapical involvement. There was a history of tenderness following root filling. The striking feature about his case was that with the removal of the upper right lateral, the upper left first bicuspid, and the lower right first molar, there was a complete clearing up of his neuritis and of his acute constipation. Whereas this patient had suffered continuously for three years previous to the removal of this dental infection, and at times with extreme severity, the effect of the operation was greatly to relieve him. A year or two later he had another attack of colitis,

Private Records of Weston A. Price, M.S., D.D.S., 8926 Euclid Avenue, Cleveland, Ohio

Form No. 15– Serial No. 752

RESISTANCE AND SUSCEPTIBILITY CHART

PATIENT R.S.N. Case No 752 AGE 32

ADDRESS DATE May 17, 1919.

CHIEF COMPLAINT Pain in back - Stomach

Temp. 98 Pulse 75

Pt. has now	Pt. has had	RHEUMATIC GROUP LESIONS AND COMPLICATIONS	OWN: Brothers	Sisters	Sons	Daughters	Hsbnd Wf	FATHERS SIDE: Father	Grndfthr	Grndmthr	Uncles	Aunts	MOTHERS SIDE: Mother	Grndfthr	Grndmthr	Uncles	Aunts
		No.	0	0							0	5					
		Tonsillitis															
	+?	Rheumatism															
		Swollen or Deformed Joints															
	###	Neck-back or Shoulders															
		Lumbago											Excellent				
	###	Neuritis															
		Sensitizations															
		Sciatica															
		Chorea or St. Vitus's Dance															
	#	Nervous Breakdown															
		Mental Cloud															
		Persistent Headache															
		Heart Lesions															
		Dropsy															
		Kidney Lesions, Brights															
		Liver or Gall Lesions															
	*	Appendicitis											(1?)				
	###	Stomach pain or Ulcer						⊕	#	#?		⊕					
	+²	Eye, Ear, Skin, Shingles															
		Pneumonia															
		Anemia															
		Goiter															
	#	Lassitude, Chilliness															
		Hardening of Arteries															
		Stroke															
		Age if Living															
		Age at Death						56	78	50		50 40	28 Cause unknown				
		Flu with Complications															
		Flu without Complications															
	#	Persistent Constipation															
	#	Extensive Tooth Decay															
	#	Abscessed Teeth															
		Loosening Teeth															

Years / Duration of chief Affection / Duration of Dental Infection

KEY FOR CHART: + HAD LESION; # FREQUENTLY; # VERY SEVERELY; +? PROBABLY; * OPERATION; ⊕ FATAL ATTACK

D. INFCTN TYPES	CARIES	LOKD	CONDSNG	SL. HG.	SYST. RELF.	COMP.	PART.	RECR.	NONE	FACTOR OF SAFETY: V.HG.	HIGH	FAIR	LOW	V.LW.
	#	#												
	PYRRH	OPEN	REYING	RA.HG.	SUSC. TBLT.	INHT.	ACQD.	ABST.	SC.NO					
						#							#	

FIGURE 389. SUSCEPTIBILITY STUDY OF PREVIOUS CASE, NO. 752. NOTE FIVE CASES OF ACUTE STOMACH INVOLVEMENT ON FATHER'S SIDE, WITH TWO DEATHS.

following an empyema of the antrum, which cleared up with the clearing of his nasal infection, and he is again in good condition. This illustrates how with a susceptible tissue there is a tendency to involvement of that tissue, regardless of the source of focal infection. In this case, the type of dental infection was a series of three locked areas.

A study of his resistance and susceptibility chart is of particular interest. His acute neuritis and digestive tract disturbances, including the acute appendicitis, have all developed since the establishment of the definite history of these dental infections, two of which, as shown in the last column, date back thirteen years and one six years. About one year after the establishment of his dental infections, or twelve years ago, he developed an acute appendicitis; and three years ago, his chronic constipation became very severe and he began a series of hospital sojourns with digestive disturbance and neuritis, the last of which was so acute as to put him to bed. He was not able to raise his hands from the table, so great was the motor involvement. The striking thing about his chart, shown in Figure 389, is that his father died at fifty-six of acute digestive tract disturbance, both his father's father and mother had digestive tract disturbance, and two of his father's sisters also died of acute digestive tract disturbance, one at forty and the other at fifty. Note that he is developing these lesions severely at, and prior to thirty-two years of age. The history of these cases is so often that it develops early in the succeeding generations where very marked in the ancestry of one or both sides. There are, in this family, five cases of, and three deaths from, digestive tract disturbance in the immediate relatives of his father's side. This is a striking illustration of the inheritance of the weak link in the chain and of the involvement of that weak link when a dental infection exists. Note the absence of lesions in other tissues of his and of other members of his family. Another very striking thing about this case is the absence of a tenderness of the teeth and of fistulæ; and the suggestion of an earlier rarefying osteitis of a very moderate degree. Nature was not making an adequate effort in establishing the quarantine about these teeth, and the toxic substance plus the bacterial invasions were entering his system and causing a break in his susceptible tissue.

There are types of intestinal disorders which very strongly suggest that they are sensitization processes. The patient's

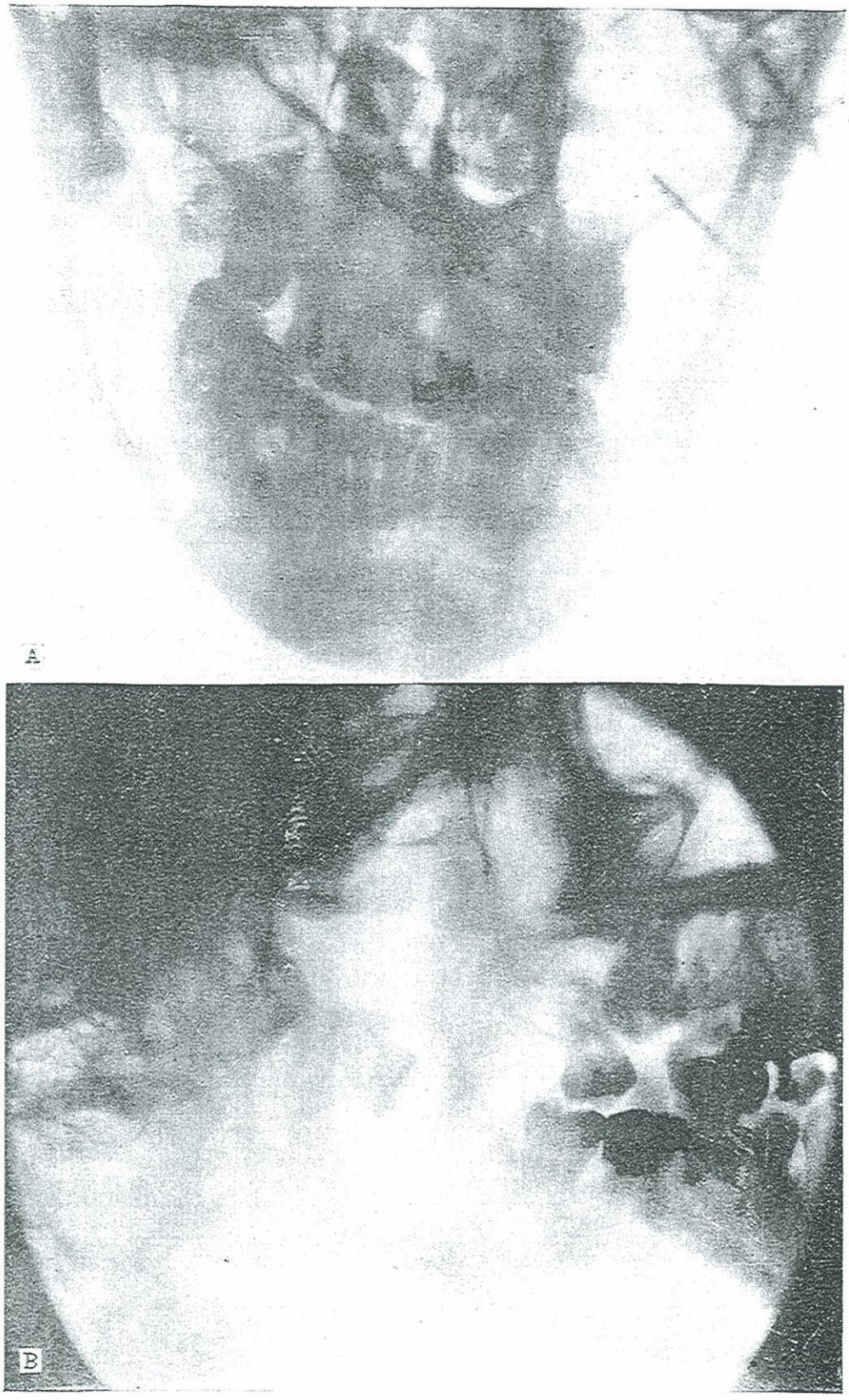


FIGURE 390. AN ENORMOUS MANDIBULAR CYST WITH MARKED DISPLACEMENT OF THIRD MOLAR, NEARLY TO NECK OF CONDYLOID PROCESS, PRODUCING COLITIS. CASE NO. 1019.

symptom may be an obstinate diarrhea which may have a periodic cycle of recurrence. We have suggested such a case in Chapter 30 on the Nature of Sensitization Reactions. In this case the source of infection was from periodontoclasia pockets. Similar and very distressing disturbances may be produced by the toxic poison from dental cysts. The following is an illustration.

Case No. 1019.—The patient had a very large and very unusual mandibular cyst, shown in Figure 390, A and B. (See great displacement backward and upward of the third molar. Note both views.) She had been having both nervous symptoms and digestive disturbances. A drop of the cyst material was aspirated with a hypodermic for microscopic study and culture. It contained a few organisms and had an abundance of cholesterol crystals. For twenty-four hours before the operation on this cyst, the patient's bowel movements occurred on an average of about thirty minutes, with some griping. At the time of operation, some of the cyst material was inoculated intravenously into a rabbit and it developed an acute diarrhea in about forty minutes. Four rabbits were inoculated. All four developed acute colitis; three developed rheumatism and liver involvement; two gall-bladder, and one stomach involvement in addition. The patient was also suffering from marked rheumatic lameness in her right shoulder. With a thorough irrigation of the cyst chamber and packing for a few days to keep the air from the sensitive structures, particularly the exposed inferior dental nerve, and the removal of the third molar which, as shown, had been pushed backward and upward by the cyst, entirely out of its normal position, the patient's intestinal symptoms entirely disappeared and in two years have not recurred.

The surgical removal of this tooth was a matter of very great difficulty, since the width of the tooth was greater than the thickness of the ramus. It was accomplished, however, under local anæsthetic, with the aid of specially designed and constructed instruments with which I moved the tooth down and forward through the opening in the anterior border of the ramus, while the lateral walls of the ramus were distended to make possible the delivery of the tooth. The method of treating was to allow the mucous membrane of the mouth to extend into the cyst chamber, and the patient was provided with the means for the irrigation, twice daily, of the chamber. If these cysts close over before the pyogenic membrane is displaced with the normal mucous membrane of the mouth, they tend to recur. This premature closing

is prevented by frequently changed light packings in the orifice.

It is, of course, impossible to determine, with certainty, the degree of the specificity in a given case of apparent elective localization. Some very striking conditions have appeared in our experimental animals. In general, elective localizations tend to be much more frequently expressed when cultures are grown quickly and the desired quantity injected intravenously, using as young generations as possible in order that the influence of the new medium may not have destroyed these qualities. We have, accordingly, found that when teeth are implanted beneath the skin, they tend to produce such grave changes in the morphology and chemistry of the blood as to overwhelm the animal before clear cut localizations appear. Notwithstanding this fact, many of these animals develop involvements of special tissues, an illustration of which is the following case:

Case No. 1353.—The patient, forty-nine years of age, was suffering from sleeplessness, general nervousness, and an abdominal distress that was giving him much anxiety since it had developed near the site of the operation for an appendectomy. His dental conditions included several quite badly involved, deep periodontoclasia pockets, with some apical involvement. The second molar, shown in Figure 391, was implanted beneath the skin of a rabbit which died with acute appendicitis. The tooth was planted under the skin of another rabbit which also died with acute appendicitis. The appendices of these two rabbits are shown in Figure 391. But this is not more striking than the fact, that with removal of his dental infections, his abdominal distress and pain disappeared and has not recurred for many months. It is my interpretation in the light of my present knowledge that the infected tooth placed beneath the skin furnished both toxin and bacteria which invaded his body and which localized in tissues similar to those already sensitized in the patient's body.

I have shown in the Chapter on Circulatory System, a rabbit that was given one inoculation in the margin of the ear vein, consisting of about 1 cc. of a twenty-four hour broth culture grown from the root of a tooth of a patient suffering from acute rheumatism and which developed acute rheumatism resulting in deforming arthritis. This rabbit lived for approximately two and one-half years, was crippled, and moved about like an old man with typical deforming arthritis. His toes were turned in and he

FIGURE 391. ACUTE APPENDICITIS PRODUCED IN TWO RABBITS IN SUCCESSION BY PLANTING OF SAME TOOTH BENEATH THE SKIN, TAKEN FROM PATIENT SUFFERING FROM PAIN IN VICINITY OF PREVIOUS APPENDIX OPERATION.

walked on the sides of his feet. When this rabbit died, it was from a streptococcal peritonitis with extensive adhesions. The joint involvements had, apparently, been walled off and except for the deformity were quiescent. I refer to this case as a suggestion, and perhaps an illustration, of how infections, that have become walled off or focal in the system, may develop extensive adhesions by their secondary involvement of peritoneal tissues.

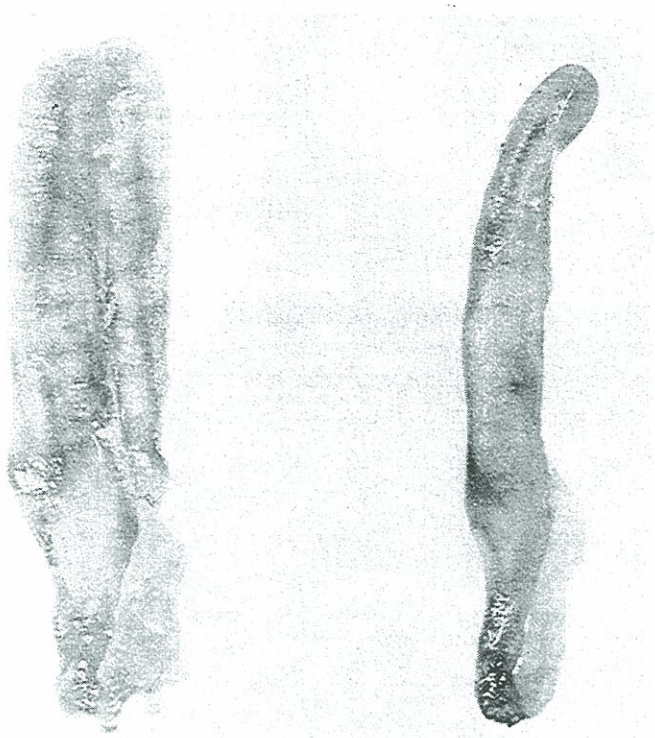


FIGURE 392. INTERNAL AND EXTERNAL APPEARANCE OF ACUTELY INVOLVED APPENDIX OF A RABBIT WITH TOOTH IMPLANTED BENEATH ITS SKIN, FROM CASE NO. 1346 SUFFERING FROM A DIGESTIVE DISTURBANCE.

It is, therefore, not improbable that this may have been the nature of the disturbance that was going on in this patient's body, expressing itself as pain quite typically like the postsurgical adhesion distresses following appendectomies and other abdominal operations. I would also stress that we may have here one of the etiological factors in the various adhesions that develop in the abdominal tissues.

Another case which is also very striking is the following: This patient, Case No. 1346, had a very serious physical break, becoming progressively worse for three years, until he was practically incapacitated for duties. The chief expression of his difficulty was pain about his heart, particularly after eating, so severe that he could not walk a block, and he even avoided the exertion of conversation for some time after eating. He had had many examinations, and the interpretation had been that he was suffering

from myocarditis with a digestive involvement. He had been put on a very rigid diet. We have discussed his case from the cardiac standpoint in the Chapter on the Circulatory System, and recorded there the most remarkable improvement he made following the removal of his dental infections and special treatment, which latter was outlined in Chapter 22 on Elective Localizations. I have shown how there seemed to be a relation between the fact, that he had a most obstinate secondary recurrent hemorrhage following his first extraction, and the development of spontaneous hemorrhages in a large group of rabbits inoculated with the culture grown from his teeth. The point of special interest here is that when one of his teeth was planted beneath the skin of a rabbit, it died with a very acute appendicitis. Internal and external views of this appendix are shown in Figure 392. One of the rabbits inoculated with the culture, the one receiving the youngest culture, therefore retaining most largely the specific qualities of the organism, developed in addition to the extensive spontaneous hemorrhages, of which it died in twelve hours, hemorrhages into the muscular coat of the stomach, one of which already showed signs of necrosis, which was clearly not a postmortem change. This is shown in Figure 393.

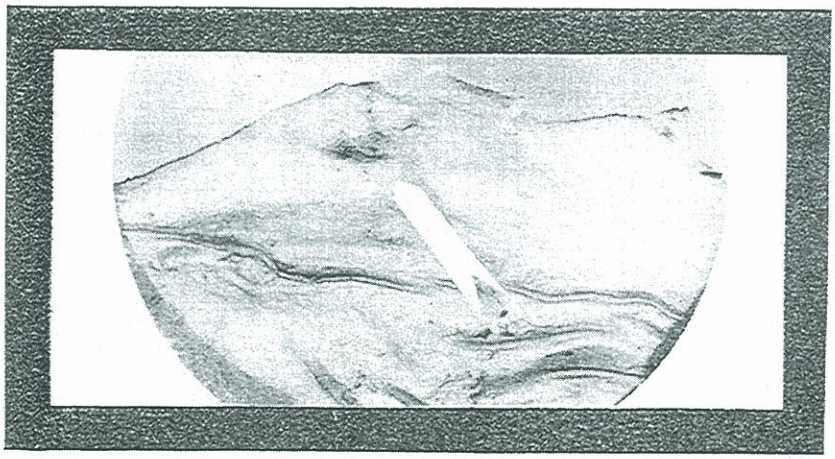
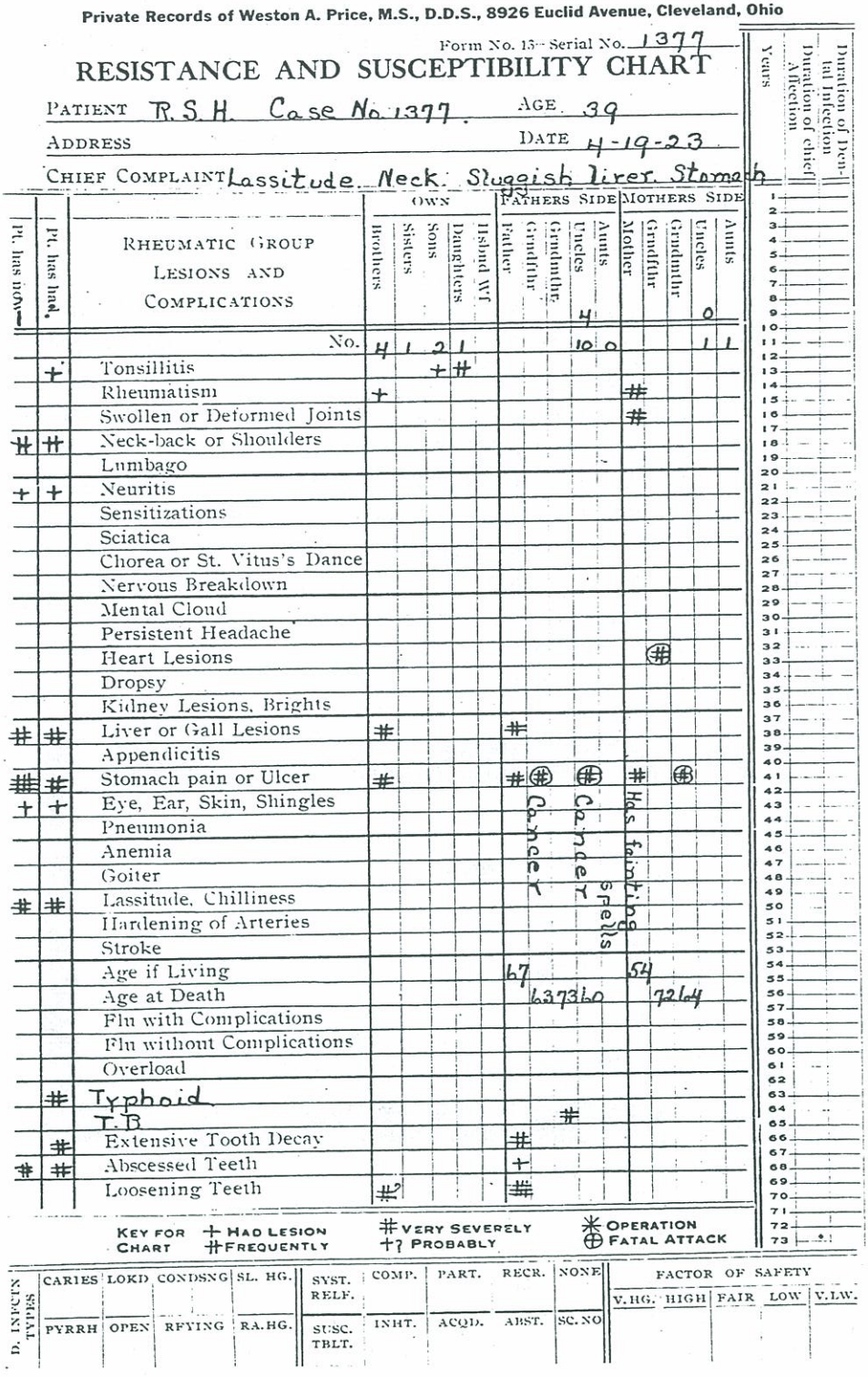


FIGURE 393. STOMACH ULCER PRODUCED IN RABBIT BY TOOTH IMPLANTATION, CASE NO. 1346 WITH STOMACH INVOLVEMENT.

We cannot pass the chapter on the digestive tract disturbances without discussing another type of disturbance of the digestive tract which is perhaps the most dreaded enemy of mankind: namely, cancer of the stomach. In Chapter 31, on Precancerous



Private Records of Weston A. Price, M.S., D.D.S., 8926 Euclid Avenue, Cleveland, Ohio

Form No. 15 Serial No. 1377

RESISTANCE AND SUSCEPTIBILITY CHART

PATIENT R. S. H. Case No. 1377. AGE 39

ADDRESS DATE 4-19-23

CHIEF COMPLAINT Lassitude. Neck. Sluggish liver. Stomach

Pt. has now	Pt. has had	Rheumatic Group Lesions and Complications	Own: Brothers	Own: Sisters	Own: Sons	Own: Daughters	Own: Husband Wf	Father's Side: Father	Father's Side: Grandfthr	Father's Side: Grndmothr	Father's Side: Uncles	Father's Side: Aunts	Mother's Side: Mother	Mother's Side: Grandfthr	Mother's Side: Grndmothr	Mother's Side: Uncles	Mother's Side: Aunts
		No.	4	1	2	1					4					0	
	+	Tonsillitis			+	#											
		Rheumatism	+										#				
		Swollen or Deformed Joints											#				
#	#	Neck-back or Shoulders															
		Lumbago															
+	+	Neuritis															
		Sensitizations															
		Sciatica															
		Chorea or St. Vitus's Dance															
		Nervous Breakdown															
		Mental Cloud															
		Persistent Headache															
		Heart Lesions												(#)			
		Dropsy															
		Kidney Lesions, Brights															
#	#	Liver or Gall Lesions	#					#									
		Appendicitis															
#	#	Stomach pain or Ulcer	#					#	(#)		(#)		#		(#)		
+	+	Eye, Ear, Skin, Shingles							Cancer		Cancer		Has fainting spells				
		Pneumonia															
		Anemia															
		Goiter															
#	#	Lassitude, Chilliness															
		Hardening of Arteries															
		Stroke															
		Age if Living						67					54				
		Age at Death						63 7360					7264				
		Flu with Complications															
		Flu without Complications															
		Overload															
	#	Typhoid															
		T.B									#						
	#	Extensive Tooth Decay						#									
#	#	Abscessed Teeth						+									
		Loosening Teeth	#?					#									

Years

Duration of Dental Infection

Duration of chief Affection

KEY FOR CHART: + HAD LESION; #FREQUENTLY; #VERY SEVERELY; +? PROBABLY; ✳ OPERATION; ⊕ FATAL ATTACK

D. INFCTN. THIS	CARIES	LOKD	CONDSNG	SL. HG.	SYST. RELF.	COMP.	PART.	RECR.	NONE	FACTOR OF SAFETY: V.HG.	HIGH	FAIR	LOW	V.LW.
	PYRRH	OPEN	RFYING	RA.HG.	SUSC. TBLT.	INHT.	ACQD.	ABST.	SC. NO					

FIGURE 394. A REMARKABLE INSTANCE OF INHERITED SUSCEPTIBILITY FOR STOMACH INVOLVEMENT. NOTE SIX OF PATIENT'S IMMEDIATE RELATIVES SUFFERED FROM SAME, WITH THREE DEATHS.

Conditions, I have presented evidence which suggests to me some form of anaphylactic reaction of tissues of various parts of the body, particularly the skin, which seemed to be related to precancerous conditions, and in which the exciting antigen is, in certain cases, a toxic substance of dental origin. I have, in that chapter, referred to the fact, that cancers of the stomach, as suggested by Dr. Charles Mayo, seem definitely to be related to the scars of stomach ulcers, and also to the fact, that in our susceptibility studies of patients and their families I have found that, by selecting out only the cases where the records seem complete enough to justify some conclusions, cancers were four times as prevalent in the group with an absent or acquired susceptibility as in the group with a streptococcal inherited susceptibility, and that this corresponds with the groups in which we find practically all of our cases of sensitizations. In Figure 394, I present a striking resistance and susceptibility chart. This patient, age thirty-nine, presents with acute digestive tract disturbance. He has four brothers, one of whom is similarly affected. His father is similarly affected. His father's father and his father's brother were similarly affected and died of cancer of the stomach. His father's mother has stomach disturbance and his mother's mother died of acute stomach involvement. In other words, we have, in this family, seven cases of acute stomach involvement, three terminating in death and two distinctly as cancer of the stomach. I do not interpret this to mean that cancer of the stomach, as such, is inherited, but that a type of susceptibility to sensitization reaction has been inherited, and, further, that the defensive elements of the stomach itself, have, by inheritance, been defective, tending to determine the site of the localization of the sensitization. I do not present this as based upon sufficient experimental data to be ready for acceptance, but as the simplest explanation of the phenomena I am here presenting.

CHAPTER LXVI.

NERVOUS SYSTEM AND SENSE ORGANS.

DISCUSSION.

It is quite remarkable to me that notwithstanding the fact, that I have been making an intensive study of oral infections and their systemic expressions for over twenty-five years, nearly all of the involvements of the nervous system escaped me during the early part of this period, and this notwithstanding we now find more disturbances of the nervous system than of any other type of tissue. One of my early cases in which I found an unmistakable connection was as follows:

Case No. 110.—The patient, then about fifty years of age, was suffering from an involvement of the muscles of the side of her neck, a type of torticollis, though differing in that the spasm was not constant. She stated that her only recognition of the developing involvement was that in church she could not keep her head from going over sideways and was compelled to brace it with her hand to keep it upright. It was not rotated as usual. She went to a photographer to have her picture taken and he was compelled to support her head to keep it from gradually going over to the side. This involvement was on the left side. After studying her case, I condemned the lower left second bicuspid shown in Figure 395,

FIGURE 395. A DENTAL INFECTION WHICH PRODUCED A TIPPING OF THE HEAD. COMPLETELY RELIEVED BY THE EXTRACTION OF THE BICUSPID. CASE NO. 110.

which, as will be noted, had a very marked condensing osteitis and which, of course, I did not understand and appreciate at that time. With the removal of this tooth, her trouble was entirely corrected.

Compared with the information available at that time, we have learned that there are very many disturbances of the nervous

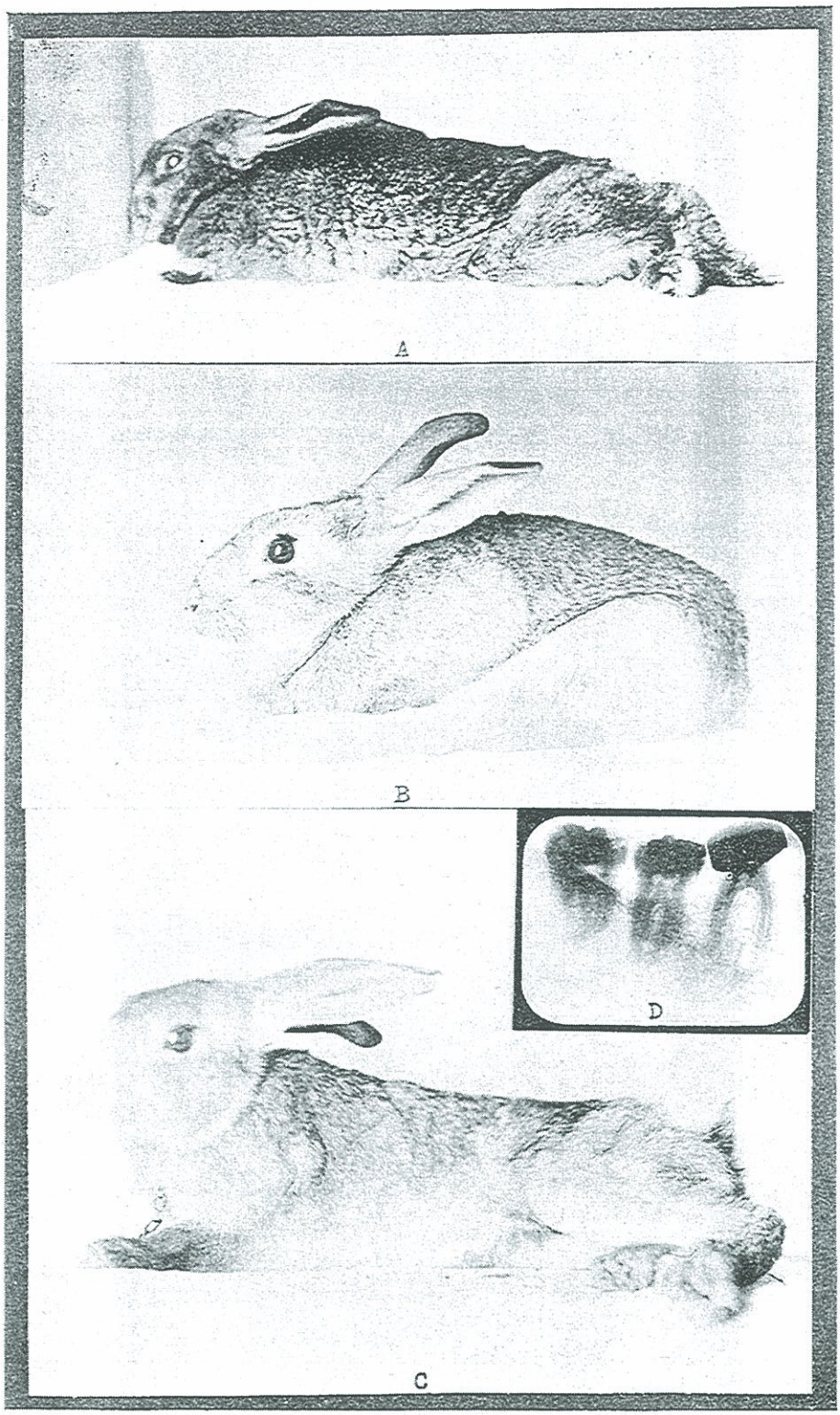


FIGURE 396. FOUR RABBITS WERE INOCULATED WITH THE CULTURE FROM THE TOOTH SHOWN IN D, THREE OF WHICH WERE COMPLETELY PARALYZED FROM THE CENTERS OF THEIR SPINES BACKWARD, AS SHOWN IN A, B, AND C. PATIENT SUFFERED FROM SPASMS. CASE NO. 1001.

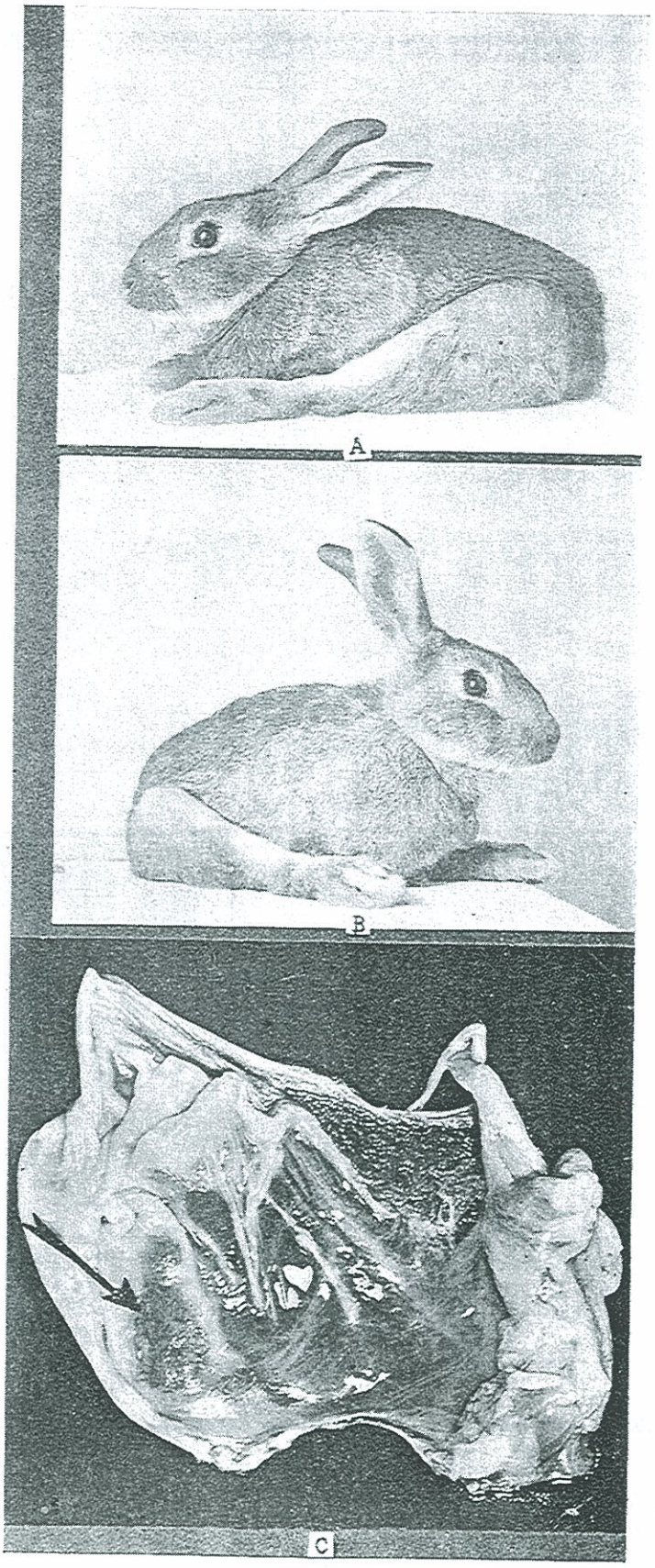


FIGURE 397. PARALYZED RABBIT. A AND B. C. AN ULCER ON INNER SURFACE OF ITS BLADDER, SHOWN IN NEXT FIGURE.

system, both motor and sensory, and particularly of the neck and shoulders; but compared with the great amount of information that is needed, we yet know but little. As stated in the Chapter on Skeletal and Muscular System (Chapter 64) in discussing neck involvements, our histopathological studies of lesions produced in animals revealed marked lesions in both the muscle and nerve tissues, not always in both and the same case; and in no part of our work has our animal inoculation part of the study thrown so much direct information as in the study of the lesions of the nervous system; nor could evidence of elective localization be much more marked than in some of these cases. This is strikingly illustrated in the following case.

Case No. 1001.—This patient was suffering from disturbances of the central nervous system, which expressed themselves with loss of both motor and sensory control for from a few minutes to half an hour, followed by a marked interference with motor control for several hours. This disturbance was so severe that she was compelled to give up her position. The attacks were becoming more frequent. The lower left first molar, shown in Figure 396-D, was condemned. Note a distinct zone of condensing osteitis apparently surrounding a zone of rarefying osteitis, which condition indicates to me both a considerable amount of infection and a very inadequate reaction in the tissue surrounding the tooth. This patient is not, while in this condition, producing an adequate quarantine about the tooth for her self-protection. This tooth was extracted and with much difficulty, owing to this condensing osteitis. This type of socket tends always to be slow in healing, as we have discussed elsewhere. Cultures taken from this tooth were inoculated into four rabbits, and three of them were completely paralyzed from the center of their bodies backward, including sphincters, abdominal muscles, and sciatics. Both motor and sensory groups were affected. These three rabbits are shown in their living state in Figure 396. They did not lose, seriously, in weight; their appetites were good; and they kept well nourished. They dragged their hinder parts as though they did not belong to them. There was no control of urine or fæces. The rabbit shown in 397-A is shown in dissection after being chloroformed in Figure 398. Very marked lesions were found in the spinal cord and sciatics, both within the spinal column and outside, shown in Figure 398-D. The bladder of this rabbit was found to contain about twenty times the normal amount of urine,

FIGURE 398. SITE OF LESION IN SPINAL NERVES IN D. E, THE PARALYZED BLADDER TWENTY TIMES NORMAL SIZE.

FIGURE 399. PHOTOGRAPHIC APPEARANCE OF VENTRAL SURFACE OF SPINE, WITH ONE DESTROYED CARTILAGE.

being enormously distended. Apparently the same strain of organism that was grown from the tooth and inoculated into the rabbit was abundant in the bladder. The internal surface of the bladder showing a very large ulcerative area is shown in Figure 397-C. The ulcers on the inner surface of the bladder are shown in Figure 397-C. The complete relaxation and helplessness of the hinder parts of the rabbit are shown in the two views of 397, which were the normal positions before posting. The rabbit shown in Figure 400-C is also shown in section in Figure 400-B.

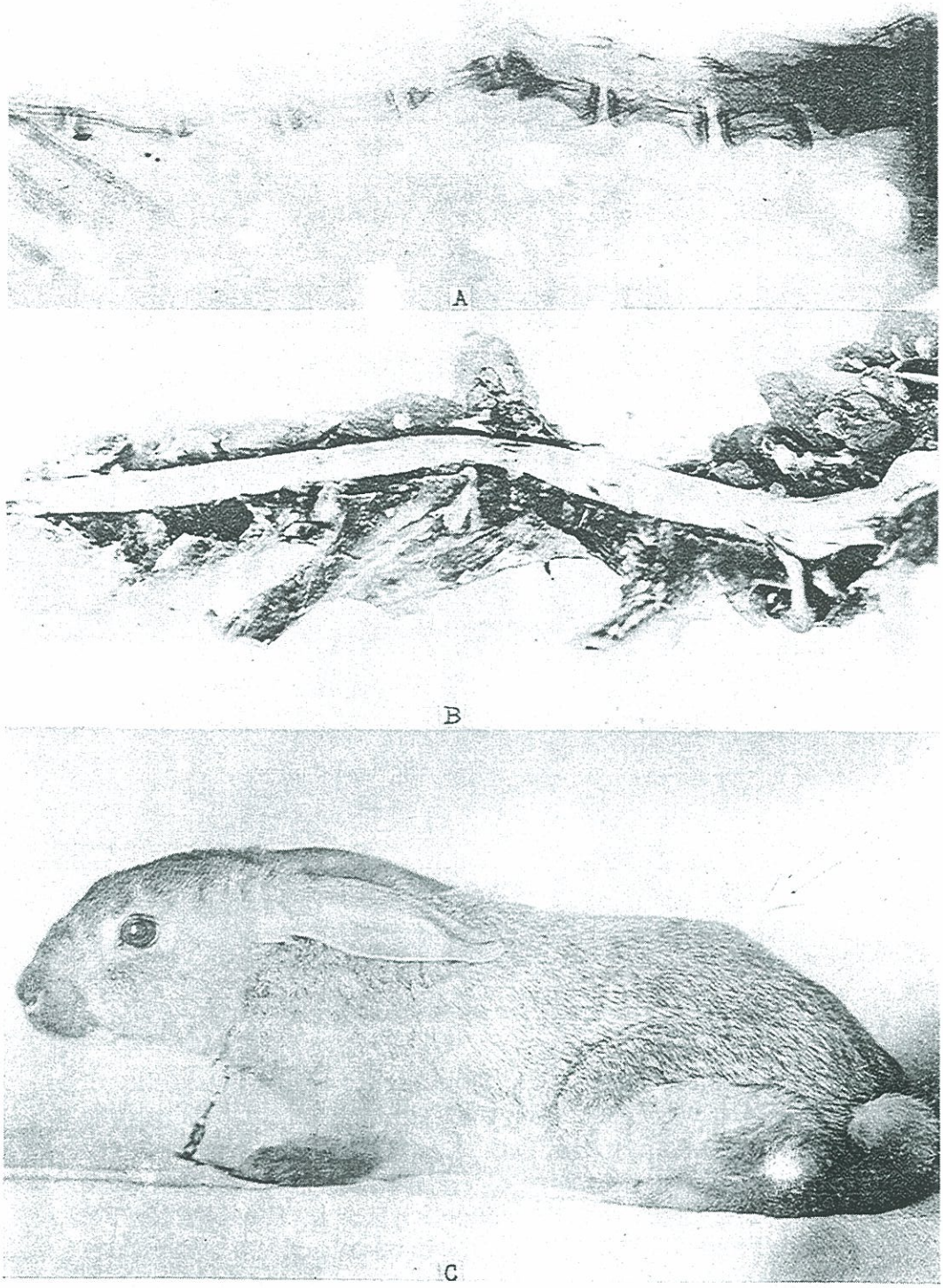


FIGURE 400. ANOTHER PARALYZED RABBIT OF THIS SERIES. A, ROENTGENOGRAPHIC APPEARANCE OF SPINE. NOTE CONDENSING OSTEITIS. B, COMPRESSION OF SPINAL CORD BY PROLIFERATIVE OSTEITIS. C, EXTERNAL APPEARANCE OF RABBIT.

C shows a definitely developed deformity in the spine. Figure 399 shows a dissection of the spinal column from the ventral surface. Note that the second lumbar cartilage is absent, there being a distinct lesion in the body of both second and third vertebræ. A dissection, exposing a lateral view of the spinal cord at this point, is shown in Figure 400-B. Note a marked displacement and curvature in the spinal column with a compression of the spinal cord at the point of the infective process. All nerves, motor and sensory, beyond the point of this compression were paralyzed. A roentgenogram of this lesion is shown in Figure 400-A. Note particularly, as we have called attention to in Chapter 64 on condensing and rarefying osteitis, this lesion is not revealed as a zone of rarefaction, but one of condensation; and with the destruction of the cartilage and the involvement of the body of the adjoining vertebræ, there is a partial dislocation. We have here an evidence of the experimental development of a type of Pott's disease which may be analogous to some of those obscure spinal lesions which develop in children, many of which are definitely known not to be tubercular.

In many respects the pathology of these animals is very similar to that of the rabbit presented in Chapter 64, Figures 347 and 348. We wish to review that case in connection with the nervous system. The intravenous inoculation of this rabbit with the culture grown from the embedded root of a tooth of a patient that had been bedridden for some years, developed a complete paralysis from the center of the spine backward, which, while complete for both motor and sensory nerves, gradually disappeared, leaving the animal with a disturbed gait much like a child who has had anterior poliomyelitis. The roentgenograms of this animal's spine show very clearly the location of the lesion, as does also the dissection shown in photograph in Figure 348. In the Chapters on Pregnancy, and Primary and Secondary Sex Organs, we have discussed this case because of the very marked nervous disturbance that developed in this rabbit which had become apparently normal, physically, so far as its original streptococcal infection was concerned. That overload was sufficient to bring on in a very acute form a very marked central nervous system disturbance, as, for example, with excitement such as the clapping of the hands near the rabbit, it would fall over on its side. It became very emaciated after its confinement, at which time its five young died in from a few hours to two days; and the rabbit went

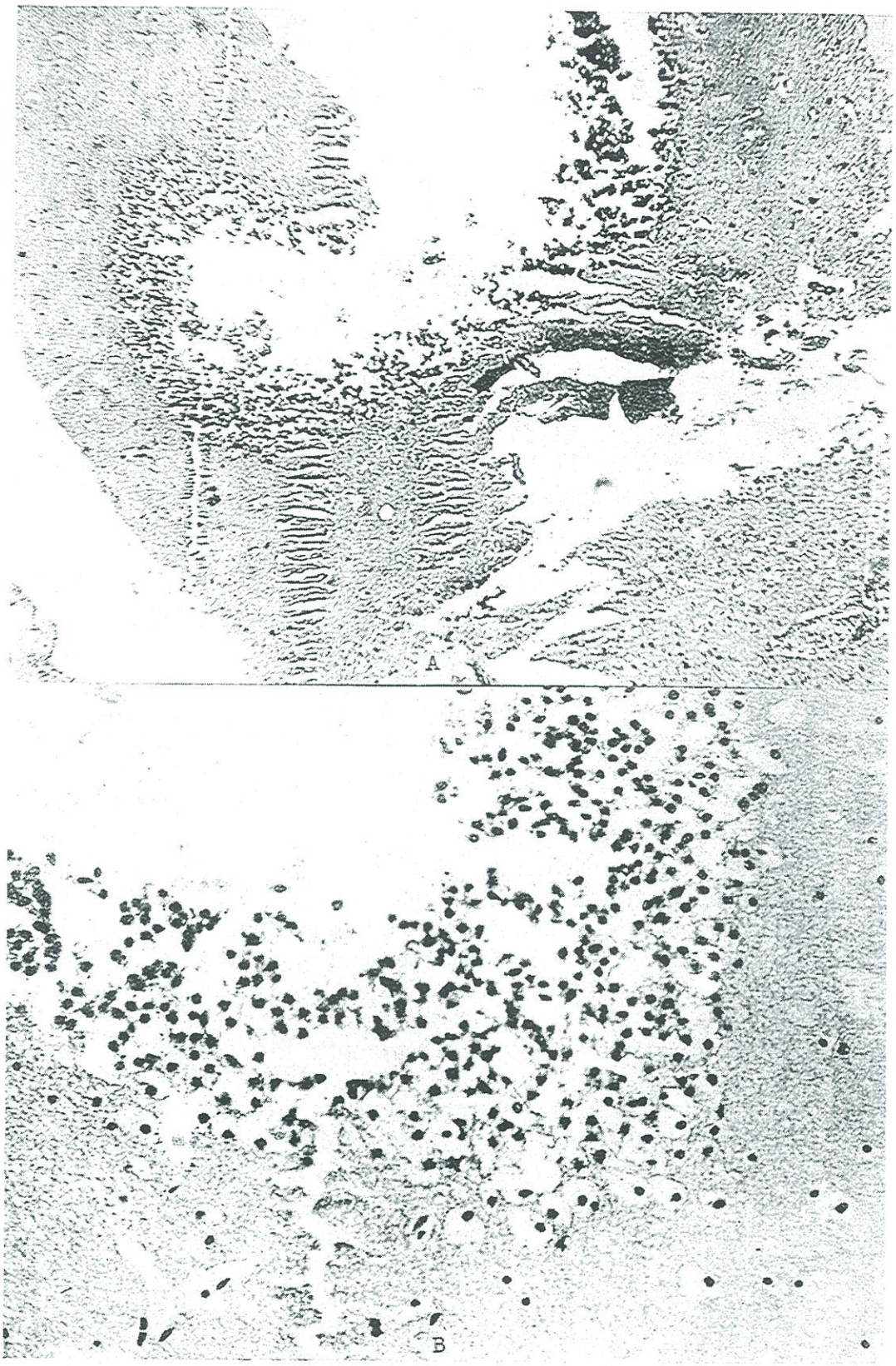


FIGURE 401. LESIONS IN THE CORTEX OF THE BRAIN, RABBIT WHICH DEVELOPED ACUTE CHOREIC NERVOUS SYMPTOMS, SHOWN IN FIGURE 347.

into a rapid nervous decline, dying in about a month from terminal pneumonia. A of Figure 401 shows high power studies of the spinal cord and nerve tissues of this rabbit. B shows a section of the cortex of the brain. Figure 348 shows a roentgenogram of the spinal cord of this case.

Our many studies on animals have revealed a definite tendency on the part of the organisms, taken from dental infections of patients with central nervous system disturbances, to produce nervous disturbances in rabbits and a tendency to rarefying osteitis.

It is probable that very many more lesions of the brain are caused by streptococcal infections than are recognized. These tend frequently to express themselves with choreic movements which, because of their motor expressions are, of course, recognizable, though their etiology may not be. When, however, brain disturbances are of such a type as to disturb function rather than motor control, the lesion is probably generally thought of as being physiologic rather than pathological; and it now seems probable that disfunction of the brain cannot exist without a structural pathological counterpart and cause. We, accordingly, studied the brain of this rabbit with a great deal of interest and detail. The following is the pathologist's detailed histopathological study.

"Rabbit X. Brain Tissue from One of the Hemispheres. Microscopic Study.

"*Inverted Ocular.*—The section shows an irregularly-shaped piece of tissue, stained with a light purplish color. The tissue is somewhat dense.

"*Low Power.*—The section represents brain tissue, where with great difficulty can be traced the borders of the gray and white matter. The most conspicuous histological finding is the pronounced vascular reaction, blood vessels and capillaries are markedly distended, filled with red cells, intermingled with many leucocytes, some of which are in the center, some around the periphery. Practically all around the larger vessels and capillaries, is to be seen a condition of perivascular round cell infiltration. In some cases this infiltration is very pronounced. This vascular reaction has its location mainly on the periphery, in the pial membrane. The same round cell (perivascular) can be seen also in the deeper tissue of the gray and white matter. In one location of the white matter there is a distinct localized accumulation of round

cells, a localized abscess, and in the neighborhood of it all the blood vessels are markedly dilated, filled with red cells, intermingled with white cells and around them are many round cells. The brain tissue proper shows some fatty changes, fatty degeneration, granular changes. Throughout the whole brain tissue can be seen in small groups of two to four, cells of round cell infiltration.

"*High Power.*—In the localized abscess the cells are mostly round cells; also throughout the brain substance the cells are small round cells. Otherwise, there are the same changes as described above. In some localities there are small blood vessels that show considerable sclerosis.

"*Histopathological Diagnosis.*—Acute leptomeningo-encephalitis."

RHEUMATIC NEURITIS.

It is not improbable that the disturbances, functional and structural, which we are producing in animals are often paralleling those in the patients who present to us for study and treatment. It is for this reason that we esteem very highly the information which we have gained by study of the animal pathology, both histological and clinical. This is well illustrated in the following case.

Case No. 484.—The patient, male, forty-one years of age, as he presented to me eight years ago, had the following symptoms: Physically, he was under weight, about five feet nine inches tall and weighed only 123¾ pounds, making him 22 per cent under weight. One arm was much smaller than the other. This muscle atrophy was so marked that he could not lift, and had not for about twenty years, five pounds higher than his shoulder, with his right arm, while with his left he could lift fifty pounds. He suffered a great deal from rheumatic neuritis. There was no involvement of the joints, but much involvement of the muscles and nerves. He suffered much from lassitude and had a definite heart murmur. His history showed a very unusually severe overload coming to a young man of definite rheumatic susceptibility. In midwinter a water main burst in the plant of his employer and he worked for two hours in the nearly ice cold water repairing the break which threatened to do great damage to the plant. That night he was taken with an extremely severe attack of what was called inflammatory rheumatism, and from the description undoubtedly involved the spinal and sciatic nerves. Both knees

were drawn up to his chin and remained so for weeks. One arm, his left, was flexed against his shoulder. Finally, with extreme force, his body was straightened and strapped in that position. About a year before this exposure, he had a number of teeth treated and filled, roentgenograms of some of which are shown in Figure 402. This does not represent their condition at the time of the exposure, but their condition as he presented to me eight years ago. We extracted several teeth and condemned several

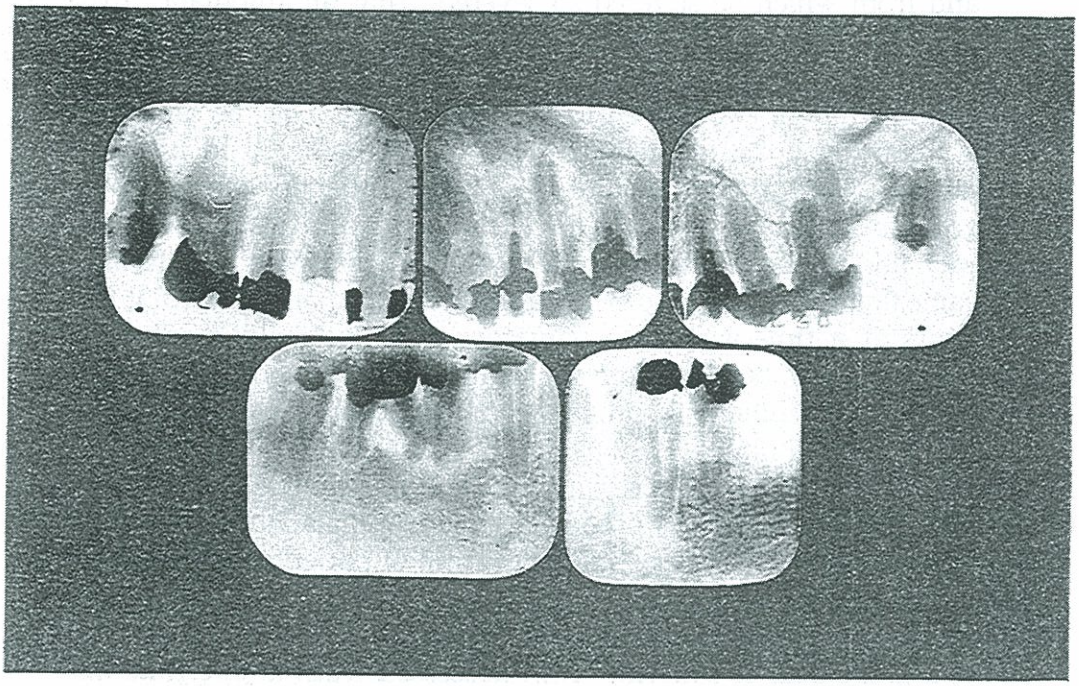


FIGURE 402. ROENTGENOGRAPHIC APPEARANCE OF THE TEETH OF CASE NO. 484; PATIENT SUFFERING WITH RHEUMATIC NEURITIS AND HEART, WITH EXTREME MUSCLE ATROPHY.

others. Another dentist told him that he was foolish to have these teeth extracted, that he could drain them and fill them, which he proceeded to have done. With the removal of the infected teeth he made very marked improvement, so much so that he could raise 15 pounds above his head, with his atrophied arm, and its circumference increased considerably. This improvement lasted for about one year; and his old trouble came back gradually, but with its former distressing symptoms progressively getting worse. He returned to me saying that he was willing now to abide by my judgment and wished me to take his case again, which I did. With the removal of some more of his infected teeth he made rapid and excellent improvement.

A very important incident happened in connection with one of these teeth, the lower right cuspid. We desired to take a culture from the pulp chamber before its extraction, for study of the type of organisms. This was done by opening the tooth, removing some of the contents on a sterile broach and resealing the opening, and I arranged for the extraction of the tooth at a subsequent sitting. The patient returned to the manufacturing plant where he was employed. That afternoon he was taken so severely with a type of neuritis that drew his right knee up against his body, and from which he suffered so severely, that an ambulance had to be called to take him to his home. We extracted the tooth the following day and the trouble began to improve in a few hours and in a day or two had entirely disappeared. This, he said, was a symptom quite identical to what he had suffered in his first attack. With the removal of these dental infections he made so great an improvement that for the first time in twenty years he was able to use his right arm almost as efficiently as his left, and came finally to be able to swing a heavy sledge hammer with it for hours at a time without exhaustion. He was making splendid progress when he was taken with Flu and developed pneumonia, which I presume was probably streptococcal pneumonia and which proved fatal.

Several important observations should be made in his case. The structural changes produced in the animals inoculated with strains from similar cases and from teeth of patients suffering less severe lesions are characteristic. There is a marked tendency to localize in the spinal and motor nerves. This man gave a history of a great deal of suffering from abscessed teeth at the time his dental work was done at nineteen or twenty years of age. There is no doubt that much of the infected tissue, shown in Figure 402, was present, in part, at the time he had his extreme exposure in the cold water at twenty-one years of age. It is not improbable that had his dentist at that time carried out a program of prevention, not building simply for a man in normal exposure and with normal resistance, but one for much less than normal defense, as a study of his history would have revealed, and had prepared him not only for ordinary overloads of exposure but for extreme ones such as he got—in other words, built a factor of safety that would stand rough seas as well as calm—this man might have been spared his months of agonizing suffering, years of incapacity, and premature death; and yet this dentist did just what nine out of ten probably of the dental profession of the country are doing

today through ignorance.

In Figure 403, we show his susceptibility chart from which it will be seen that his chief trouble was rheumatic neuritis, and lassitude with heart involvement; that he had a definite inherited susceptibility to rheumatism and neuritis from his father's side and to heart from his mother's side, his mother having had heart involvement quite severely though she died suddenly, presumably of a stroke. The mother's brother died of heart involvement. A brother and two sisters have all had rheumatism, and a sister has had a serious heart involvement and two of her sons have had very severe heart involvement. He has broken just where we should have expected; and the result, in his case, corresponds to a large majority of cases with a marked hereditary susceptibility plus dental infection and overload. This triad will break any human body. The life, at sea in this boat, is sailing in a vessel that is safe only in calm waters; and this case represents, probably, one in ten of all the patients who come into any dental office. When we remember that one in ten of the funerals of all ages is a life that has been foreshortened because of heart involvement, we are simply recording the fate of a craft that has drifted into rough seas, for which its factor of safety is too low. The cracked china cup may last longer than any cup in the cupboard, but only because it is taken better care of than are the others.

In this conection, I wish to refer to the affect of a similar exposure upon our injected rabbits, to which I have referred in Chapter 21 on Overloads. These showed that rabbits, that were subjected to chilling by having a part of the body submerged in ice water for fifteen minutes a day for a few days following their inoculation, developed acute purulent arthritis where the controls receiving the same culture and same quantity, but were not subjected to this chilling, did not develop lesions.

MENTAL CLOUD.

Cases that will naturally be grouped under central nervous system with psychic involvements will include a great number and a wide variety of affections. This is so common a disturbance that we have found it necessary to make a place on our resistance and susceptibility charts for it, and where, for convenience and courtesy's sake, we have termed it "Mental Cloud." We have, therefore, discussed this group under that title.

As indicated in the closing paragraph of the preceding text, we had a very large variety of disturbances of which an important,

Form No. 13 Serial No. 484

RESISTANCE AND SUSCEPTIBILITY CHART

PATIENT R.C.N. Case No. 484 AGE 41

ADDRESS DATE 5-2-18

CHIEF COMPLAINT Rheumatic neuritis. Lassitude Heart

Pt. has now	Pt. has had	Rheumatic Group Lesions and Complications	Own: Brothers	Own: Sisters	Own: Sons	Own: Daughters	Own: Hsbnd Wf	Fathers Side: Father	Fathers Side: Grndfthr	Fathers Side: Grndmothr	Fathers Side: Uncles	Fathers Side: Aunts	Mothers Side: Mother	Mothers Side: Grndfthr	Mothers Side: Grndmothr	Mothers Side: Uncles	Mothers Side: Aunts
		No.	2	3	1	1										4	3
		Tonsillitis		*	#	+?											
##	##	Rheumatism	#	#²				#	#		+						
		Swollen or Deformed Joints						#									
	#	Neck-back or Shoulders															
		Lumbago															
##	##	Neuritis		#				#									
		Sensitizations															
		Sciatica		#													
	+	Chorea or St. Vitus's Dance		#	#			sister's child									
	#	Nervous Breakdown		#	+	+											
		Mental Cloud															
	#	Persistent Headache	#	#			#										
##	##	Heart Lesions		##									#			⊕	
		Dropsy															
	#	Kidney Lesions, Brights						#									
		Liver or Gall Lesions															
		Appendicitis	*														
	#	Stomach pain or Ulcer				#	+										
		Eye, Ear, Skin, Shingles															
		Pneumonia															
		Anemia															
		Goiter		+													
	#²	Lassitude, Chilliness					+²	#									
		Hardening of Arteries															
		Stroke						⊕					⊕	⊕	⊕		
		Age if Living															
		Age at Death						85					72	90	90		
		Flu with Complications															
		Flu without Complications															
	#	Typhoid															
		Extensive Tooth Decay															
		Abscessed Teeth															
		Loosening Teeth															

Years: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73

Duration of chief Affection

Duration of Dental Infection

KEY FOR CHART: + Had Lesion; # Frequently; # Very Severely; +? Probably; * Operation; ⊕ Fatal Attack

Dental Caries	Caries	Lokd	Condsng	Sl. Hg.	Syst. Relf.	Comp.	Part.	Recr.	None
	#	#	#	#			#		
	Pyrrh	Open	Revng	Ra. Hg.	Susc. Tblt.	Inht.	Acqd.	Abst.	Sc. No
						##			

Factor of Safety	V. Hg.	High	Fair	Low	V. Lw.
					#

FIGURE 403. SUSCEPTIBILITY RECORD, CASE NO. 484. NOTE THE STRONGLY INHERITED SUSCEPTIBILITY FOR HEART AND RHEUMATISM, WITH FOUR DEATHS FROM STROKE.

if not the chief expression, is a psychic depression or aberration. A very simple and the most frequent expression of this is a sense of impending doom and discouragement. In a number of instances, patients not only did not care whether they lived, but struggled with a fear that in these states they would take their own lives. In many instances this depression has completely disappeared after the removal of dental infection. Another and very common expression is that of discouragement and a depression amounting to gloom, with a reaction, as crying, with little or no provocation. The next case illustrates such a condition.

Case No. 1178.—The patient, age thirty-five, mother of two small children, the youngest six or eight months old, has been suffering from extreme nervousness, apparently without cause, numbness of the hands, digestive disturbance not accounted for by food, and pain in the back. These had dated back to a recent pregnancy and had been most severe during the period of lactation. The mental condition was sufficiently alarming to cause her husband and herself much apprehension, and it did not respond either to rest or medication. Her resistance and susceptibility chart, shown in Figure 404, and her history indicate that she has been breaking very seriously in the nervous system at different periods of her life. The first two columns, showing the present and past rheumatic group disturbances of the patient, indicate that she has been breaking with unusual severity. Her one brother, twenty-nine years of age, has also had several of the same lesions. Her father, still living, had a very severe nervous breakdown at forty-eight. He also has had rheumatism and acute digestive disturbance. His father died young, by accident, and his brothers and one of his sisters had acute rheumatism and a severe neuritis. This patient's mother died at fifty-two, by accident. However, she had been troubled severely with gallstones and acute indigestion. Her mother's father died of Bright's disease and two of her mother's brothers died of acute digestive tract complication.

The analysis of her case reveals, as types of dental infection, a marked tendency to caries, much apical infection, locked area infection, with condensing osteitis. The sockets were very slow in healing. The systemic relief from the removal of the dental infections was complete; the type of susceptibility, inherited; and the factor of safety, low. This patient had had a tendency to gingival recession. There was no free pus at this time. The teeth

Form No. 13 Serial No. 1178

RESISTANCE AND SUSCEPTIBILITY CHART

PATIENT S.B.H. Case No. 1178 AGE 35

ADDRESS DATE Sept 20, 1921

CHIEF COMPLAINT Nerves. Crying. Backache. Digestive disturbance. Numbness of hands

Pt. has now	Pt. has had	Rheumatic Group Lesions and Complications	Own: Brothers	Own: Sisters	Own: Sons	Own: Daughters	Own: Husband Wf	Father's Side: Father	Father's Side: Grndfthr	Father's Side: Grndmthr	Father's Side: Uncles	Father's Side: Aunts	Mother's Side: Mother	Mother's Side: Grndfthr	Mother's Side: Grndmthr	Mother's Side: Uncles	Mother's Side: Aunts
		No.	1	0	1	1					4	4				5	4
		Tonsillitis															
	#	Rheumatism	#					##				#					
		Swollen or Deformed Joints															
	#	Neck-back or Shoulders															
##	#	~~Lumbago~~ Backache															
#	##	Neuritis	#					#				##					#
		Sensitizations															
	#	Sciatica															
		Chorea or St. Vitus's Dance	#														
##	#	Nervous Breakdown	#				(48)	##									
##	##	Mental Cloud						#									
		Persistent Headache															
	+	Heart Lesions	##														
		Dropsy															
		Kidney Lesions, Brights									#		⊕	1			
		Liver or Gall Lesions						#					#				
		Appendicitis															
##	##	Stomach pain or Ulcer						#					#			⊕	3
#	#	Eye, Ear, Skin, Shingles	#														
		Pneumonia														⊕	
		Anemia															
		Goiter															
#	#	Lassitude, Chilliness															
		Hardening of Arteries															
		Stroke													⊕		
		Age if Living	29					62									
		Age at Death						Y 9[illegible]					52	77	77	42	3
		Flu with Complications															
		Flu without Complications															TB
		Accident						⊕					⊕				
#	##	Neuralgia										#					
	#	Extensive Tooth Decay															
##	##	Abscessed Teeth															
	+	Loosening Teeth															

Years: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73

Duration of Dental Infection

Duration of chief Affection

KEY FOR CHART: + HAD LESION; # FREQUENTLY; #VERY SEVERELY; +? PROBABLY; ✳ OPERATION; ⊕ FATAL ATTACK

D. INFECTN TYPES

CARIES	LOKD	CONDSNG	SL. HG.
#	##	#	#
PYRRH	OPEN	RFYING	RA.HG.
+			

SYST. RELF.	COMP.	PART.	RECR.	NONE
	+			
SUSC. TBLT.	INHT.	ACQD.	ABST.	SC. NO
	#			

FACTOR OF SAFETY

V. HG.	HIGH	FAIR	LOW	V. LW.
			#	

FIGURE 404. SUSCEPTIBILITY RECORD OF CASE 1178. NOTE STRONGLY INHERITED SUSCEPTIBILITY FOR STOMACH INVOLVEMENT AND NEURITIS.

condemned are indicated and all are shown in Figure 405. We would call particular attention to the zone of condensing osteitis surrounding the rarefying in the mesial root of the lower left first molar and surrounding both roots of the lower right first molar, indicating that, previously, there had been a state of relatively high resistance which had changed to one which we consider to be of less resistance, in which the local reaction took the form of a deposition rather than a rarefaction.

The length of the lines in the two columns, Duration of Dental Infection and Duration of Chief Affection, show that the dental history indicates that the lower first molars were known to have abscessed and been treated when she was fourteen years of age. During girlhood her defense was apparently ample to protect her against this infection. Her present series of serious breaks began with her first pregnancy at twenty-eight years of age. The removal of her dental infections was followed by a prompt removal of all the acute nervous disturbances. In this case there was a great deal of dental infection and of a type most likely to be serious, as indicated by the condensing osteitis surrounding the rarefying.

Cultures taken from her teeth and inoculated into animals produced very marked central nervous system disturbances and degenerative arthritis accompanied by other important pathological changes.

Rabbit 716, shown in Figure 406, had a very marked disturbance, including dragging of the hind legs followed by an acute painful swelling in the region of the left hip joint. This paralysis developed in about three weeks after inoculation with 1 cc. of a 24 hour culture from the teeth. In about a week's time the rabbit began to improve rapidly, but retained deformity in its gait with some swelling of the left hip, as shown in the roentgenogram in Figure 407. The progressive stages of this hip disease are shown in the succeeding pictures, A, B, C, etc. The rabbit was chloroformed and posted about four months after the inoculation, at which time it weighed 1493 grams, a total gain of 378 grams, it having weighed at the time of the inoculation 1115 grams, and from which weight it reduced to 965 grams at the time of its paralysis. Figures 408 and 409 are photographs showing the changes in the heads of the femurs. Figure 410 shows a smear of diplococci taken from the joint capsule.

Rabbit 710 was inoculated intravenously with 1½ cc. of a twenty-four hour culture of freshly extracted teeth, at which

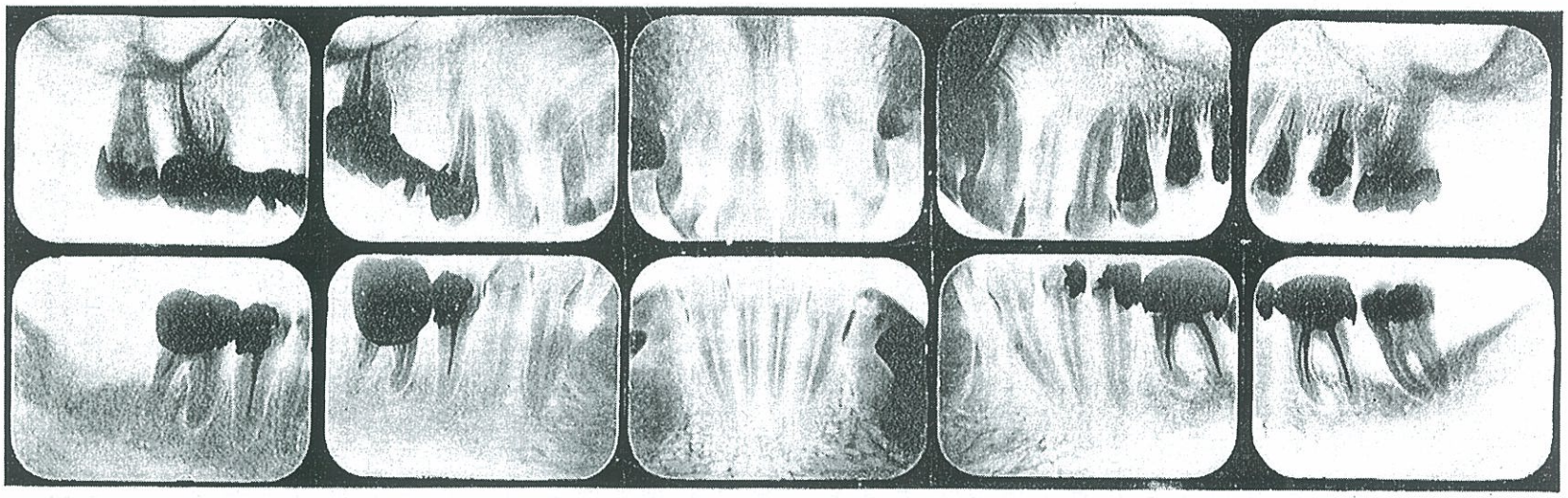


FIGURE 405. ROENTGENOGRAPHIC APPEARANCE OF TEETH OF CASE 1178. NOTE LIMITED PERIAPICAL ABSORPTION ABOUT LOWER FIRST MOLARS. PATIENT SUFFERED FROM EXTREME NERVOUSNESS.

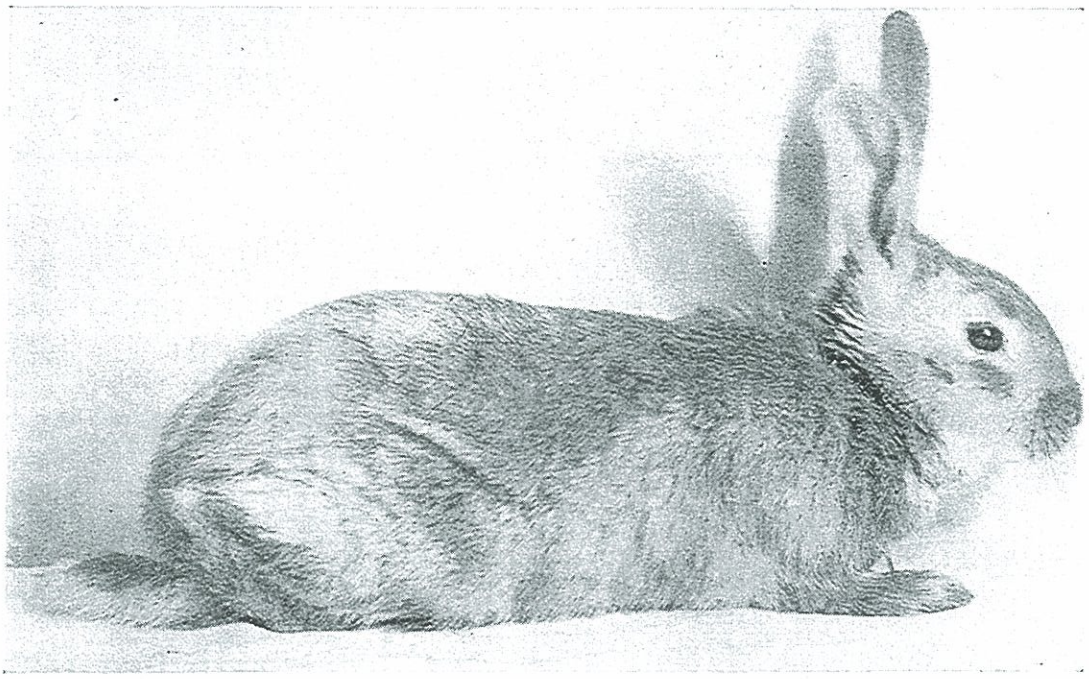


FIGURE 406. THIS RABBIT 716 CARRIED OR DRAGGED ITS HIND LEG FROM A CULTURE FROM THE TOOTH SHOWN ON OPPOSITE PAGE. SEE NEXT FIGURE.

time it weighed 1665 grams. In twelve days, the rabbit was given the second inoculation, thirty-two days after which a condition of partial paralysis developed in the hind legs. The rabbit with the paralysis of the hind legs is shown in Figure 411. Roentgenograms of the vertebral column were made and show the condition in Figure 412. The weight of this rabbit, when chloroformed five weeks after the inoculation, was 14 grams more than when inoculated. The postmortem of this rabbit showed a tumor-like mass on the posterior surface of the vertebral column in the region of the first and second lumbar vertebræ. The intervertebral cartilage was completely destroyed and its position surrounded by a thick fibrous capsule. On opening the capsule, there were exposed the vertebral borders bathed in the mass of broken down tissue and plasma. The neighboring vertebræ and the cartilages were normal. This necrotic suppurative process extended into the intervertebral space and involved the spinal cord. This rabbit also had a myocarditis and an acute nephritis. The paralysis involved the sphincters. There was an acute dilatation of the urinary bladder with retention. Motion pictures were

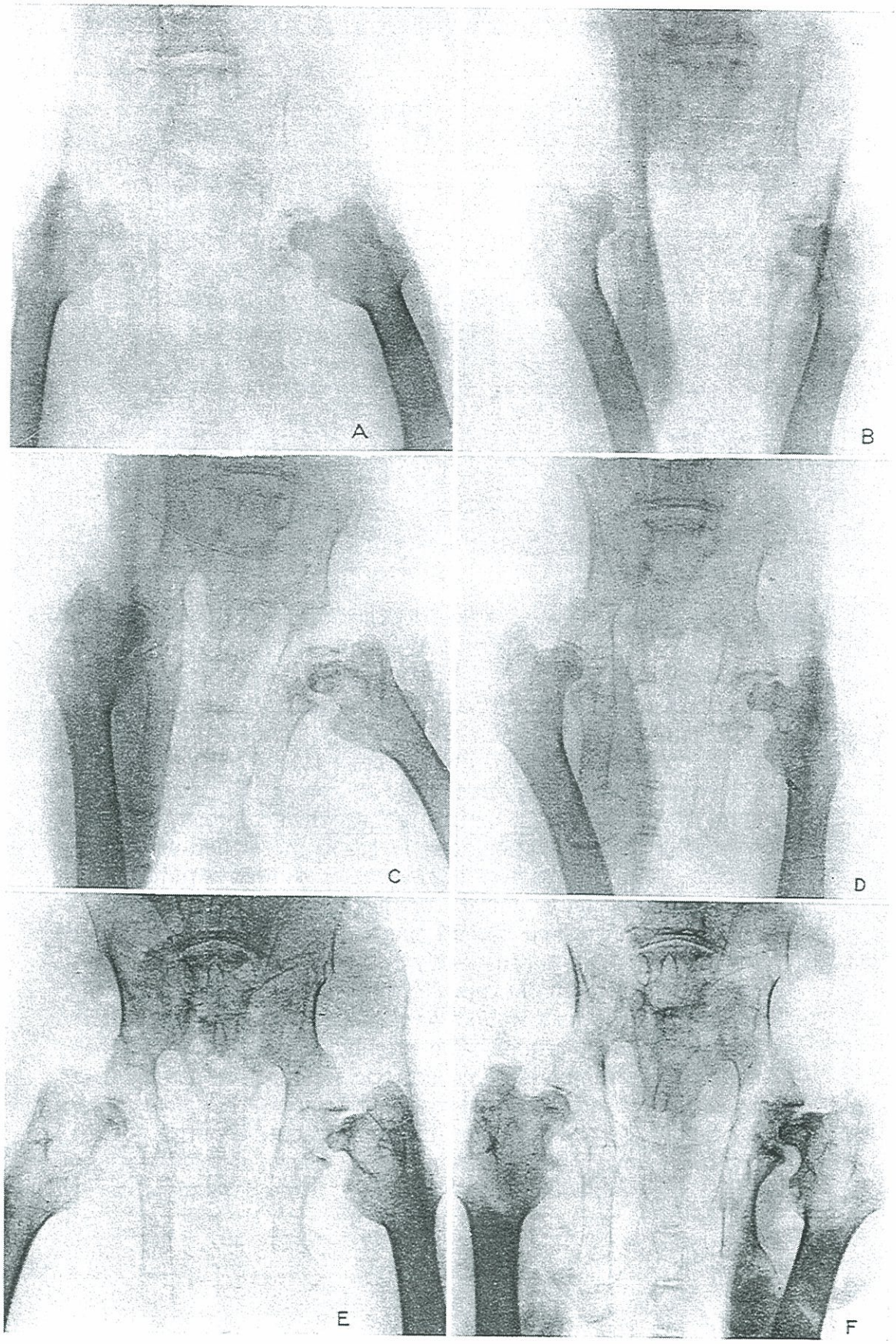


FIGURE 407. A SERIES OF ROENTGENOGRAPHIC VIEWS OF PROGRESSIVE DEVELOPMENT OF HIP DISEASE IN RABBIT 716, SHOWN IN PREVIOUS FIGURE. CULTURE FROM TOOTH IN CASE 1178.

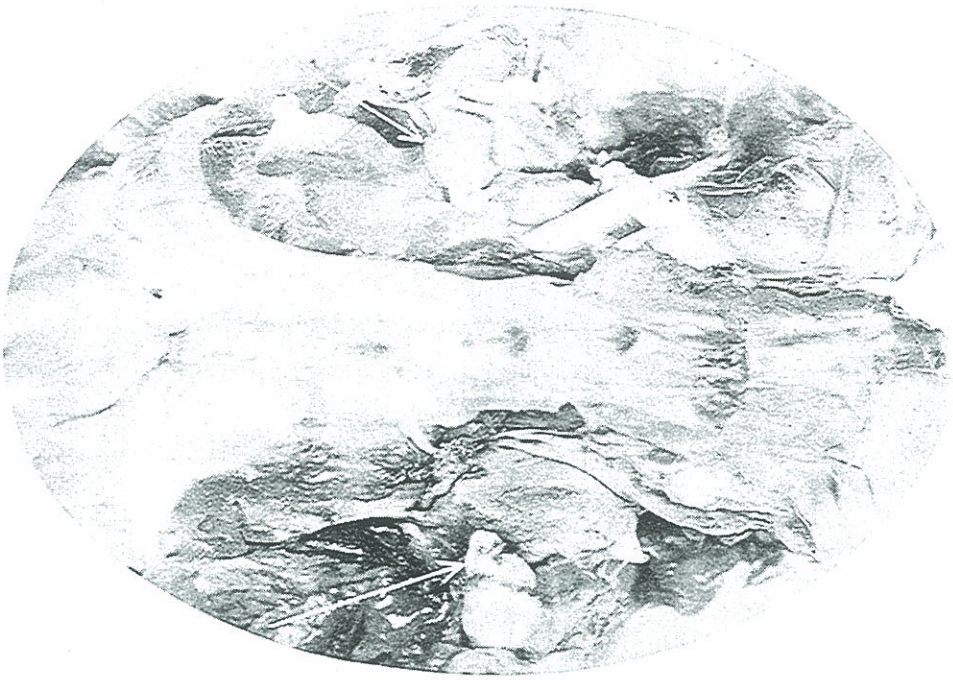


FIGURE 408. PHOTOGRAPHIC APPEARANCE OF HEADS OF FEMURS ON POSTING, RABBIT 716.

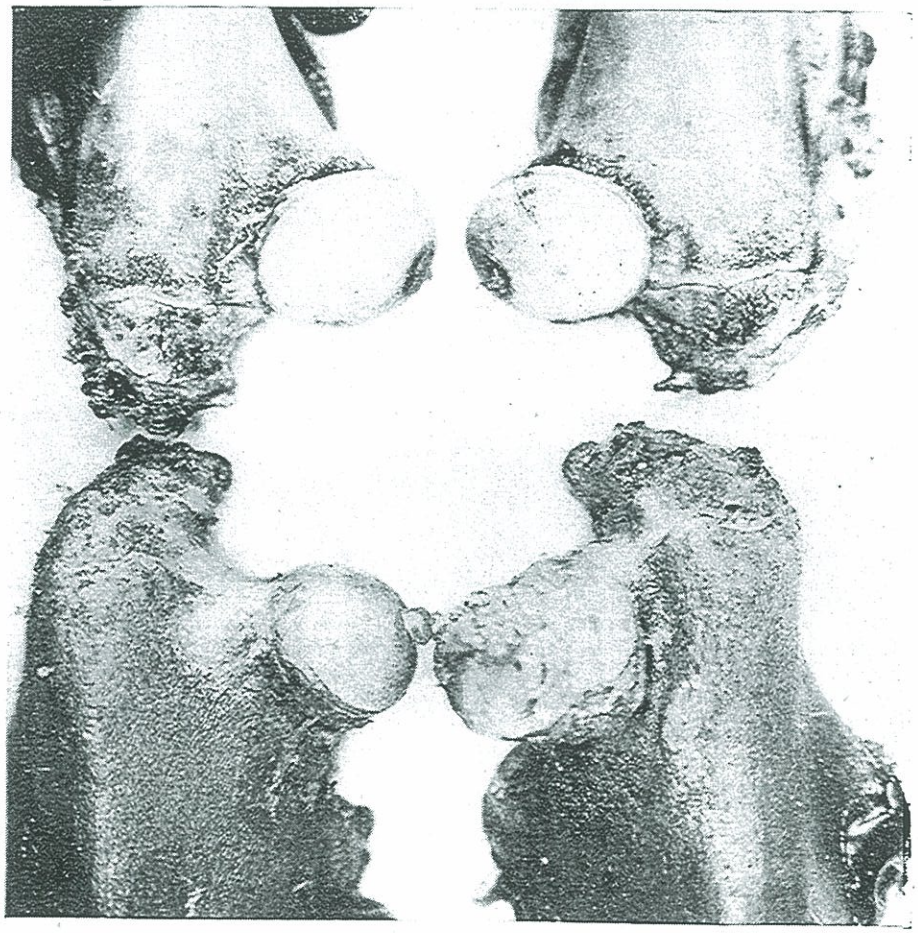


FIGURE 409. ENLARGED VIEWS OF NORMAL AND DISEASED FEMURS OF RABBIT 716 FROM CASE NO. 1178.

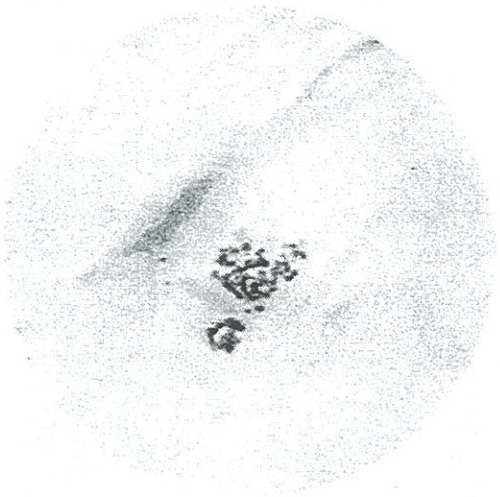


FIGURE 410. A SMEAR SHOWING DIPLOCOCCI IN PUS FROM HIP JOINT OF RABBIT 716.

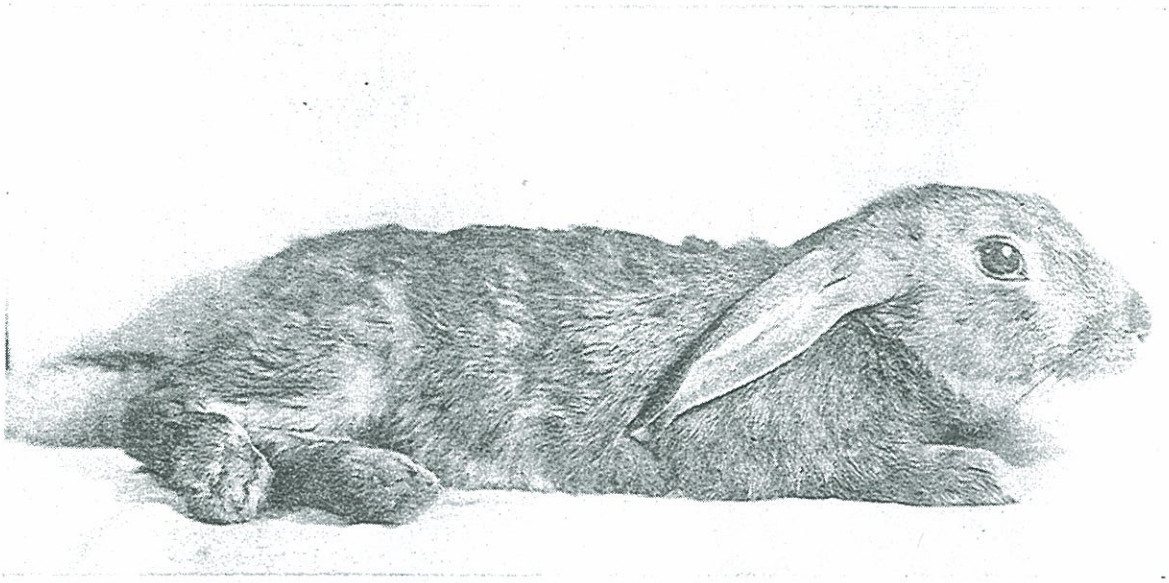


FIGURE 411. RABBIT 710, WHICH DEVELOPED PARALYSIS OF HIND LEGS FROM DENTAL CULTURE FROM CASE 1178.

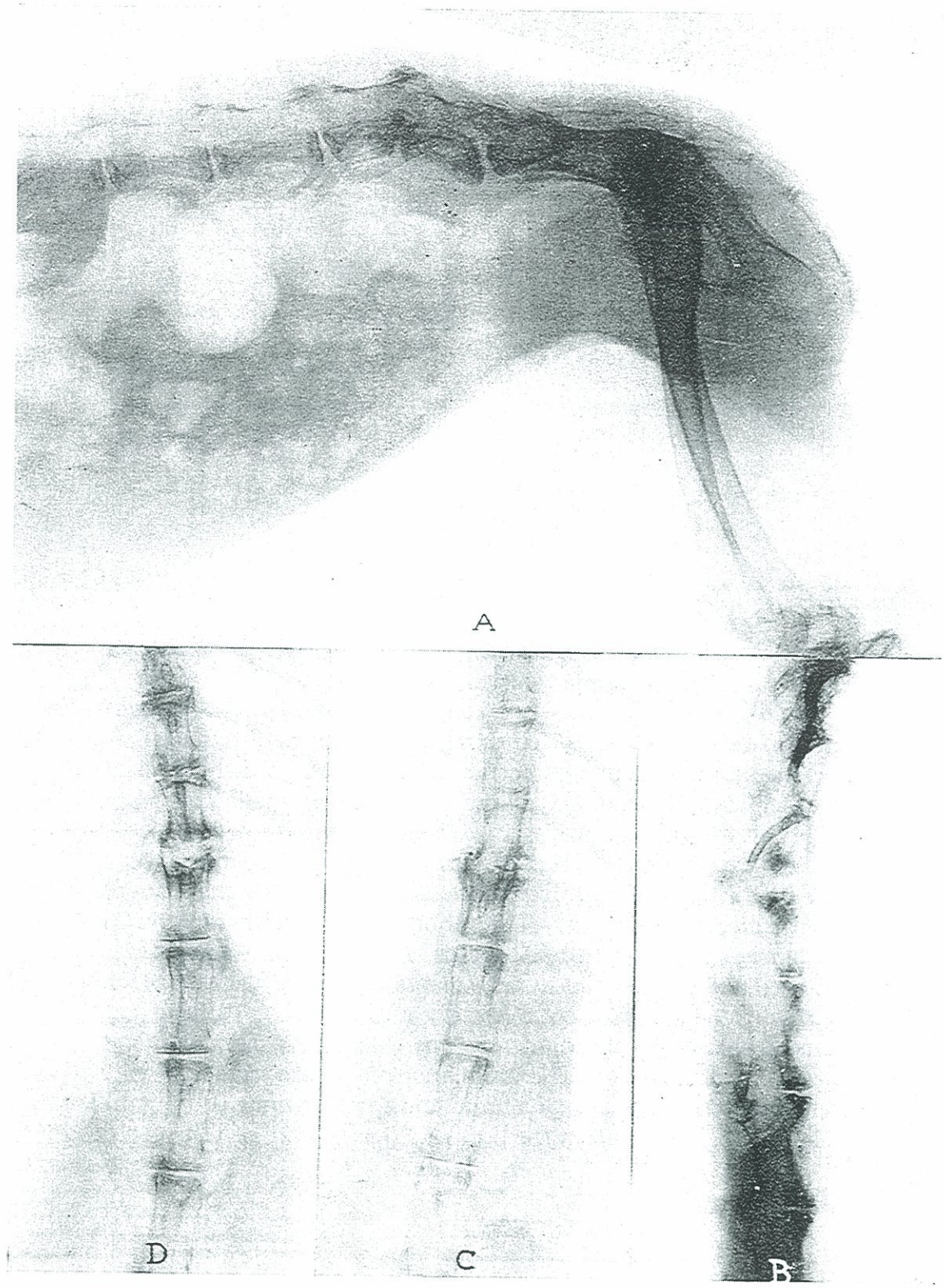


FIGURE 412. ROENTGENOGRAPHIC APPEARANCE OF LESION IN THE SPINE OF PARALYZED RABBIT, 710. CASE 1178. A, LATERAL VIEW WHILE LIVING. NOTE CONDENSING OSTEITIS. D, C, AND B, VENTRAL AND LATERAL VIEWS. NOTE CONDENSING OSTEITIS.

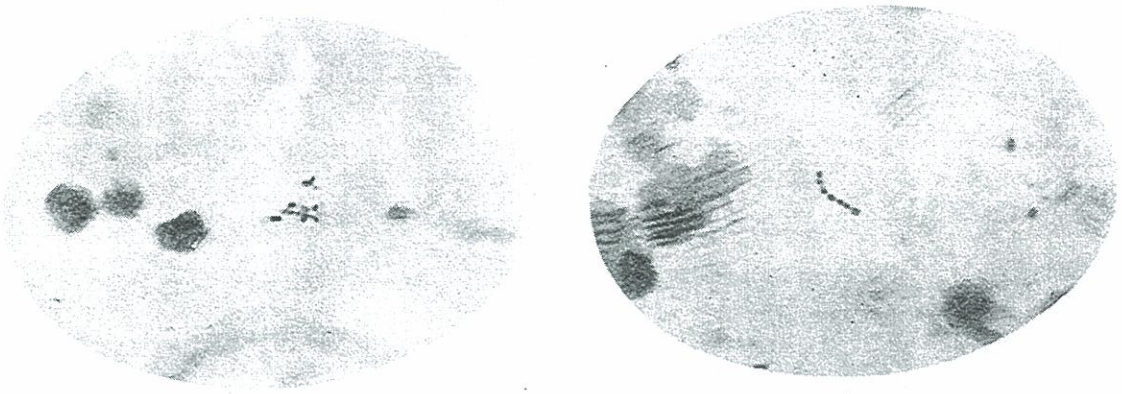


FIGURE 413. SMEAR FROM KIDNEY OF RABBIT WITH NEPHRITIS FROM DENTAL INFECTION, SHOWING PUS CELLS AND STREPTOCOCCI.

made of this rabbit. A smear from such a kidney is shown in Figure 413, showing pus cells and streptococci.

Rabbit 632 weighed, when inoculated, 1100 grams. It was inoculated with a twenty-four hour culture prepared by inoculating media with the filtered portion of the washings of the crushed teeth. This filter took out all but the extremely small organisms. The culture which grew was an exceedingly minute streptococcus in diplococcal form. The next morning following the inoculation, the rabbit showed peculiar choreiform movements and lateral nystagmus of both eyes. The rabbit lost in weight rapidly. In eight days it reduced to 822 grams, at which time the head was rotated and the choreiform movements were very marked, which torticollis developed more markedly until the rabbit's head was turned sharply to the right. It was chloroformed sixteen days after the inoculation. The brain and spinal cord were markedly engorged, with evidence of a brain and spinal meningitis. Figure 414 shows sections from the brain and spinal cord of this rabbit.

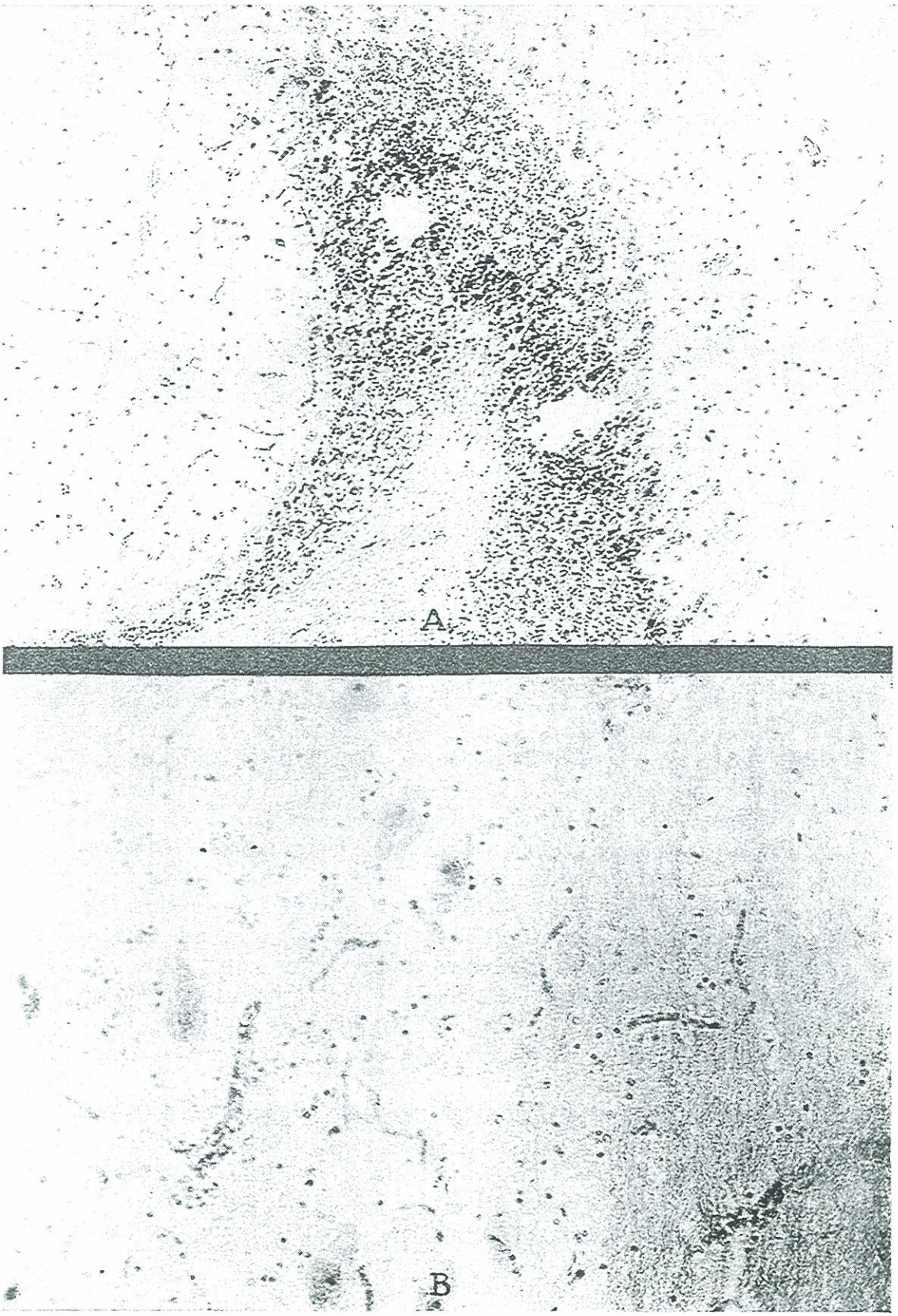


FIGURE 414. CENTRAL NERVOUS SYSTEM CHANGES IN RABBIT 632 WITH CHOREA, NYSTAGMUS, TORTICOLLIS, AND GYRATORY MOVEMENTS: A, A FOCALIZATION IN CEREBELLUM OF BRAIN; B, CONGESTION AND DEGENERATION IN GRAY MATTER OF CORD.

Rabbit 630 was injected with the same quantity of the same media which had not been inoculated from the filtered washings of the crushed teeth, at which time it weighed 1075 grams. It was posted in twenty-one days, at which time it had gained 120 grams, approximately normal growth. No pathology was found and in every way the rabbit was apparently normal. This was a control rabbit to see whether any other substances than the virus from the crushed teeth were involved.

Rabbit 626 was inoculated intravenously with a suspension in normal salt solution made by finely grinding some of the sediment from which the filtrate was taken for inoculating Rabbit 625. This inoculation was used in part to test its effect in sensitizing the rabbit for the culture grown from this sediment; and ten days following the sensitizing dose above, the animal was inoculated intravenously with 1 cc. of the culture grown from the same sediment. Two days later, the rabbit was favoring the left front leg and a swelling appeared in the left shoulder joint. Eight days later it was chloroformed, at which time it had gained 168 grams. The postmortem showed an intracapsular purulent arthritis of the right shoulder joint. Note that this is an exceedingly short period of time for a culture to produce a purulent arthritis, and in the light of the history of similar strains, strongly suggests that the first dose, while infinitely minute in actual amount of organisms conveyed, tended to prepare the animal for the inoculation of the strain grown from this source. This is in contradistinction to the immunizing effects produced in small but graded doses.

Rabbit 624 was inoculated intravenously with 5 cc. of the filtrate from the crushings of these same teeth: namely, the upper right first and second bicuspids. (See Figure 405.) This again was a test of the effect of the filtered washings for producing a sensitization or preparation of the rabbit for an intravenous inoculation, which was made twelve days later with 1½ cc. of a culture from these teeth. Seven days later, the rabbit developed an acute swelling of the left hind leg and knee region, partially carrying the same. It was chloroformed, at which time it showed a total gain of 129 grams.

A very marked and unusual condition is expressed with this strain. All these rabbits, though seriously involved, have shown gains in weight, quite unlike the reactions produced by ordinary strains and particularly all those producing proliferative arthritis. An associated very important and characteristic symptom

of this case is that this patient, notwithstanding her extreme nervous involvement, was not reduced in weight but was slightly over weight. On postmortem, this rabbit was found to have ulcerative aortitis and intra- and extra-capsular articular purulent arthritis of the left knee. Figure 415 shows an aortic arch

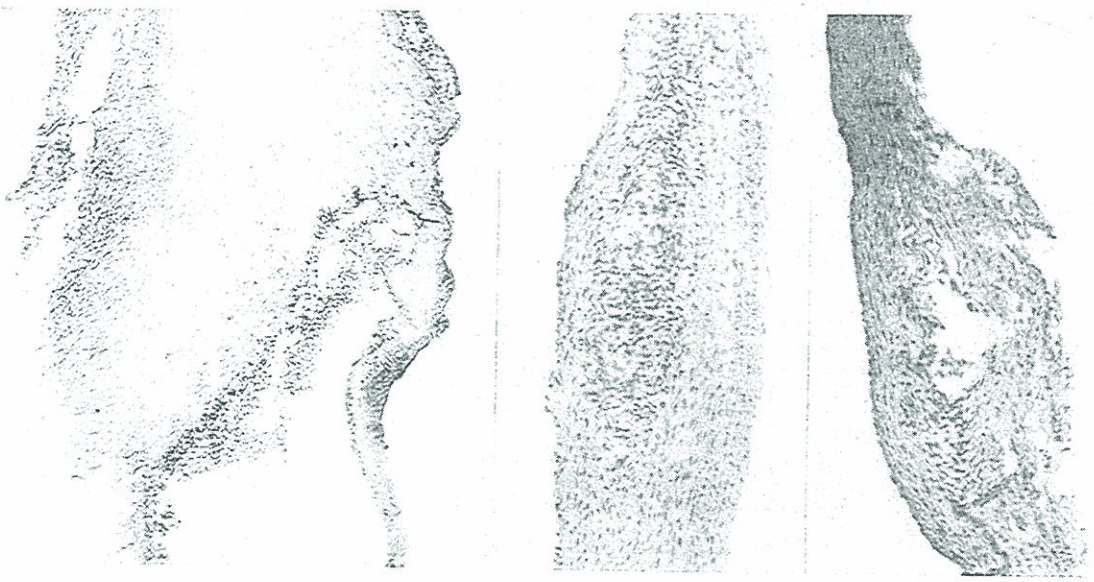


FIGURE 415. LESIONS IN THE AORTIC ARCH OF RABBIT 422.

section and Figure 416 a section of the joint capsule illustrating this condition. Note that Rabbits 624 and 626 give evidence of an anaphylactic arthritis.

Rabbit 604 was injected intravenously with the filtrate from the washed crushings from the lower right first and second molars, at which time it weighed 1110 grams. This rabbit went into a progressive condition of marasmus and cachexia. It died in twelve days from extreme emaciation. Otherwise, there was no gross pathology. It had lost in weight 318 grams or nearly 29 per cent of its weight. Note that this animal lost in weight, receiving only the filtered washings of the tooth; whereas, those that received the culture grown from this sediment gained in weight. This rabbit did not develop acute localization symptoms but, primarily, marked symptoms of a toxemia. It is very evident that we are dealing here with two distinct types of animal reaction produced from teeth from the same patient.

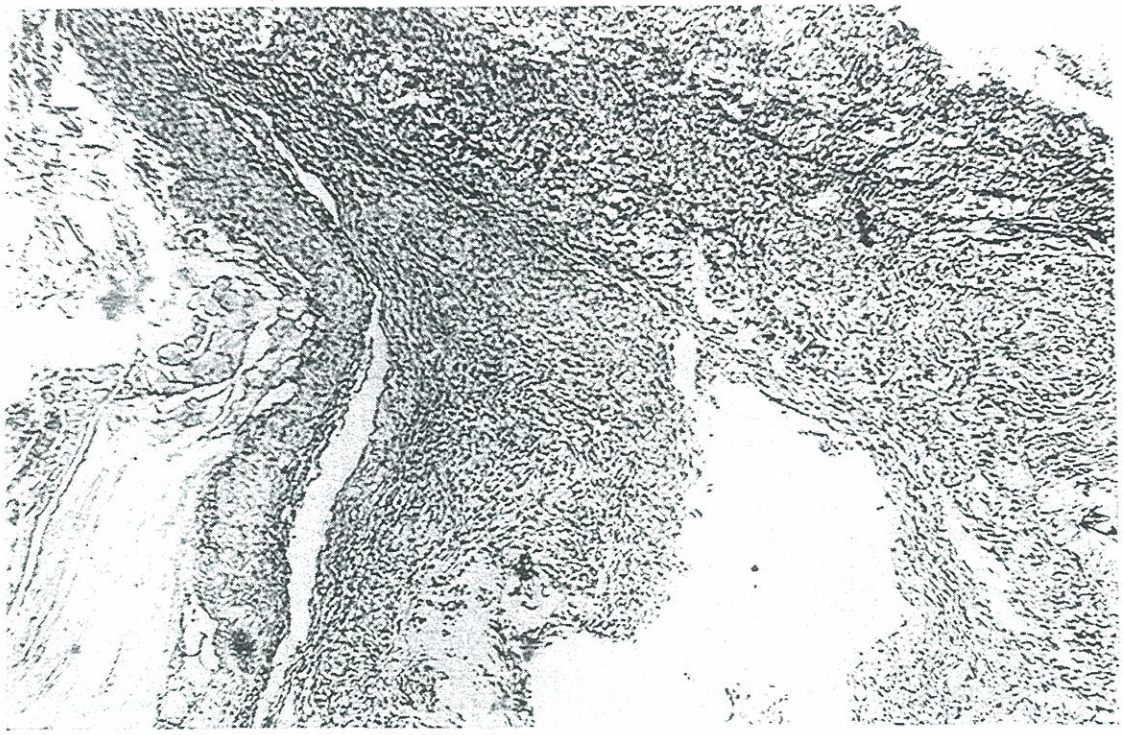


FIGURE 416. TYPICAL DEGENERATIVE ARTHRITIS OF JOINT CAPSULE OF RABBIT 624.

Another and very common expression is a disturbance of the centers controlling sleep. These disturbances may take any of a variety of forms: extreme sleepiness, marked inability to sleep, distressed dreams with sudden awakenings, muscular twitchings and jerkings during sleep. One of these is illustrated in the following case: A young man, Case No. 711, age twenty-two, who would regularly sleep fourteen hours and then had to be awakened. Almost immediately there was a change in his condition and he was slept out in eight hours. He remained normal in this regard when last reported, one year after the extraction.

Another illustration is shown in Case No. 1273, whose disturbances were the following: extreme sleepiness requiring fourteen hours a day, neuritis in his neck and shoulder, and nervous indigestion. These symptoms entirely disappeared within a few days after the obliteration of the dental infection, so much so that he was more rested in eight hours than formerly in fourteen hours. The roentgenographic record of his dental condition is shown in

Figure 417. The history showed that this condition of disturbed sleep, nervousness, and lassitude dated back for two and one-half years, during which time it had been recurring with increased severity, the last attack lasting a month and being very distressing. One year later the patient reports that he has had complete relief from his old trouble of sleepiness.

Another and more serious expression of disturbance of the central nervous system and sleep is illustrated in the following case which had been cons dered one of hopeless insanity. This patient, age forty-seven, was brought with the history that she had not slept for five weeks; that her previous attacks of insanity had been preceded by similar disturbances; and that she had been in insane institutions for approximately eight of the twelve months of each of the last five years. Her attacks developed in the following order: First, sleeplessness developing with increased severity until she would be awake every hour, day and night for several weeks; extreme excitability and irritability; and finally, violence, in which stage she would be put into an insane asylum. The dental condition is shown in Figure 418. Her history showed that the upper right central and lateral were broken by an injury at twelve years of age and had been suppurated ever since, namely thirty-five years. There had been exceedingly little local discomfort from her teeth. With the removal of three or four of the teeth, the patient slept much of the time for three days. The cycle of her developing symptoms indicated that soon she would be violent and she was to have been taken to the state asylum for treatment, when placed in our care. While giving her our attention, we placed her in the private ward with a skilled nurse. In a few days' time she passed through the series of nervous system disturbances which in previous attacks had taken many weeks. After removing her several infections with as much care and freedom from nervous overload as possible, she was placed in an insane asylum because of the danger to those attending her. In about two weeks' time we were notified that she was apparently normal and could go home. All previous attacks for five years had required, approximately, eight months to recover from. She was kept in the institution as an instructor in fancy-work for the female patients. Being a highly trained business woman, she was transferred to the office where she had the responsibility of the director's work for ten hours of the twenty-four in an institution with two thousand insane patients. She has had

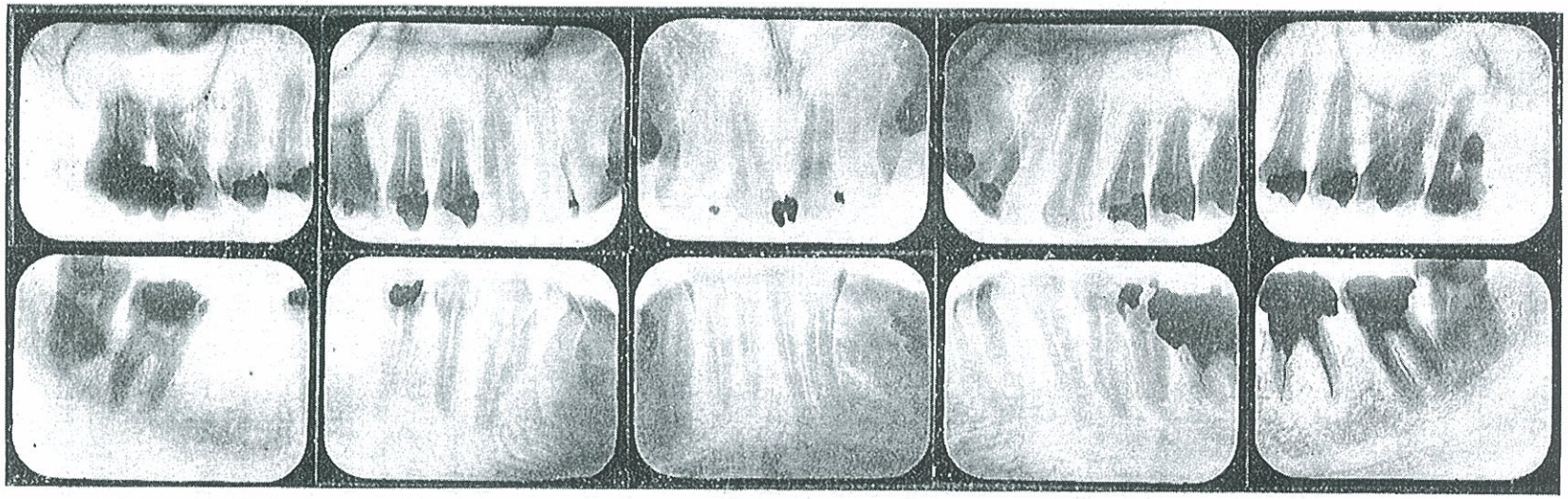


FIGURE 417. ROENTGENOGRAPHIC APPEARANCE OF TEETH OF CASE 1273 WITH EXTREME SLEEPINESS.

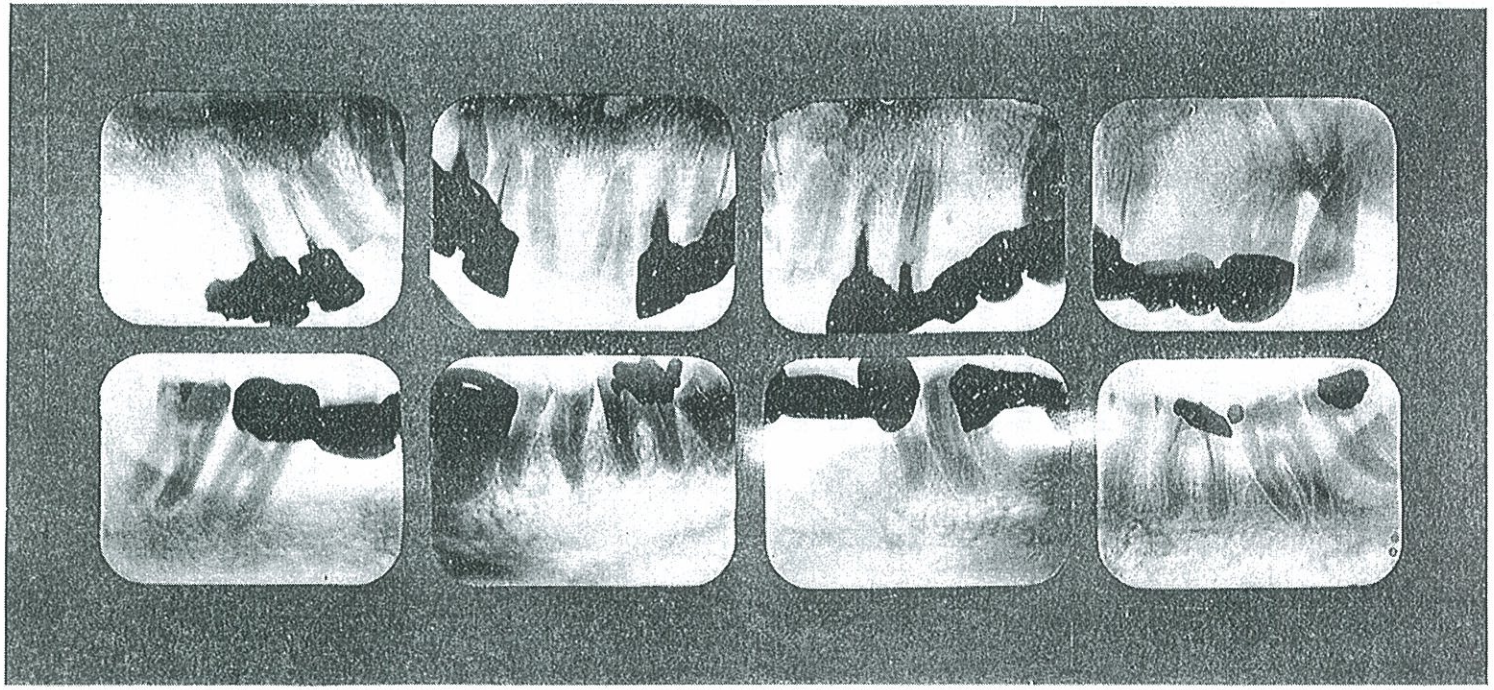


FIGURE 418. DENTAL CONDITIONS OF CASE NO. 557, WITH VIOLENT SPELLS OF INSANITY COMING ON AS SLEEPLESSNESS.

no symptoms of recurrence for approximately four years, has since been married, and is, as nearly as we can judge, a fairly normal woman.

Her susceptibility chart, shown in Figure 419, would be interpreted as follows: The patient's chief trouble has been a type of nervous breakdown with mental cloud as insanity. One of her sisters has had several disturbances of the nervous system, including a mild nervous breakdown. The patient's father had nervous breakdown and headaches. The patient's mother had symptoms in a mild way resembling those of the patient. While she never required to be in the care even of a guardian, she had spells of violent anger and was given to nagging and continual fault-finding with members of the family, but too shrewd to do so in the presence of outsiders. She died at seventy-two having lived alone the last twenty years of her life because of her disposition, which made it impossible for her children to live with her. Rheumatism was present on the mother's side. This daughter, therefore, received by inheritance this marked tendency to nervous break from her mother, accentuated by nervousness and headache from her father. This phase of her central nervous system was a very weak link in the chain; and in accordance with our studies, when such a person has a dental infection, its effect is, primarily, to irritate and affect that weakest link. The thing that happened to her was just what should have been expected. In addition to this, an acquired susceptibility tends to affect the nervous system or an injured tissue, chiefly the former.

As disclosed by the roentgenograms, she had an unusually large volume of dental infection; and by volume, I do not mean the cubic area of absorption at root apices, but the extent and quality of the infected dentin, as expressed in its ability to cause reaction in the patient, locally and systemically. If she carried root end infection perpetually from the time she was twelve years of age until she was forty-eight, it would require an exceptionally high defense to maintain her safety. The absorption on the side of the right lateral is an indication of an ability on the part of the patient to make a vigorous reaction during a long period of time. The condensation around these areas would indicate that the patient had come to a period sometime previously when her local reaction was less efficient. According to her history, these teeth were crowned twelve years previously and her nervous disturbances began about eight years ago and took on their extreme phase five or six years ago. The fact that

Form No. 15- Serial No. 557

RESISTANCE AND SUSCEPTIBILITY CHART

PATIENT Case No. 557 S.W.N. AGE 48

ADDRESS DATE 1-10-19

CHIEF COMPLAINT Insanity

Pt. has now	Pt. has had	Rheumatic Group Lesions and Complications	Own: Brothers	Sisters	Sons	Daughters	Hsbnd Wf	Fathers Side: Father	Grndfthr	Grndmthr	Uncles	Aunts	Mothers Side: Mother	Grndfthr	Grndmthr	Uncles	Aunts
		No.	2	3							4	1				4	3
		Tonsillitis															
		Rheumatism		#									#				
		Swollen or Deformed Joints											#			#	#
		Neck-back or Shoulders	#	#													
		Lumbago														#	
		Neuritis		#													
		Sensitizations															
		Sciatica															
		Chorea or St. Vitus's Dance															
#	#	Nervous Breakdown		#				#					#				
#	#	Mental Cloud as Insanity											#				
		Persistent Headache						#			+						
	+	Heart Lesions											+				
		Dropsy															
		Kidney Lesions, Brights											⊕				
		Liver or Gall Lesions															
		Appendicitis															
	+	Stomach pain or Ulcer	#														
	+	Eye, Ear, Skin, Shingles	+					#									
		Pneumonia															
	+	Anemia															
		Goiter															
	#	Lassitude, Chilliness											#				
		Hardening of Arteries															
		Stroke															
		Age if Living															
		Age at Death	½	2				63	49	84	70	35	72	73	63		
		Flu with Complications															
		Flu without Complications															
	#	Neuralgia		#									+				
		Childhood Disease	⊕														
		Typhoid		#													
	#	Extensive Tooth Decay		#													
	#	Abscessed Teeth															
		Loosening Teeth															

Years / Duration of chief Affection / Duration of Dental Infection

KEY FOR CHART: + Had Lesion; # Frequently; # Very Severely; +? Probably; ✳ Operation; ⊕ Fatal Attack

D. Infctn Types				Syst. Relf.					Factor of Safety				
Caries #	Lokd #	Condsng	Sl. Hg.	Comp. #	Part.	Recr.	None		V.Hg.	High	Fair	Low	V.Lw.
Pyrrh	Open	Rfying	Ra.Hg.	Susc. Tblt.: Inht. #	Acqd. #	Abst.	Sc. No						#

FIGURE 419. SUSCEPTIBILITY RECORD OF CASE NO. 557, WITH INSANITY AND MARKED INHERITED SUSCEPTIBILITY TO NERVOUS BREAKDOWN, AND MENTAL CLOUD.

this patient was passing into the series of progressive symptoms precisely as the previous attacks for five succeeding years had come on, indicates that the same forces were at work and that the patient was reacting in a similar manner. Since, however, the long maintained excitement and violent stage were aborted by the removal of the infections, so completely that she was reported by her brother to be more normal in two months than he had seen her for years and was reported to be so greatly improved as to come home in two weeks' time, suggests, if it does not indicate, that an important contributing factor had been removed in the removal of the infected teeth. This, together with the fact that she has had no recurrence, puts great importance upon thedental infection.

As for the future, we would say that the same inherited susceptibility exists and a sufficient overload will doubtless bring about a break. It is my opinion that few, if any, overloads are more potent to bring about such a break than dental infections. Whether these act largely or chiefly by bacterial invasion of the central nervous system, by toxemia's irritating the central nervous system, or a sensitization as true allergic reaction, or all three, is not as yet definitely established. There is strong indication, however, that each of these mechanisms may contribute and each may be the chief acting force in certain cases.

We have undertaken to study the effect of the toxic substance in infected teeth as a sensitizing agent. We have discussed this specifically in Chapter 30. It will be of interest in this connection to review the studies of these phenomena where the sensitizing substance was taken from the teeth of a patient suffering from central nervous system disturbance. The patient, female, married, age about twenty-four, two children, ages about two and four, has developed a very striking central nervous system disturbance expressing itself chiefly in crying without provocation. With the removal of her dental infections, these symptoms have disappeared. The teeth involved are shown in Figure 420. The extent of the areas, as suggested by the roentgenograms, particularly the upper right and left laterals, suggests that the patient has previously had a good power of reaction. The beginning zone of condensing osteitis, forming a boundary about these zones, suggests the onset of a period of less effective defense. This probably dates back to her pregnancy of three years ago. Studies were made to determine the effect upon ani-

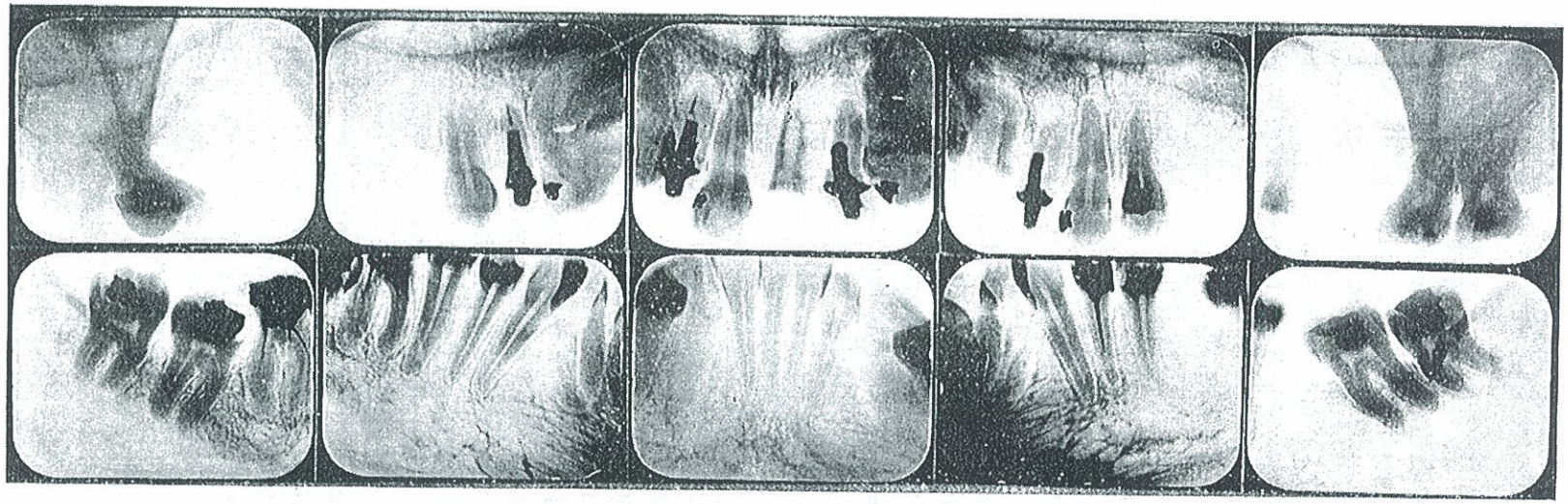


FIGURE 420. DENTAL CONDITIONS OF CASE NO. 402, WITH NERVOUS DISTURBANCE AS CRYING.

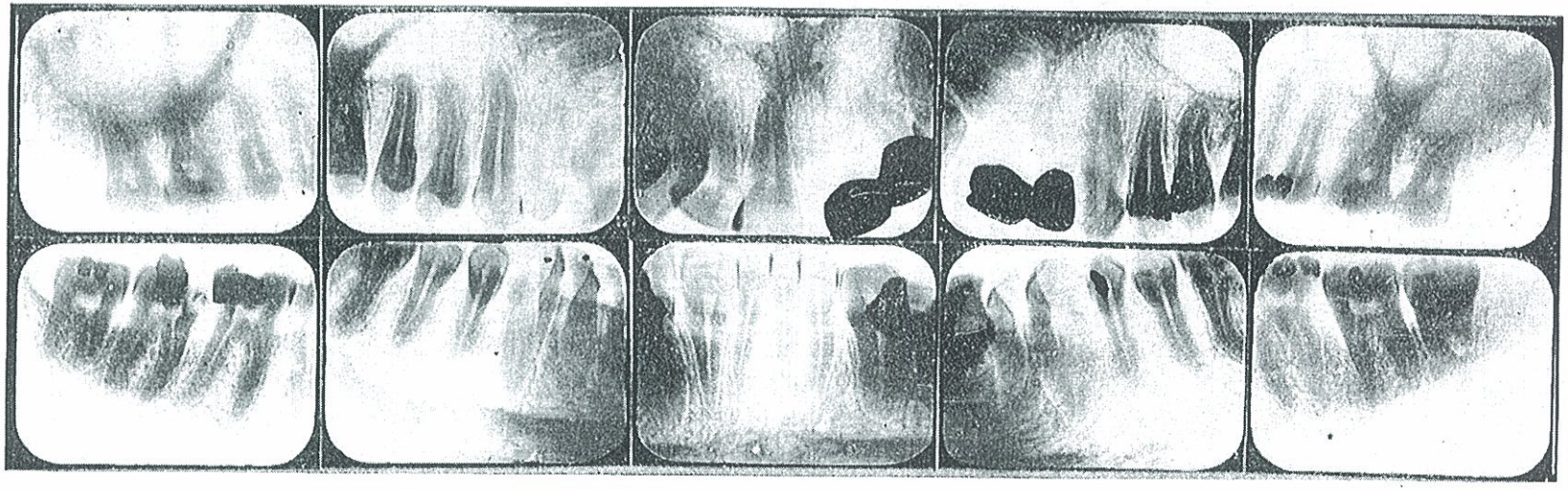


FIGURE 421. ROENTGENOGRAPHIC APPEARANCE OF TEETH OF CASE 1139.

mals, both by direct inoculation and by sensitization with filtered washings from the infected teeth. The effect of the extractions was to improve, greatly, the nervous disturbances.

Lesions of the brain, being in a tissue that does not readily reconstruct destroyed functioning cells, of necessity leave an entirely different type of scar or after effect from a lesion in muscle or even bone tissue. Patients suffering from a toxic or bacterial irritation of central nervous system tissue, brain, or cord, for a period of many months or a couple of years, tend readily to develop permanent lesions. When these affect certain areas of the brain, the only apparent lesion may be as a psychosis. Such individuals are termed queer or insane in accordance with the degree of that disturbance. These lesions may have a large range of expression, and it now seems probable that a very large number of the inmates of our insane asylums are simply illustrations of the effect of a too long maintained focal infection, the toxic irritation of which tended to select brain tissue, with the result of a permanent functional, and though ultramicroscopic, a permanent physical injury. To extract the infected teeth causing this condition after this permanent scar in the brain tissue has been established, should not be expected to cure this extreme disturbance because this tissue does not repair. The appeal of so many of the readers of our dental profession that dental infections that they presume to be slight are doing no harm and should not be disturbed until the patient shows evidence of a physical injury, is in many cases delaying the surgical interference which might prevent a permanent brain lesion, beyond the time when repair is possible. The prevention of the serious and permanent central nervous system disturbances, such as the insanities, can only be accomplished by the removal of the dental infections before the central nervous system tissues are seriously injured. Preventive measures, as a prophylaxis for these individuals, should be accomplished before the trouble begins. Teeth that are potentially capable of furnishing a focal infection are of danger to this type of patient, not so much in proportion to the quantity of that infection, as in the predisposition to the involvement of brain tissue. Hence all patients should have as a part of their study a thorough susceptibility study in order that the weak links of the chain may be found and guarded against before the break comes, rather than waiting for the irreparable break and using it as the danger signal, which is all too late and not sensible medical practice since it is neither preventive nor prophylactic.

We should discuss in this connection reflex irritations as causative factors in producing central nervous system disturbances in addition to the disturbances of dental origin of an infective nature. Such a case is as follows:

Case No. 1082.—A girl of twenty-one has been in a state of serious mental break, consisting chiefly of hallucination and aberration without violent symptoms and maintained as a quite even and constant lesion. The history of the case is as follows: There is a very marked tendency to insanity on her father's side of the family. Several cousins have been affected. About six years ago, while motoring in the East, she and her party found themselves quarantined because of the epidemic of poliomyelitis. The embarrassment and fright brought on a most violent alarm and fear of infection, which is her chief obsession. Every particle of food that she ate had to be boiled and boiled to kill all germs, particularly for fear the germ producing infantile paralysis might be present. If any member of her family had been out riding and brought his or her gloves into the room where she was, she would have a paroxysm of alarm. When brought to my office, she brought her own drinking water which was the only water she would permit to be used about her mouth as well as her own drinking glasses which had been boiled, probably for hours. A sealed jar, glasses, etc., were wrapped in towels that had been baked in the oven until they were brown from the over-heating. Great care had to be taken not to allow the cleaning woman to pass through the part of the building where she was. She would instantly place one of her burnt towels over her mouth. The roentgenograms of her teeth are shown in Figure 422; and, incidentally, the films for these had to be wrapped individually by her in sterile gauze, which she brought for the purpose, before they might be placed in her mouth. The infected molar and the seriously impacted third molar were removed at separate sittings, with so great a change that she invited people to come to see her, who had not been permitted to do so for years; whereas, previously, she would go out of the house only when it was raining, for even her dental appointments had to be postponed until a suitable rainy day was found when there would be no germs in the air, a difficult condition to fulfill in Cleveland. She shortly improved so greatly that these problems largely disappeared. It is quite impossible to say how much of the disturbance in her case was sympathetic, due to the impacted third molar, and how much

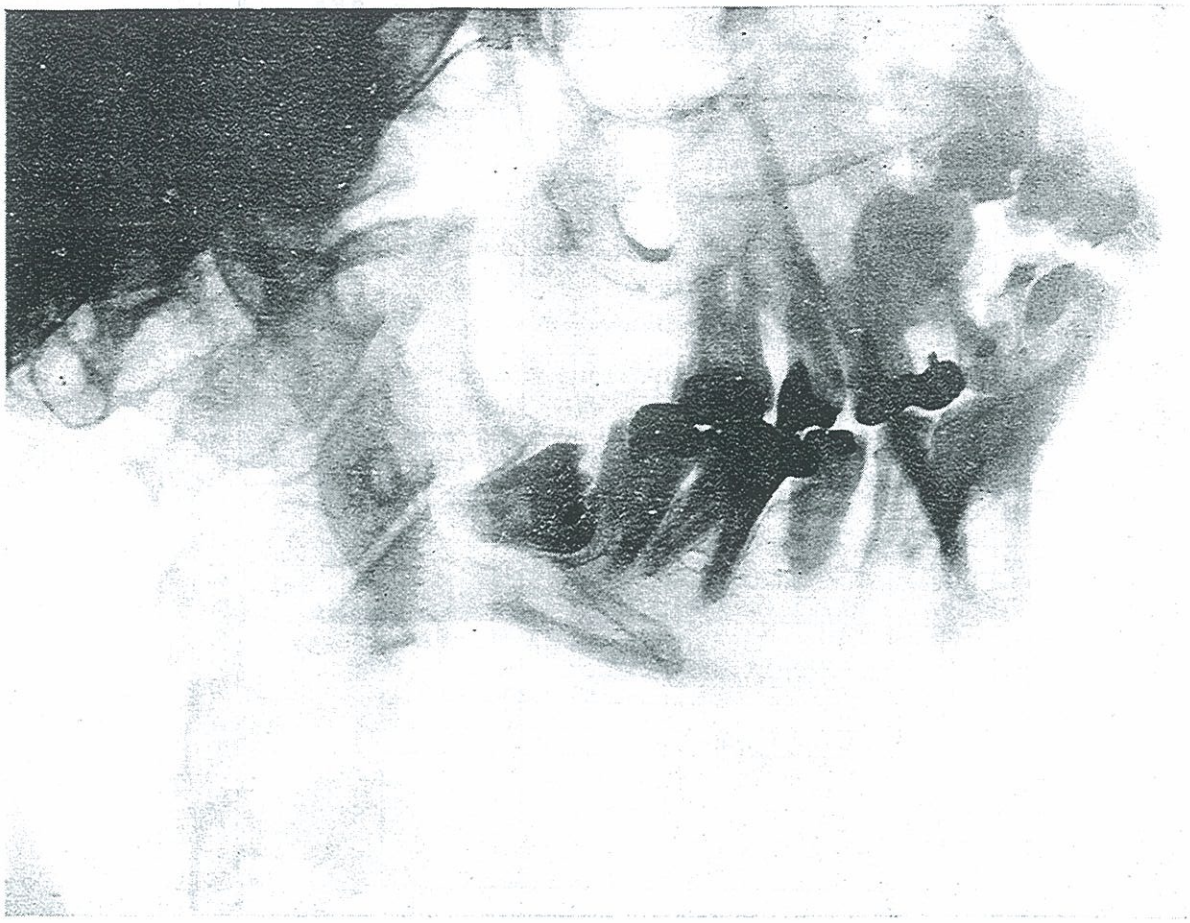


FIGURE 422. DENTAL CONDITION OF CASE NO. 1082. MILD INSANITY GREATLY IMPROVED BY REMOVAL OF DENTAL PATHOLOGICAL CONDITION.

to the infective process of the first molar. It is probable, however, that the former was an important contributing factor.

This girl, while very greatly improved, has not returned to normal; nor do we believe that, particularly in the sense of her susceptibility to break of the central nervous system which in her case is an inherited quality, she can ever become normal. In other words, her normal carries a deficiency, which deficiency may become a first factor in the development of a defect.

Case No. 1401.—A still more striking case is the following: A young married woman, age twenty-two, had been in an asylum for two years, with violent spells, which, at one time, required her to be in a strait-jacket. Frequently, her hands had to be tied, and she practically always had to be under guard. When brought to me for study from a neighboring city, she was kept under guard

Form No. 13 Serial No. 785

RESISTANCE AND SUSCEPTIBILITY CHART

PATIENT R. W. E. Case No. 785 AGE 36

ADDRESS DATE 5-18-18

CHIEF COMPLAINT Sciatic Rheumatism

Pt. has now	Pt. has had	Rheumatic Group Lesions and Complications	Own: Brothers	Own: Sisters	Own: Sons	Own: Daughters	Own: Husband Wf	Fathers Side: Father	Fathers Side: Grandfthr	Fathers Side: Grandmthr	Fathers Side: Uncles	Fathers Side: Aunts	Mothers Side: Mother	Mothers Side: Grandfthr	Mothers Side: Grandmthr	Mothers Side: Uncles	Mothers Side: Aunts
		No.	1	3	1						6	2				4	3
	#	Tonsillitis	#	+	*		#										
	+?	Rheumatism	#		#								#				#
	+?	Swollen or Deformed Joints											#				
	#	Neck-back or Shoulders											#				
	#	Lumbago	#					#					#				
#	#	Neuritis						#					#				
		Sensitizations															
#	#	Sciatica															
		Chorea or St. Vitus's Dance															
	#	Nervous Breakdown											+		#		
#	#	Mental Cloud															
	#	Persistent Headache						#									
#	#	Heart Lesions			+?			⊕	⊕		⊕[3]						#
		Dropsy						⊕									
		Kidney Lesions, Brights															
		Liver or Gall Lesions															
	+?	Appendicitis															
		Stomach pain or Ulcer						#									
	#	Eye, Ear, Skin, Shingles															
		Pneumonia		#					#				⊕				
		Anemia															
		Goiter															
	#	Lassitude, Chilliness															
		Hardening of Arteries															
		Stroke															
		Age if Living															
		Age at Death															
		Flu with Complications															
		Flu without Complications															
	#	Typhoid															
		Neuralgia						#									
		Childbirth Infection		⊕													
	#	Extensive Tooth Decay		⊕ T.B.				#									
	#	Abscessed Teeth						#									
		Loosening Teeth Several Locked															

Years: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73

Duration of Dental Infection

Duration of chief Affection

KEY FOR CHART: + HAD LESION; # FREQUENTLY; # VERY SEVERELY; †? PROBABLY; * OPERATION; ⊕ FATAL ATTACK

Dental Infection Series	CARIES	LOKD	CONDSNG	SL. HG.	SYST. RELF.	COMP.	PART.	RECR.	NONE
	#	#		#			#	#	
	PYRRH	OPEN	RFYING	RA. HG.	SUSC. TBLT.	INHT.	ACQD.	ABST.	SC. NO
						#			

FACTOR OF SAFETY				
V. HG.	HIGH	FAIR	LOW	V. LW.
				#

FIGURE 423. SUSCEPTIBILITY RECORD OF CASE 785, WITH SCIATIC RHEUMATISM AND HEART. NOTE MARKED HEREDITARY SUSCEPTIBILITY, WITH FIVE DEATHS FROM HEART INVOLVEMENT ON FATHER'S SIDE AND ONE CASE ON MOTHER'S SIDE.

all of the time. The history indicated that her central nervous system disturbance began about three years before, was progressive in its onset, and there had been no abatement of the severity, or but slight. Her parents said to me how much they wished they could see her die, as they had been advised there could be no hope and her case was getting progressively worse. In about two weeks' time after her return to the asylum, her parents were notified that she could return home, which she did. This occurred in June. The following September she went away to college apparently perfectly normal, took up music, and the following spring stood at the head of her class of sixty, having made a most remarkable record and with no tendency to break. This occurred six years ago and she has had no break since. In order that I might have a late report of her case, I have just written to her mother regarding her, and she writes, "M——is as well in every way as a girl can be." A study of the family history reveals that her father had suffered from a very serious nervous breakdown, her mother a less serious one, and her brother had a mental obsession.

In this connection, it might be inferred that insanity may be due, generally, to dental infection. This is so far from being the case that we deemed it best to illustrate a case in which there is no apparent connection between the dental and the mental lesion.

Case No. 1139.—The patient, a man age thirty-six, had been in an asylum for the insane for several years with recurring attacks of a very serious mania in which he would not recognize even his nearest relatives. These periods would last for days and would be followed by states of apparent normality. The roentgenograms of the dental conditions are shown in Figure 421. It will be noted that his teeth are all apparently normal except the lower left second molar which had recent caries, extensive but not seriously involving the pulp. Thermal and electrical tests of his teeth indicated them to be normal. We advised that the dental conditions were not responsible for, nor contributing seriously at present to, his mental condition. The only questionable tooth did not have a history extending back over the period of mental disturbance. This tooth was extracted as a matter of prophylaxis; but, as we expected, there was no improvement in his condition. If, however, this patient had developed a series of one or more serious dental infections, particularly of a locked area type, this source or any other source of streptococcal infec-

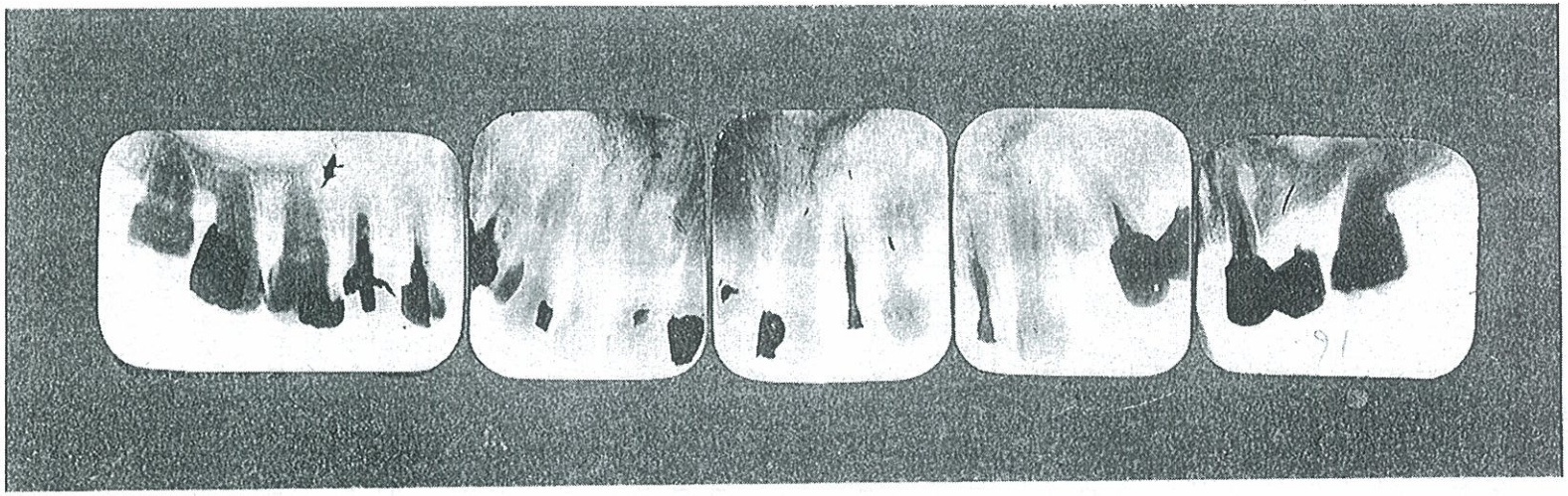


FIGURE 424. DENTAL CONDITIONS OF CASE NO. 1139, SUFFERING WITH ACUTE NEURITIS, COMPLETELY RELIEVED BY REMOVAL OF DENTAL INFECTIONS.

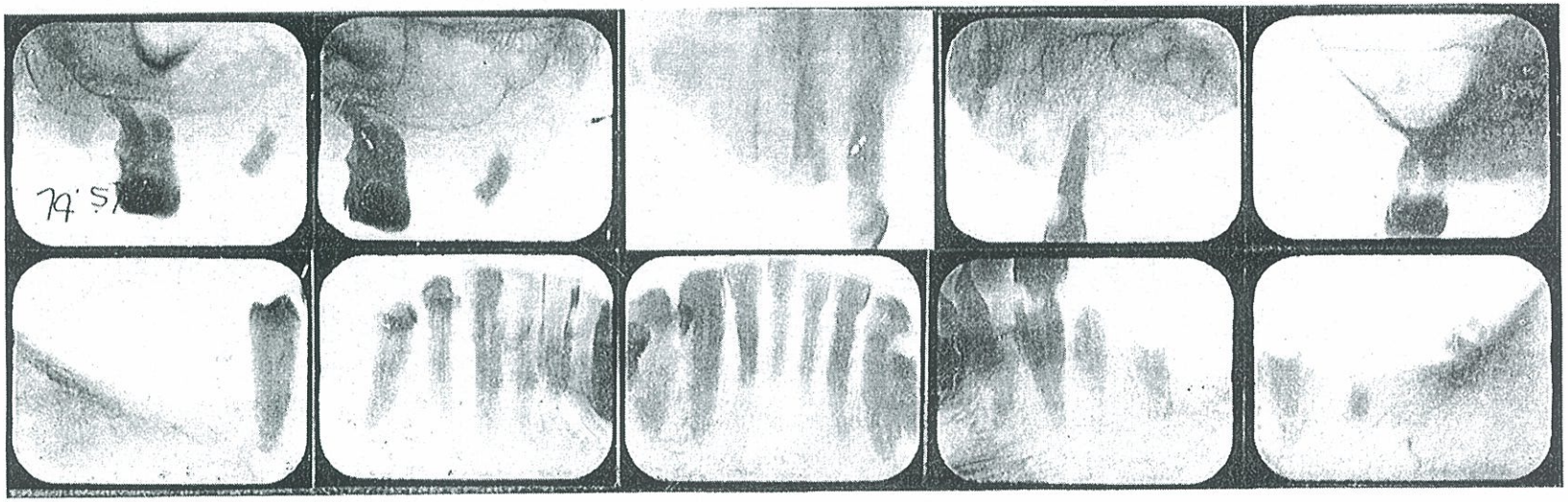


FIGURE 425. DENTAL CONDITION OF CASE NO. 805, BOOKED FOR AN INSANE ASYLUM AS A BEDRIDDEN INVALID WITH PALSY. REMARKABLE RELIEF FROM REMOVAL OF HER DENTAL INFECTIONS.

tion, and probably several other types of infection, would have tended to aggravate the mental lesion.

There is, however, a type of border-line case that is exceedingly difficult to interpret. The patients who are at best living in a zone of marked tendency to nervous affection will have that condition aggravated seriously by dental infection. Such a case is illustrated in the following:

Case No. 785.—The patient, age thirty-six, had been in bed for six months approximately, with acute neuritis and nervous symptoms. He had suffered very severely. The removal of several dental infections, while he was in bed, made an immediate improvement which was practically complete so far as his neuritis was concerned. His irritable nervous system, however, was a constant menace; and while he has had no return of his neuritis for four years, each type of overload, worry, and exhaustion, has tended to bring about a nervous break. His heart condition, which was alarming during the period of his acute neuritis, has so greatly improved that he takes care of a large business effectively.

A study of his susceptibility chart, shown in Figure 423, illustrates the marked inherited susceptibility. He has strongly inherited nerves and rheumatic susceptibility from his mother and heart susceptibility from his father's side of the ancestry. It will also be seen, that his father, his father's mother, and three of his father's brothers died of heart affection. One of his mother's sisters has a heart affection. We must, therefore, come more to think of the host and his or her normal defenses as being the most important fundamental factor; for a normal high defense may, and usually will be, ample to defend people against even large amounts of dental infection during the greater part of their lifetime; but people without that defense are already in grave danger; and insurance companies will doubtless come to place great stress upon the presence or absence of streptococcal susceptibility, and the individuals without the normally high defense will receive less consideration than those with an ample streptococcal resistance in so far as their inherited susceptibilities are concerned.

A striking illustration of an extreme neuritis in an individual with, normally, a high defense is shown in the following case. Case No. 449.—This patient, male, age forty-three, had so severe a neuritis in his back and hips, which had lasted for twelve weeks and had been progressively getting worse, that he could not sit in a chair; he had either to stand or lie down. The removal of the dental infections, shown in Figure 424, completely relieved his

neuritis in about three days; and in five years' time, there has been no recurrence. His susceptibility chart shows his case to be one of strikingly acquired susceptibility, there being no evidence of neuritis in either the immediate family or his ancestry. This is the type of case in which a prognosis should be considered favorable.

NERVOUS BREAKDOWN.

Of the many nerve lesions, probably none are more pitiable than those involving the mind. However, if there is coupled with the mental break an acute neuritis, the case becomes much more distressing. An illustration of such a case is the following:

Case No. 805.—Arrangements had been completed and the day set for taking this patient to an insane asylum because of a palsy that made her a supposedly hopeless bedridden invalid. The palsy of her extremities began about four years ago, with increasing severity, with its onset as a nervous breakdown; and her prostration was accompanied by severe pain of obscure neuralgic nature. She was carried to our ward. The condition of her teeth is shown in Figure 425. There was an early and very marked improvement after the removal of her dental infections, which expressed itself in the mental lesion, the palsy, and the neuritis. Within a few weeks after the removal of the dental infections, she was so greatly changed that she returned to the office alone on the street car, and walked without difficulty, without even a cane. Notwithstanding her age of sixty-seven, instead of being an embarrassing burden to her household, she became very helpful, for she not only was able to take care of herself but assisted in taking care of others.

CHOREA

As previously stated, of the many lesions produced or aggravated by dental conditions, few are more distressing and baffling than are those of the central nervous system, affecting the mind. In our mixed clinic we find that, approximately, seven per cent of the patients presenting for study of the relation of systemic disease to dental infection are recorded to have had mental cloud. We have seen so many times an improvement or complete relief by the removal of dental infections that we have come to think of these functional disturbances as being pretty largely the result of structural change due either to bacterial or toxic invasion. In children these affections may involve both lack of coördination and more or less severe psychic irritation, characterized by the

patient's irritability and impetuosity, and even violence, all of which so often make up the picture of chorea. A typical illustration is as follows:

Case No. 458.—The patient, nine years of age, was brought by his mother with the following history. As the tears streamed down her cheeks, she said, "Why have my husband and I been cursed with such a wicked boy? The teacher sent him home with a note saying that if he returns she will leave the school. He cannot play with children without slapping them in the face or some other unpardonable violence without provocation. He does this also to his father and to me. While keeping him out of school, since we have to, I thought it would be a good time to have his teeth taken care of, etc., etc." We made a few studies of the boy and soon found that he had largely lost his power of coördination. He had a very sharply developed symptom group chorea with an exaggeration of the irritability phase. While undertaking to make roentgenograms of his teeth, he would strike me in the face without any provocation. In addition to making these studies, we made motion pictures of his lack of coördination. It was apparently impossible for him to sit still, and every moment he was twitching and jerking and, as such patients do, would try to turn an involuntary muscular contraction into a voluntary one. He would find his knee jerking up, and, in order to avoid the embarrassment, would turn it into a kick; and similarly with his hands. If he had something in his hand at the time the involuntary reflex occurred, and his hand started swinging, he would let the article fly as though he had intended that to be the movement. We do not wonder that his teacher had reached the limit of her capacity to control, for no ordinary power could control him, not even his own mind. We explained to the mother that her boy was not a bad boy; that he had an infection of the cortex of the brain, probably largely coming from his infected teeth; and that when his infection was removed he probably would return to normal. With very great difficulty, because of his extreme condition, we succeeded in removing the deciduous teeth which were deeply carious, several of which had infected pulps. These were cultured and animals were inoculated, several of which developed very acute involvements of the central nervous system; and we had four at one time of this series with such marked central nervous system disturbance that with little excitement they would fall on their sides. Sections made from the cortex of the brain showed multiple petechial hemorrhages and diplococcal zones of

infection. Immediately after the removal of these teeth the boy's condition improved and very rapidly he returned to normal. In two weeks' time he was back in school, a normal child, and has not had a single recurrence in five years.

I have young patients whose histories are so definitely suggestive of this type of affection, since they have previously had involvements of chorea or acute nervous affection with irritability, that I have warned their parents to be sure to let me know if at any time these symptoms became apparent and to bring the child in. Such a case is as follows:

Case No. 1402.—The father had been a partial invalid from a heart involvement and rheumatism. His father had died at about fifty years of age from heart involvement. This lesion had been dominant in the father's side. The mother had the history of nervousness which had been dominant on one side of her ancestry. The oldest child had died under a simple operation from streptococcal septicemia, the susceptibility to involvement from which organism is definite in both sides of the ancestry and which in great probability accounted for her being such a poor risk. This child had, at different times, had marked nervousness. With the attack in question, the mother called me on the phone and said that her little girl had developed just such symptoms as I had advised her to watch carefully for; that she had been sent from school, would slap her parents in the face and drop things, so characteristic of choreal patients. On account of the marked familial susceptibility to streptococcal infections, I desired that she should not, under any circumstances, have an infected pulpless tooth. This patient was exceedingly hard to operate on and the tendency to caries was very great. In spite of our effort and care, largely due to the lack of cooperation, she had developed an infection of the pulp of a deciduous tooth from a proximal caries. On being given this information over the phone, I arranged to have the child brought to the office immediately; and on finding the difficulty, arranged for a very early operation for the removal of the infected deciduous tooth shown in Figure 426. This was done on Saturday morning, and on Monday the mother telephoned me that her daughter was so much improved that her nervous twitching had stopped, her irritability was practically gone, and she thought she could go back to school. Kindly note the lack of roentgenographic evidence of a putrescent pulp in the first deciduous molar.

When we think of the tragedy of ignorance during all the past

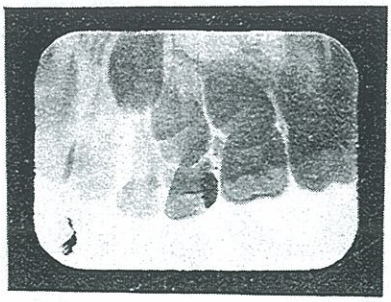


FIGURE 426. INFECTED DECIDUOUS MOLARS, WITHOUT ROENTGENOGRAPHIC EVIDENCE OF SAME, WHICH WERE PRODUCING CHOREA IN A CHILD. CASE NO. 1402.

centuries, and so little improved in our own generation, our hearts go out to the child life which has been misunderstood amidst all its suffering. History records that a few centuries ago it was a practice to drive these children with switches to the tomb of St. Vitus with a hope of the removal, thereby, of their affliction; and this seems to have been the origin of the name St. Vitus's Dance. How many children today are suffering from such infections we can only guess, but from the number I see, I am convinced that the affliction is a very common one; and its pathology strongly argues in favor of the removal of all infected deciduous teeth and, primarily, for a program of prevention through nutrition and prophylaxis that will make the development of the caries, which shall infect those teeth, impossible. This will only be brought about by an intelligent dental profession, guiding wisely, and creating a well informed public, which latter has shown evidence of being just as anxious to learn as has the dental profession.

NERVOUS EXHAUSTION.

Few, if any, of the lesions of the body which may come under consideration as being influenced by focal infection, and particularly dental infection, are so obscure as the so-called functional diseases of the nervous system. We have thought of functional diseases as being something entirely different from those due to structural changes. It is a question, if there be such a thing as a functional disease without structural change; indeed, there probably cannot be.

The patient whom we shall use as an illustration of this type of lesion suffered from a group of symptoms, some or all of which are exceedingly common; and her case had been diagnosed by her physician as one of hysteria. At times she had severe pain in various parts of her body, for which no adequate cause could be found. She frequently had an extreme sense of fatigue and weariness, for which also no cause was found. At times she had symptoms of a heart involvement, and with it all, a sense of mental

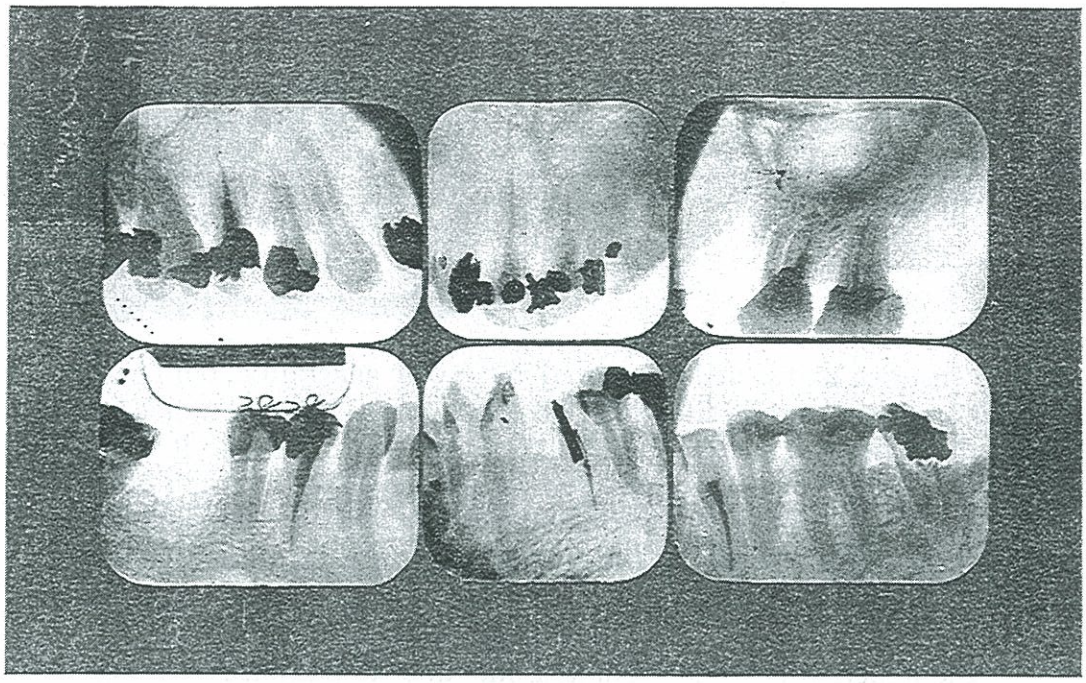


FIGURE 427. ROENTGENOGRAPHIC APPEARANCE OF TEETH OF CASE NO. 335, WITH HYSTERIA AND LASSITUDE. SEE NEXT FIGURE.

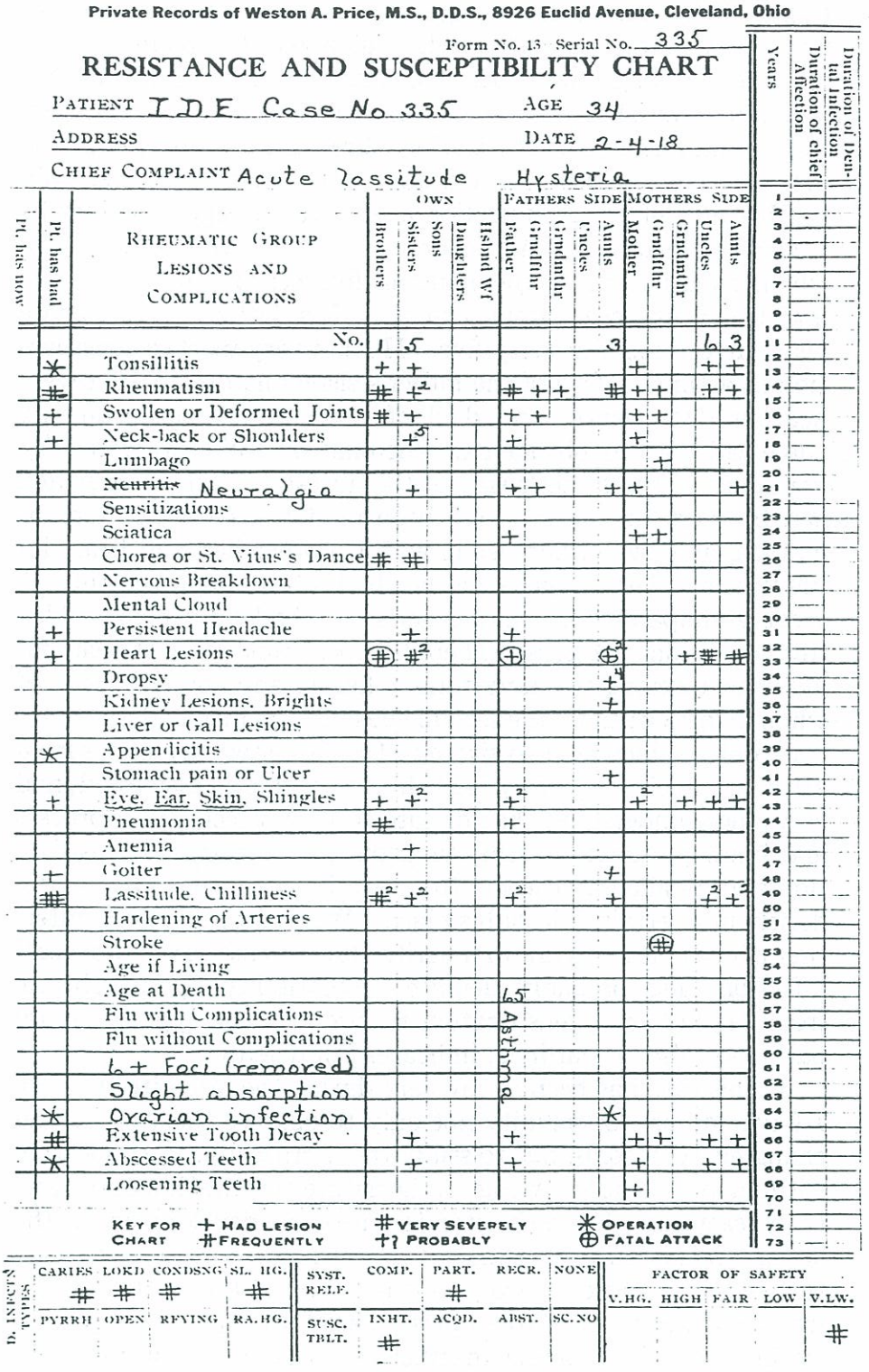
cloud and depression against which she had to struggle. For about five years she was compelled to be out of employment, approximately half the time because of inability to work. At times she could hardly compel her mind to do simple problems. One physician, thinking he had found the trouble, had an ovary removed. At another operation, the appendix was removed; and at another, the tonsils; none of which produced any marked change in her condition.

Her dental conditions are shown in Figure 427. A striking and typical illustration of the type of dental pathology that developed in her case is seen in the lateral, the pulp of which is non-vital. There was no history of soreness, exceedingly limited zone of apical absorption of alveolar tissue, and no fistula, and never had been; the very type of local condition which we now interpret as indicating an inadequate reaction on the part of her system adequately to protect her against her own infection—an inefficient local quarantine.

In order to understand this case, it is necessary to go back and analyze the measure and quality of her defense or susceptibility, the nature of her overloads, and the type of inheritance that would establish her defensive mechanism. This is shown in

Figure 428. The patient's age at that time, seven years ago, was thirty-four. Her net weight was about 103 pounds. Her chief disturbances have been rheumatism, a type of nervous breakdown, and heart involvement, with operations for appendix, ovary, and tonsils; and she has been breaking seriously, young in life. A study of her brothers and sisters shows that her only brother died of a heart infection at six years of age; and that he had acute rheumatism and chorea. She has five sisters, two of whom have had acute rheumatism, five nervous involvements, and two acute heart involvements. Her father died of acute heart involvement at sixty-five. He had very marked sensitization as asthma. Two of the father's sisters had had very severe nervous disturbances and died of heart involvement, and all three had heart involvements. Rheumatism and heart were very dominant in the father's side of the ancestry. The mother and her brothers and sisters had been mildly susceptible to rheumatism, and two of her sisters and a brother had had heart involvement. The mother's mother had a heart involvement. A great grandparent on the mother's side had been chair-ridden from deforming arthritis. There had been nine cases of heart involvement among the immediate relatives and ancestry, four of whom had died; and if the second cousins were included, the number would be increased to sixteen. Her father was a sufferer from asthma, which frequently made him very greatly distressed; and as we now understand that disease to be a sensitization process and know personally of the symptoms, believe it was sensitization and an allergic reaction to a certain weed, that grew abundantly in a certain field of his place. We would, therefore, interpret her case as being one of inherited low defense to streptococcal infection; and probably definite susceptibility by inheritance from her father to sensitization reactions. The type of dental pathology also, as outlined, indicates low defense.

As this case has been in my care during the last fifteen years, I have had an opportunity not only to observe the various and changing symptoms, but to study them critically, in connection with our increasing knowledge of the nature of dental infections and their reactions. From the standpoint of the development of the history, it is important to know that we adopted a very conservative program. One or two at a time, only, of the teeth were extracted, which had had root fillings placed within them and which we interpreted as having insufficient pathology to account for her disturbance. After each extraction, there would be marked



Private Records of Weston A. Price, M.S., D.D.S., 8926 Euclid Avenue, Cleveland, Ohio

Form No. 13 Serial No. 335

RESISTANCE AND SUSCEPTIBILITY CHART

PATIENT I.D.E. Case No. 335 AGE 34

ADDRESS DATE 2-4-18

CHIEF COMPLAINT Acute lassitude Hysteria

Pt. has now	Pt. has had	Rheumatic Group Lesions and Complications	Own: Brothers	Own: Sisters	Own: Sons	Own: Daughters	Own: Hsbnd Wf	Fathers Side: Father	Fathers Side: Grndfthr	Fathers Side: Grndmthr	Fathers Side: Uncles	Fathers Side: Aunts	Mothers Side: Mother	Mothers Side: Grndfthr	Mothers Side: Grndmthr	Mothers Side: Uncles	Mothers Side: Aunts
		No.	1	5							3				6	3	
	✳	Tonsillitis	+	+									+		+	+	
	#	Rheumatism	#	+2				#	+	+	#		+	+	+	+	
	+	Swollen or Deformed Joints	#	+				+	+				+	+			
	+	Neck-back or Shoulders		+3				+					+				
		Lumbago												+			
		~~Neuritis~~ Neuralgia		+				+	+			+	+				+
		Sensitizations															
		Sciatica						+					+	+			
		Chorea or St. Vitus's Dance	#	#													
		Nervous Breakdown															
		Mental Cloud															
	+	Persistent Headache		+				+									
	+	Heart Lesions	⊕	#2				⊕				⊕3			+	#	#
		Dropsy										+4					
		Kidney Lesions, Brights										+					
		Liver or Gall Lesions															
	✳	Appendicitis															
		Stomach pain or Ulcer										+					
	+	Eye, Ear, Skin, Shingles	+	+2				+2					+2		+	+	+
		Pneumonia	#					+									
		Anemia		+													
	+	Goiter										+					
	#	Lassitude, Chilliness	#2	+2				+2				+				+2	+3
		Hardening of Arteries															
		Stroke												⊕			
		Age if Living															
		Age at Death						65									
		Flu with Complications						Asthma									
		Flu without Complications															
		6+ Foci (removed)															
		Slight absorption															
	✳	Ovarian infection										✳					
	#	Extensive Tooth Decay		+				+					+	+		+	+
	✳	Abscessed Teeth		+				+					+			+	+
		Loosening Teeth											+				

Key for Chart: + Had Lesion; # Frequently; #Very Severely; +? Probably; ✳ Operation; ⊕ Fatal Attack

Years: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73

Duration of chief Affection

Duration of Dental Infection

D. Infection Types

CARIES	LOKD	CONDSNG	SL. HG.	PYRRH	OPEN	RFVING	RA. HG.
#	#	#	#				

SYST. RELF.	COMP.	PART.	RECR.	NONE
		#		

SUSC. TBLT.	INHT.	ACQD.	ABST.	SC. NO
	#			

FACTOR OF SAFETY				
V. HG.	HIGH	FAIR	LOW	V. LW.
				#

FIGURE 428. SUSCEPTIBILITY RECORD OF CASE NO. 335. SUFFERED ACUTE LASSITUDE, HYSTERIA, HEART, AND RHEUMATISM. NOTE TEN CASES OF HEART INVOLVEMENT IN FAMILY.

improvement which, however, would be temporary. Autogenous vaccines were made from the cultures of these teeth, and these gave definite but temporary relief. From time to time, during a number of years, the clinical picture would improve after the extractions and use of the vaccines. The subnormal temperature, ranging about 96 in the morning to 97 in the afternoon, would come up, under the influence of the vaccine, a degree or a degree and one-half, and, accordingly, be normal in the afternoon. This patient, like all of her class, was always sensitive to cold; and this symptom would always improve. At times, she developed bursitis; on another occasion, herpes; but the chief lesions were obscure but definite pains with or without a sense of weakness in her limbs; and above all, the sense of lassitude. With the removal of her last root-filled tooth, these symptoms improved as they had with the extraction of other teeth, with the exception that the improvement was much more marked; and in five years' time there has not been a single recurrence of any of the symptoms, sufficient to make her lose a day of time from her work. She has gained in weight. Her general physical and nervous condition has come to, and remained upon, an entirely different level from where they had been for fifteen years previously. She was in the position of being criticized by her physicians and most of those with whom she came in contact as having affections which were largely imaginary, or that she was enjoying her discomforts.

We believe she is typical of a class containing a large number of individuals whose condition is partly one of sensitization, which sensitization is an allergic reaction to a protein, being generated within the individual's body as a result of bacterial infection, and which antigen may be present in sufficient quantities to produce such reactions, in even a root-filled tooth without periapical evidence, as revealed by the roentgenogram; that a normal individual will destroy this antigen or neutralize it by an antibody-antigen reaction close to the tooth; whereas, this patient, not producing such a reaction, permits that antigen to invade the system and irritate the tissue that has become sensitized to it. In the chapter on Sensitizations we have discussed the nature of these reactions and methods for diagnosing them. We believe these cases are also continually subjected to bacterial infection of this type from these root-filled teeth, for all of the teeth extracted from this patient were found to be infected.

Another important phase of the expression of this case is of particular interest because of its possible relation to a type of

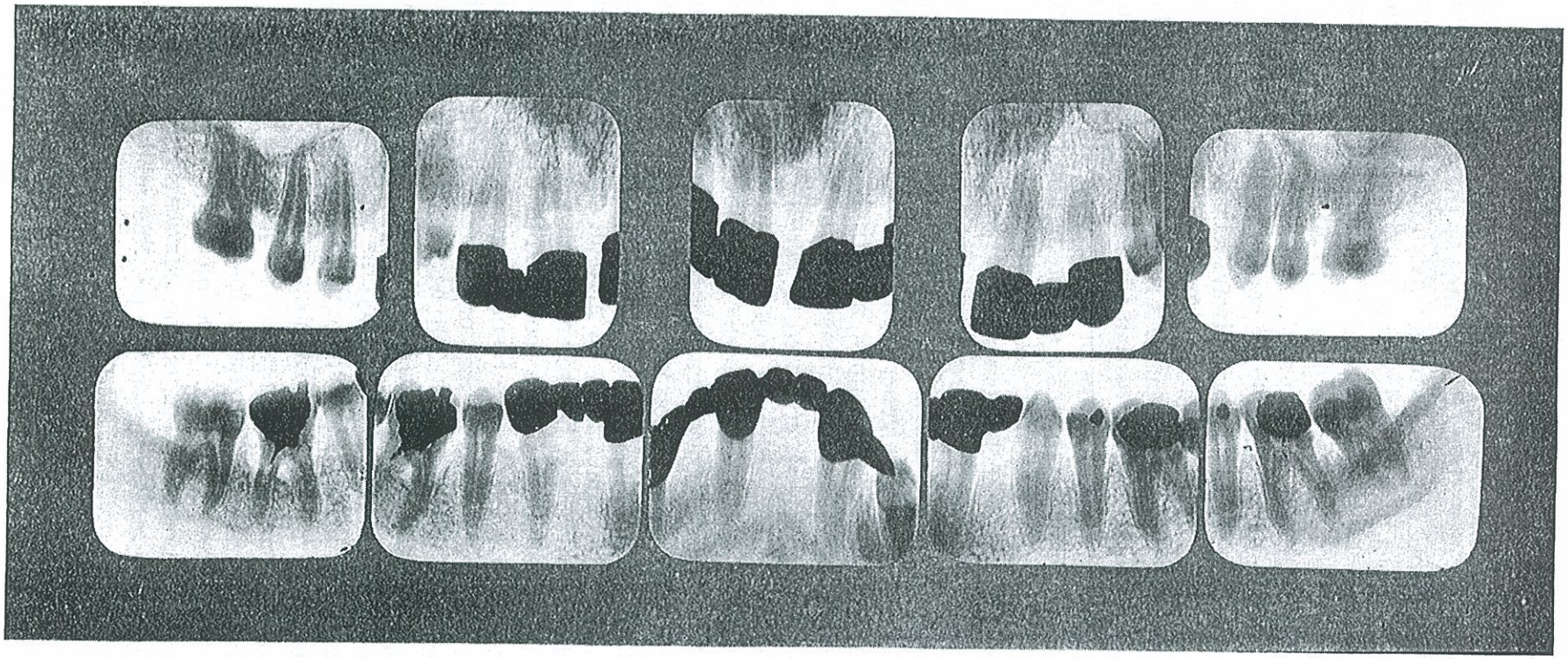


FIGURE 429. DENTAL CONDITION OF CASE NO. 1367, SUFFERING WITH ATTACKS OF EXTREME LOSS OF MEMORY. THESE WERE OCCURRING WITH INCREASING SEVERITY AND FREQUENCY. VERY MARKED RELIEF UPON REMOVAL OF DENTAL INFECTIONS.

mental disturbance, the etiology of which has been very obscure, and which relates to an affection of speech which is limited to certain words. One of the words in this case was *total*, and it not only required distinct mental effort to write it, but produced a distinct sense of pain. Another expression was the inability to remember certain names and words that were very simple.

This memory disturbance may take on a very extreme or alarming expression, an illustration of which is the following case: Case No. 1367.—This patient presented with a history of attacks of loss of memory with increasing severity, extending over a period of four years. The last attack had lasted five days and he was so nearly void of mentality that he would eat when things were put before him but lacked judgment regarding eating. His attacks would come on with at first a sense of excitement, then extreme nervousness, followed by a period of crying. During the onset of his last attack he drove his automobile thirty-five miles in forty-eight minutes on dirt country roads and could not recall the trip or any incident in connection with it. His history showed that several years ago he had several teeth covered with gold crowns, as shown in the roentgenograms, Figure 429, some time after which he began developing these serious symptoms. His first attack was brought on while moving a troop of soldiers to encampment during the war, at which time, as the commanding officer, he was without sleep almost continuously for four days. The first symptom was a slight and transient disturbance of memory. He has seen impending the probabilities of a madhouse where he would be a helpless idiot, since each attack, coming in regular succession, was progressively worse than the preceding. His present joy can be imagined from the fact, that since the removal of the gold crowns and the infected teeth he has not had one single attack. A study of his susceptibility and that of the family reveals his exceptionally high inherited defense on both the father's and mother's sides.

The patient's own description of the change is significant. When first examined a month after the removal of his infections he was looking very much better, had gained six pounds, stated that he had been entirely free from his feeling of mental cloud and tendency to lapse of memory. He described the former condition as being one in which he had been going up an incline for four years, during which time he never once returned to normal as he has since the removal of the dental infections, as though he had

returned from that elevated plateau of strain, pressure, and mental cloud, back to a lower plane. During that period he was under a sense of pain and cloud, which conditions have entirely disappeared and he has a feeling of buoyancy. He looks quite different in the face and has a mental alertness that is apparently normal. He expresses his former condition as one in which he would have to stop to think to answer simple questions, as, for example, "How much do two and two make?" When crossing the street, he would have to stop and study what crossings were and where they were. When these attacks first started, his brain seemed to act as a slow moving picture. At the time he presented he had been suffering from that attack for eight weeks, which was the longest that any of them had lasted. The longest previous had been four weeks. At the time of his first presentation his facial expression was that of frenzied delirium. His eyes were bloodshot and staring, his face drawn as though he had been through a horrible and harrowing experience. Within a few days after the removal of his dental infections, these symptoms rapidly disappeared. His case had had the most painstaking and skillful care and study by internists during these four years, the physician who sent him from another city being convinced that all other sources of possible cause had been excluded.

In interpreting his case we must keep in mind that capacity for endurance is a relative matter and always relates to overloads. It is probable that his first but mild break was dependent upon both his locked dental infection (for pulps were found non-vital in some of the crowned teeth) and his extreme strain and overload, carrying out his war duties without proper rest and nourishment. Had it been due entirely to the latter he doubtless would not have had recurrences when he came to a normal program of life again. But he quite soon came to a point where even with the most exacting care these conditions developed. His is a case of acquired susceptibility in an individual who normally should have a very unusually high defense both by personal physique and inheritance, and demonstrates that it is not sufficient to build our trestles with a strength sufficient for the ordinary load, but always provide for a factor of safety, for every individual will have some overload and many will have excessive overloads at times in spite of all good planning that they or we may do for them. The responsibility of dentistry is very clearly to refrain from building not only additional sources of overload, but sources of toxin and infection which are the neglected camp fires that

start the conflagrations which devastate the forests. But, as the brush would not take fire without ignition, so these serious breaks in the nervous system frequently cannot come without a source of toxin.

EPIDEMIC LETHARGIC ENCEPHALITIS.

In discussing this very severe group of disturbances of the central nervous system, we are dealing with one of the most distressing of human afflictions, for many of the individuals are doomed to a life of broken mentality or dismantled nervous system, or both of these conditions, to eke out an existence that is almost unbelievably painful and pathetic both for themselves and for those with whom they are in contact. I shall not undertake, for lack of space, to review its symptomatology except to review that any structures of the central nervous system may be attacked, and, when attacked, the probabilities of a permanent lesion are very high. If they do not die within four weeks, the prospects are that they will live on perhaps indefinitely. They may have any degree of paralysis from a single group of muscles to practically the entire body. A brief statement is as follows: "A disease of obscure pathology and showing unusual cerebral symptoms, the distinctive features being an increasing languor, apathy, and drowsiness, passing into lethargy. There is progressive muscular weakness and various cranial nerve palsies." (Dorland) In the current press it is spoken of as "Sleeping Sickness" because that mental apathy and drowsiness are often interpreted as sleep. There is no generally accepted etiology though a diplococcus has frequently been isolated from these cases. In the case that I shall review I do not know that we have been dealing with the causative organism though several factors have been very suggestive that we have.

The woman, age thirty-six, was brought to us with spasms of the face, with the grating of her teeth, twitching of the left arm, and drawing up of the legs, and was so horrible to look at that some of the members of my staff found it necessary to leave the room. The involuntary grating of her teeth could be heard through the surrounding rooms from where she was sitting; and, needless to say, she had loosened several of them from the uncontrollable and violent spasms of the muscles of mastication. At times the attacks would come on so violently and suddenly that the snapping of her teeth would endanger a serious wound to anyone having a finger between them. This trouble came on following an attack of Flu three months previously, which is the history of

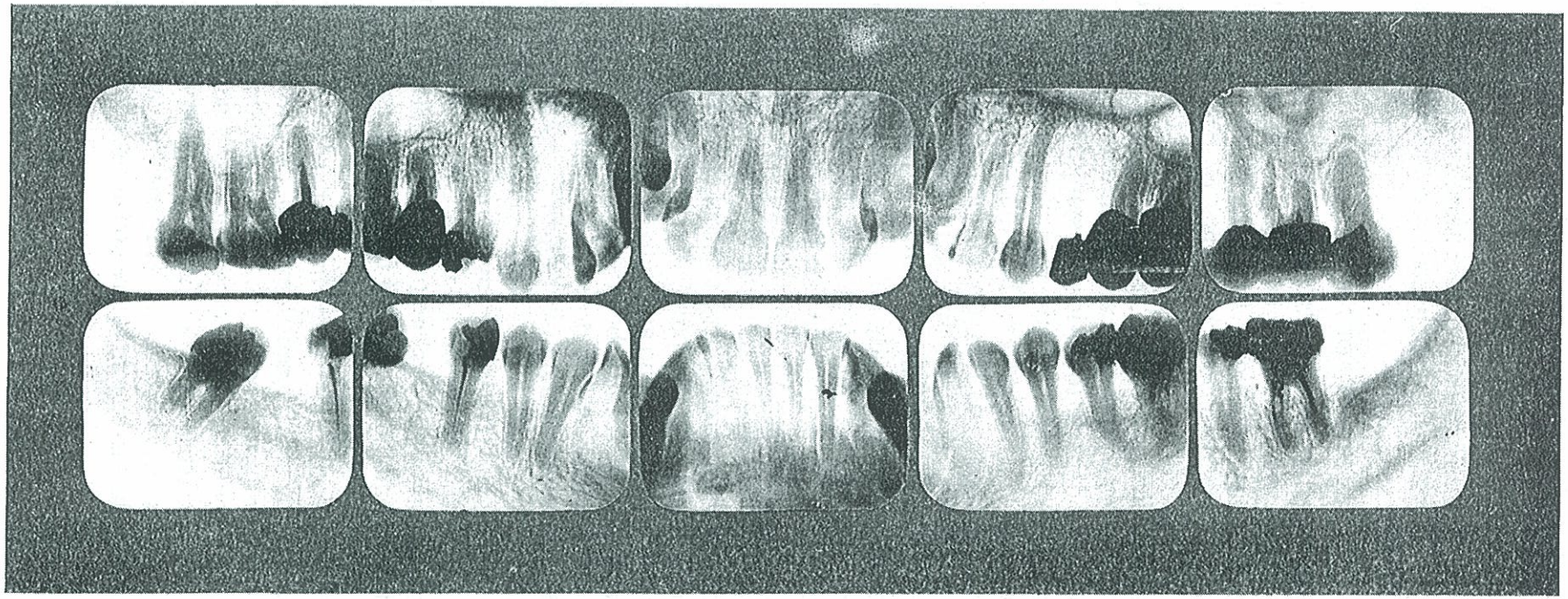


FIGURE 430. DENTAL CONDITIONS OF CASE NO. 1317. PATIENT SUFFERING FROM LETHARGIC ENCEPHALITIS.

many of these cases. The diagnosis was verified by a neural pathologist and the prognosis was, of course, considered very grave, and our efforts were devoted to studying the relation of dental infections, if any, to her condition and to the making of supports that would sustain the violent spasms without the complete destruction of all of her teeth. The neurologist took charge of her medical care.

Her dental conditions, as she presented, are shown in Figure 430. When these infected teeth were studied by our various means, including planting beneath the skins of rabbits, it was found that they contained an organism which at that time we thought to be very exceptionally virulent. We have, however, since found several instances where teeth were quite as rapidly fatal from patients who had no such symptoms. One of the teeth from this case at the time of this writing has been planted beneath the skins of over thirty rabbits, all but two of which died spontaneously within a few days, averaging about four days, the longest being ten days. Two were chloroformed just before death for study. Several other teeth from this patient were studied in the same way and all produced comparable results.

In the course of our studies the planted teeth were placed in the subcutaneous subdermal tissues, chiefly of the back. Another method of study was to place a very small quantity of these germs, under aseptic conditions, subdurally through a very finely drilled hole of the frontal brain. As controls, cultures were used from other sources. In one instance the rabbit produced violent spasmodic grating of the teeth in about two hours, which lasted for about five hours and ended in death, very strikingly similar to those suffered by the patient. We are not justified in concluding that this is specific for elective localization or reproduction of identical symptoms, since infective meningeal involvements sometimes produce these symptoms and we were able to produce similar though not identical reactions with other strains, not, however, so characteristic and violent. In two rabbits, one of which was inoculated with the aspirated material from about the tooth that had just killed a rabbit, and the other with this same material passed through a Berkefeld filter, the former died in a few hours with characteristic spasms, the latter lived for weeks, indicating that there was not free toxic substance within the bacterial growth. Intravenous inoculation of this strain did not produce typical lethargic encephalitis in rabbits. This, however,

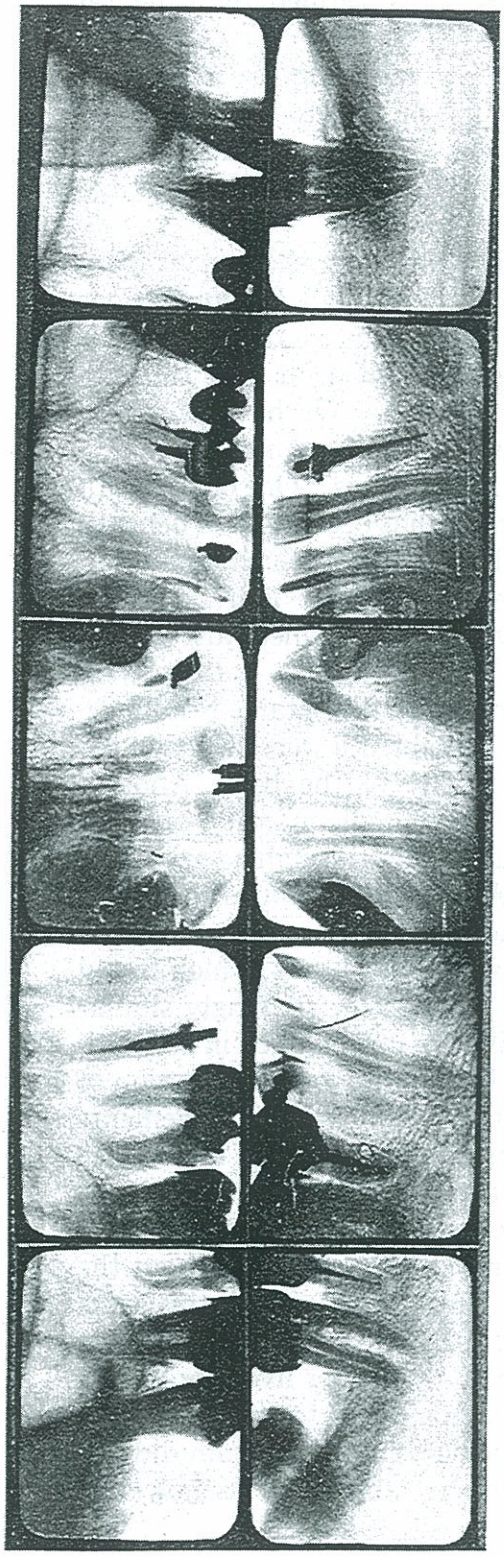


FIGURE 431. DENTAL CONDITIONS OF CASE NO. 904, WITH ACUTE INFLAMMATION OF THE SCLERA AND RETINA OF THE RIGHT EYE.

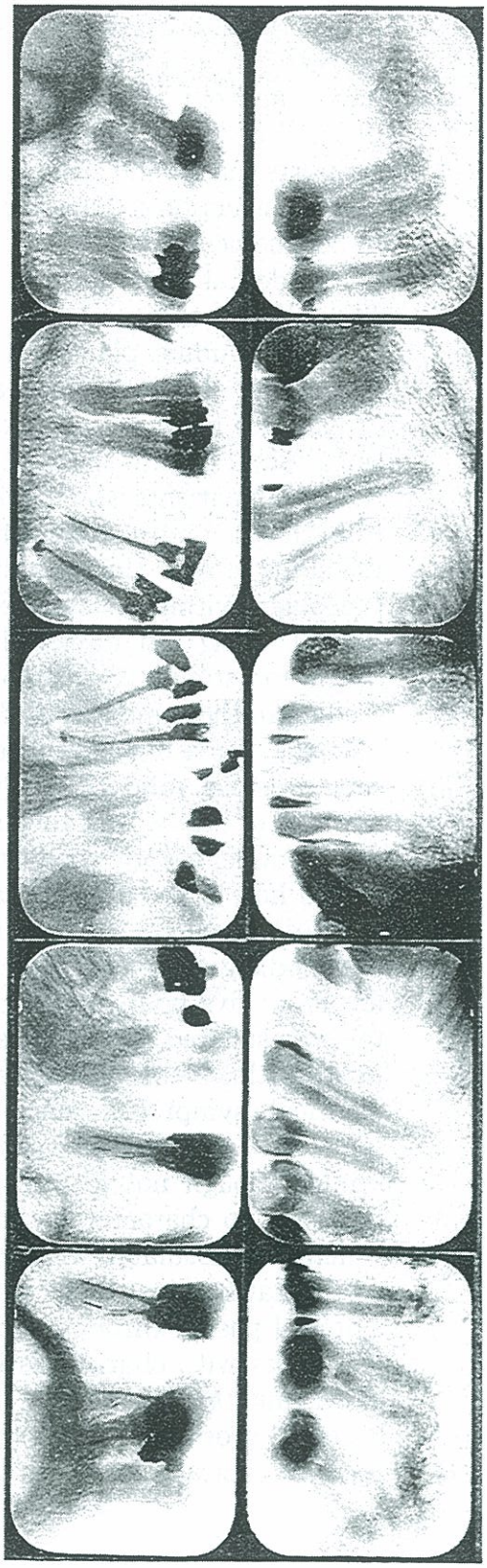


FIGURE 432. DENTAL CONDITIONS OF CASE NO. 1087, WITH COMPLETE BLINDNESS IN RIGHT EYE, LEFT EYE ONE-FIFTH NORMAL.

may not have significance since the history of inoculations with this strain isolated from patients suffering from this disease have been found by other workers not to produce the typical lesions of the nervous system unless inoculated subdurally. Several things are important for consideration, and these we may put in the form of questions.

(1) Since the etiology is so obscure, and since a diplococcus has been found by many of the investigators, is it possible that the growth in the individual's body of the organism or organisms producing the symptom group of influenza may create a condition which induces the streptococci or diplococci growing in dental infections to develop this type of tissue affinity?

(2) Is it possible that a specific strain of diplococcus or streptococcus becomes a contaminating factor in dental infections and, by residing in that nidus, maintains a perpetual infection of that individual's body through the dental channels?

(3) May it be possible that a specific organism gains its entrance into the body through carious teeth?

These are all problems of the most pressing character and demand the best attention of the profession which can only be given by an adequate program of research which is not being recognized today, and which can only be undertaken with hope of the largest possible success in a specially organized institution where that problem along with others of the dental group can receive the merited study.

EYE.

No part of this work has been more striking and satisfactory than the relief in cases of eye involvement, of which there have been many types. A very striking and common type has been affections of the various coats of the eyeball. These can probably be best discussed as individual cases.

Case No. 904.—The patient, male, forty-five years of age, good health, presents with an acute inflammation involving, with other structures, the retina and sclera of the right eye. The dental conditions would not be considered serious if judged by the roentgenograms, shown in Figure 431. Two of these teeth were extracted: namely, the right maxillary first molar and first bicuspid. Cultures were made and the culture inoculated into five rabbits. Four of the five developed acute affection in various structures of the eyeballs. This patient's inflammation was so acute that he was compelled to be in a darkened room for weeks, and the vision, which had been reduced to about one-fifth normal, was

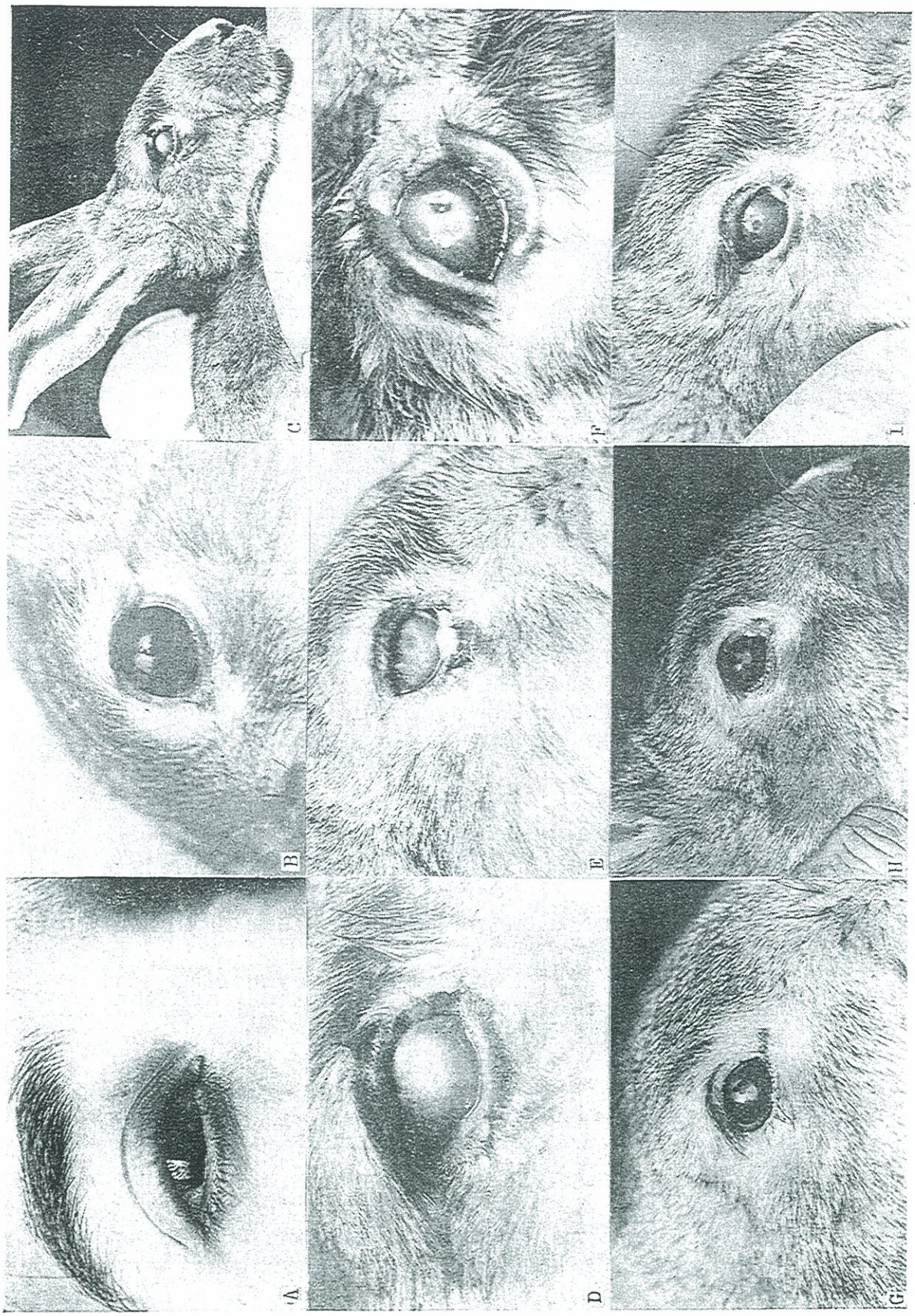


FIGURE 433. PROGRESSIVE INVOLVEMENT IN RABBIT'S EYE, FROM DENTAL CULTURE FROM CASE 904 WITH RETINITIS.

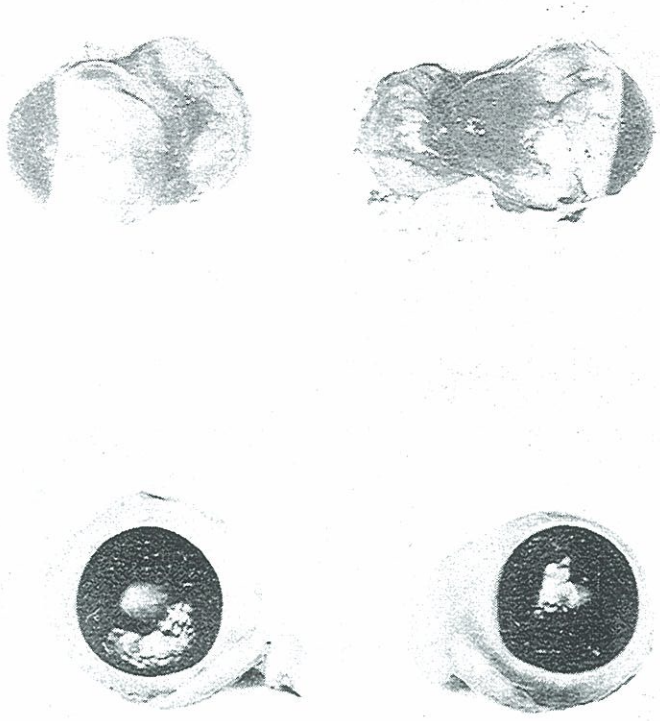


FIGURE 434. OF FIVE RABBITS INOCULATED WITH CULTURE FROM TEETH OF CASE 904, FOUR DEVELOPED ACUTE EYE INVOLVEMENT. TWO SHOWN BELOW HAVE ULCERS, AND TWO ABOVE ACUTE INFECTION OF MUSCULATURE.

considered in great jeopardy. One of the rabbits inoculated with this culture developed lesions which were strikingly severe. This is shown in Figure 433. A shows the typical appearance of an eye in this condition. Reading from left to right, will be seen different stages of the rabbit's right eye. First, a violent general retinitis and choroiditis, shown in C; in D, taken a few days later, the vision had entirely disappeared; in E, a deep ulcer is developing; in F, the extent and depth of the ulcer is revealed, also a very marked conjunctivitis; in G, repair has set in but the vision is gone; H and I show later stages of the healed scar but no return of the vision. B shows the rabbit's left eye which remained normal during the entire period. This rabbit was kept for nine months and posted and the eye retained as a specimen. Other eyes from rabbits of this series are shown in Figure 434, revealing very marked involvement of the sclera and musculature.

The most striking thing about this case is the history. This man's father is living and is partially blind in one eye. His father's mother lost the sight of both eyes and died blind, and her mother also died blind. In eleven hundred rabbits inoculated,

FIGURE 435. VERY EXTREME EXCEMENTOSIS OF A MOLAR ROOT, CASE NO. 1087, WITH A HISTORY OF GLAUCOMA RESULTING IN COMPLETE BLINDNESS OF ONE EYE AND ONE-FIFTH VISION IN THE OTHER. VISION PROGRESSIVELY DIMINISHING. MARKED IMPROVEMENT FOLLOWING REMOVAL OF DENTAL INFECTION.

not three per cent have developed eye involvements; whereas, in five rabbits inoculated for this patient, four, or 80 per cent, developed eye involvement. We are advised by this patient that his vision has returned practically to normal and there has been no recurrence of his trouble.

It now seems probable that many of the cases of gradual or sudden blindness have had their origin in infected teeth. As an illustration we will present the following case. Case No. 1087.—The patient, male, age fifty-six, presents with a history of glaucoma of the right eye, completely blind, and the vision of the left eye reduced to one-fifth, and progressively getting worse. The patient was not able to go on the street alone. His apprehensiveness of the approaching total blindness had made him almost a nervous wreck. His dental conditions are shown in Figure 432. A striking characteristic of the dental condition in his case was the very marked excementosis of some of the roots, particularly of the upper right molar. The ball on the apex of the mesiobuccal root created a condition that made it possible to rotate the root round and round, but it could not be removed until the buccal plate was removed. A section of this tooth is shown in Figure 435. The extensive lamination is very strikingly illustrated. Cultures taken from this and other teeth of this patient, when inoculated into rabbits, produced eye involvements in 100 per cent of cases. The most important part of this case and its history is the following: Whereas, his left eye was progressively losing its vision, it not only has ceased getting worse but it actually improved sufficiently, so that within a few weeks after the removal of his dental infections he was able to go on the street alone, and the condition has been progressively, but moderately, improving for over a year and one-half. This is an illustration of a case of an acquired susceptibility. The patient's defense should normally be high. Both sides of his ancestry were exceedingly clear of rheumatic group lesions.

I have no doubt that many types of blindness do not have their origin in dental infections, one of which is very serious. It is the blindness of ignorant dentists who have so little knowledge of focal infections that they are creating, with a confidence that is based only upon their ignorance, a great many dental conditions which some day may make blind patients. These dentists themselves may never know, and the patients may never know that the delayed development of knowledge in the dental profession is fundamentally the cause. Nevertheless, I believe confidently that

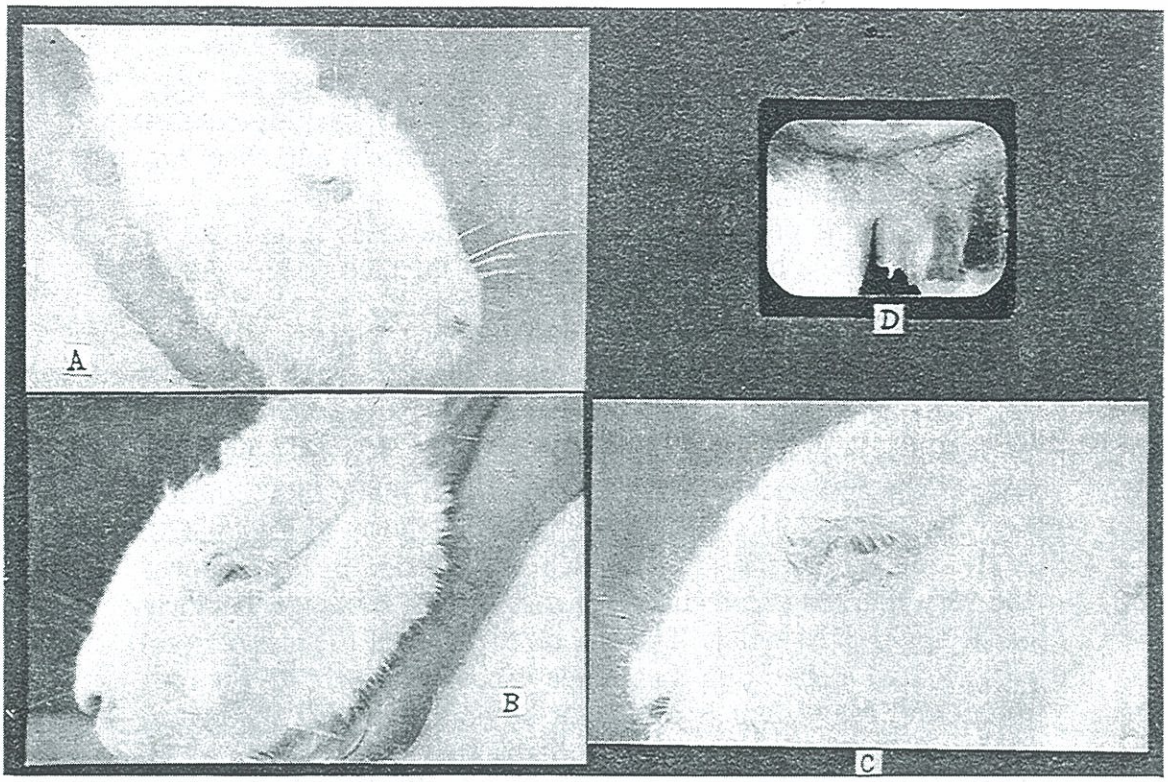


FIGURE 436. ACUTE CONJUNCTIVITIS IN RABBIT, PRODUCED BY CULTURE FROM INFECTED TOOTH IN D, FROM CASE NO. 899 WITH CHRONIC EYE IRRITATION AND HIP INVOLVEMENT.

mistaken judgments in this particular are responsible for a very large number, if not a large per cent, of certain types of optic lesions. The price that humanity pays for progress is appalling. It has always had to come that way.

Another type of eye involvement, and which is quite common, expresses itself chiefly in irritation and conjunctivitis. It usually involves both eyes and is illustrated by Case No. 899, a man, age fifty-three, who had severe arthritis which had been diagnosed as an osteomyelitis of the left hip, with a marked shortening of the right leg. This chronic eye irritation had made it impossible for him to use his eyes for reading for considerable time; and the combination of eye involvement and arthritis was aggravated by a marked sense of mental cloud or discouragement against which he had to fight continually. He had been incapacitated for work for about two years. A culture taken from the root-filled tooth shown in Figure 436-D, when inoculated into a rabbit, produced a very acute conjunctivitis with lacrimal discharge, very similar to

that suffered by the patient. The rabbit's normal eye is shown in A, and two stages of the conjunctivitis in B and C. With the removal of his dental infections and the use of a vaccine, this patient's eye trouble entirely cleared up and his rheumatism improved so much that instead of being practically helpless, he was able to return to professional practice; and a few months later, he invited me to take a walk with him, when he covered about five miles with no apparently bad effects. There has been no return of the eye trouble.

There is no doubt that several factors combine in a case of this kind. The removal of the patient's infection will in itself be important in proportion as its quantity and quality are developing definite reactions in this patient. If these reactions are in the nature of allergic sensitizations, the quantity, as shown in the chapter on sensitizations, may be exceedingly small and still produce very distressing symptoms. The use of the vaccine undoubtedly assisted him in building up a defense. The fact that he has not had a recurrence of his trouble strongly indicates that it was not a temporary benefit.

While we have had a considerable number of cases of eye involvement, I believe it will be most helpful to use as typical illustrations those in which animal inoculations have been made with the cultures grown from dental origin. In Chapter 22 on Elective Localization, we have shown that the percentage of animals developing eye lesions, where cultures were taken from teeth of patients without eye involvements, has been exceedingly low, 2 and 4/5ths per cent; whereas the animals inoculated with cultures of teeth from patients suffering from acute eye involvements, at the time, have in many instances shown 75 to 100 per cent of involvements; in the first case, 80 per cent, and in the second case, 100 per cent, notwithstanding the fact that different methods of inoculation or of bacterial growth were used as variations in the experiment. It is very striking that in patients with involvement of one eye, our rabbits have been involved only in one eye; and where the patient's involvement was in both eyes, the rabbits have in a larger percentage tended to have involvement in both eyes. The next case illustrates such a condition, one eye only being involved.

Case No. 861.—The patient, an unmarried woman forty-six years of age, was referred to me by an oculist with the statement that she was rapidly losing the vision of the left eye; that this was

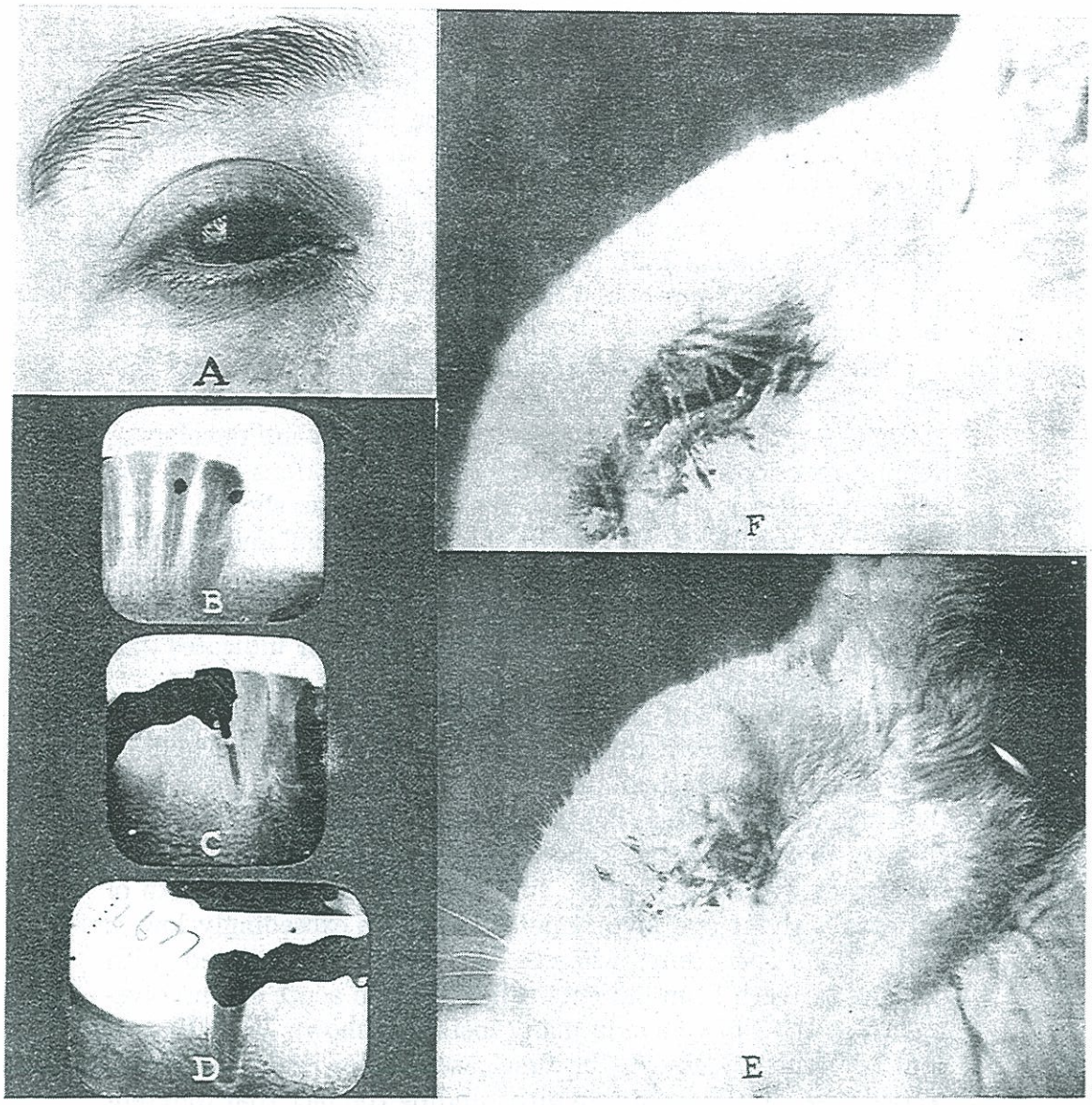


FIGURE 437. EXTREME EYE INVOLVEMENT OF CASE NO. 861. B, C, AND D, DENTAL CONDITIONS. E AND F, PROGRESSIVE STAGES OF ACUTE INVOLVEMENT IN RABBIT'S EYE, INOCULATED WITH CULTURE FROM THESE TEETH.

the fifth successive attack, each one more severe than the preceding; and that this was not responding to treatment; that if we could do anything, to do it quickly. The roentgenograms of her teeth are shown in Figure 437, and show a zone of rarefaction about the bicuspid carrying one end of a bridge, with no evidence of root filling, suggesting the irritation of an entire putrescent pulp. The other foundation of the same bridge shows but slight rarefaction. Electrical and thermal tests revealed the fact that one of her lower centrals was non-vital, shown with the small metal filling in the roentgenogram. Note that this root apex shows a condensing osteitis rather than a rarefying.

Cultures were made from the contents of these teeth and all were shown to be infected in their pulp chambers. The organisms from one of them were injected into the rabbit shown in Figure 437 with the result shown. A gives the appearance of the patient's eye; F, the appearance of the rabbit's eye in forty-eight hours; and E, the appearance in seventy-two hours. Only one of the rabbit's eyes was involved. Within twenty-four hours after the extractions, the congestion and acute inflammation had markedly reduced in the patient's eye, and was nearly gone in three days. Her vision began to improve promptly and returned practically to normal; and she has had no recurrence of the trouble in three years, although she had previously had five successive attacks with progressive severity in two years.

EXOPHTHALMOS AND RETINAL HEMORRHAGE.

A large variety of dental lesions shows evidence of direct relationship with dental infections. The patient we will present as illustrating this is a married woman, age thirty-nine, Case No. 1008. She was referred by her physician because of a recurring and extremely painful lesion in her eyes, which would sometimes come on suddenly in the night with pain so severe that it would be necessary to summon her physician who would administer a hypodermic of morhpine. There was a very marked exophthalmos, as shown in Figure 438-A.

The roentgenograms of her teeth are shown in Figure 439, and it will be noted that she had evidence of extensive gingival infection, the history of which was an acute involvement that responded to treatment a few years previously, since which the teeth had been very comfortable. Bacterial examination of the gingival pockets showed evidence of a chronic low-grade inflammatory process. Knowing from experience that many of the

FIGURE 438. MARKED BULGING OF THE EYES, CASE NO. 1003, AS SEEN IN A. EYES RETURNED TO NORMAL IN A FEW WEEKS' TIME, AS SHOWN IN B.

teeth with former acute periodontoclasial involvement have degenerating or degenerated pulps, we condemned several and

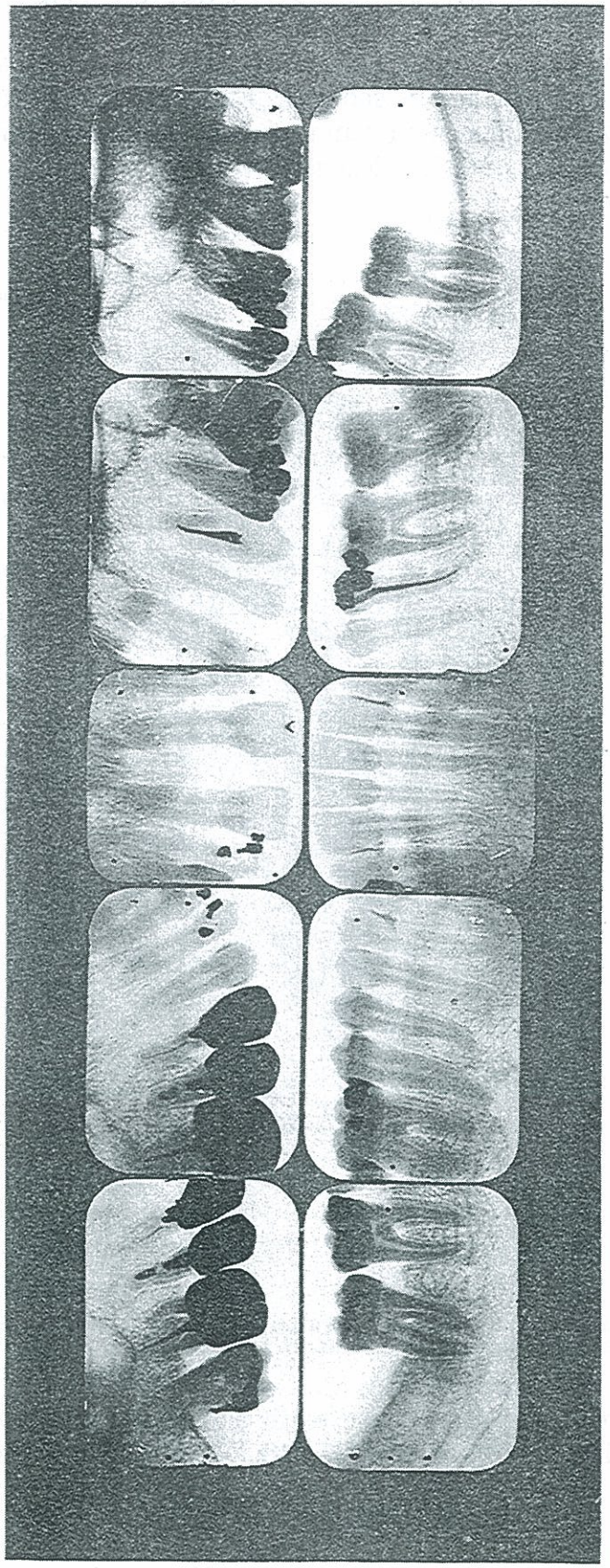


FIGURE 439. ROENTGENOGRAPHIC APPEARANCE OF TEETH OF PREVIOUS CASE, NO. 1008.

made studies of the infection in the pulps and of their structural changes. One of these is shown in Figure 440, which reveals the pulp chamber filled with a multitude of islands of calcification which was part of a slow degenerative process.

FIGURE 440. VERY MARKED PULP DEGENERATION, WITH MULTIPLE PULP STONES OF PYORRHETIC TEETH OF PREVIOUS FIGURE. CASE NO. 1008.

Cultures taken from these teeth and inoculated into rabbits produced some very striking results. Of three rabbits shown in

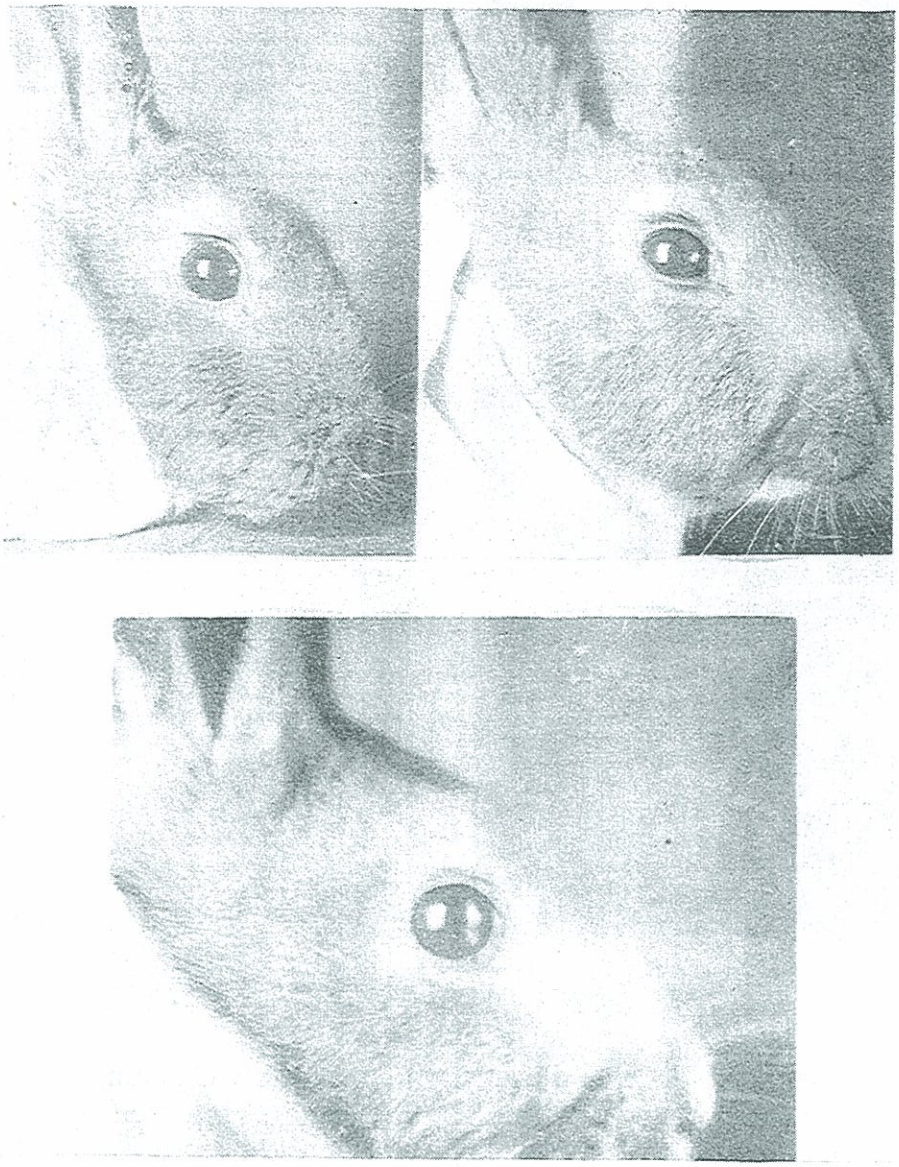


FIGURE 441. THREE RABBITS WHICH DEVELOPED ACUTE EXOPHTHALMOS FOLLOWING INOCULATIONS WITH DENTAL CULTURES FROM PRECEDING CASE, NO. 1008.

Figure 441, all had pronounced exophthalmos within eight days. Later, four rabbits were inoculated with cultures from other teeth of this patient, of which two showed exophthalmos. Immediately, the patient's acute eye involvements nearly ceased, with attacks so mild and infrequent that they were simply suggestions and soon ceased entirely. In a few weeks' time, her

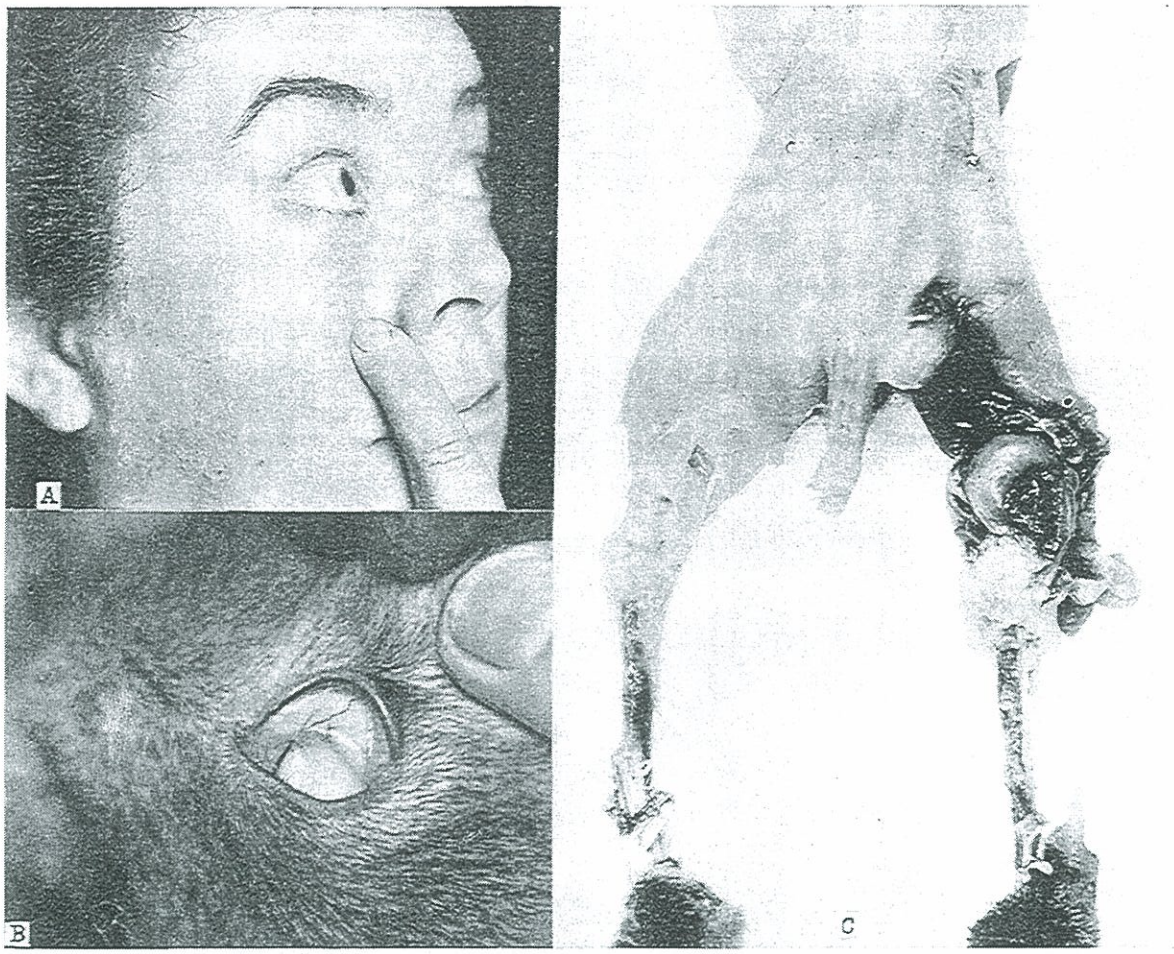


FIGURE 442. A RUPTURED BLOOD VESSEL IN PATIENT'S EYE, SHOWN IN A, WITH HEMORRHAGE INTO SCLERA. B. A HEMORRHAGE INTO THE EYEBALL OF A RABBIT FROM CULTURE OF TOOTH. C, HEMORRHAGE INTO PERIOSTEUM AND MUSCLES.

eyes reduced in size and protrusion, completely changing her appearance, as shown in Figure 438-B. Her eyes returned nearly to normal in about six weeks. The effects of the cultures from her teeth on other structures of the rabbits were very marked. Figure 442-C shows a dissection of a rabbit illustrating excessive hemorrhages into the tissue. The periosteum and muscles were particularly involved, as shown. Figure 442-B shows a rabbit with a hemorrhage in its eyeball and greatly engorged blood vessels. In the beginning of the report of this case, we have referred to a type of excruciating pain which would come on suddenly, and usually in the night, awakening her from her sleep and requiring

a hypodermic injection of morphine for its control. These would be followed by a hemorrhagic infiltration into the choroid, and were probably related to a ruptured blood vessel. The cultures from one of her teeth, when inoculated into rabbits, frequently produced hemorrhages in several of the tissues of the eyes, one of which is shown in Figure 442-B. This rabbit also had hemorrhages in various structures of the body, including the periosteum of both hind legs and the muscles of the thigh. One of these hemorrhages is shown in the patient's eye in Figure 442-A. In Chapter 65, I discussed this case from a standpoint of the alimentary tract. In a year and one-half there has been almost no recurrence; and we have had a struggle to prevail with this patient not to have all of her teeth removed. It would be as easy to persuade her that it was imagination, that she sees the sun shining, as to persuade her that her teeth were not the cause of her involvement.

In Chapter 60, on the Circulatory System, in discussing bacteremias, I have referred to the fact that patients with a very low defense for streptococcal infection may develop a recurring streptococcal bacteremia, during the attacks of which, the organism is found in the blood stream, by culturing. One of the cases cited illustrated the large variety of symptoms which may develop in such a case. In this connection I wish to refer more specifically to the eyes of this patient. Her vision was gradually diminishing. At the time she presented, she found difficulty in crossing the street unaided. There was a definite cycle to the development of her symptoms. Her eyes would become bloodshot, as she expressed it, in which condition they were very sensitive to light; and following this, she would nearly always have attacks of acute rheumatism. In the eye lesions previously reviewed, we have noted that only one eye was affected. In her case, practically always both eyes would be affected though one might be worse than the other. The photograph of her eyes, shown in Figure 443-C, illustrates her typical expression, with the eyelids very nearly closed to shut out the light, and the part of the eye that was visible, almost blood-red. Cultures grown from the teeth shown in Figure 443-D and inoculated into the rabbit shown in Figure 443 produced very definite involvement of both eyes. A shows the eye before the rabbit was inoculated, and B the following day. This condition cleared up in the rabbit in a few days' time, when it was inoculated again with the same strain, and again developed an eye

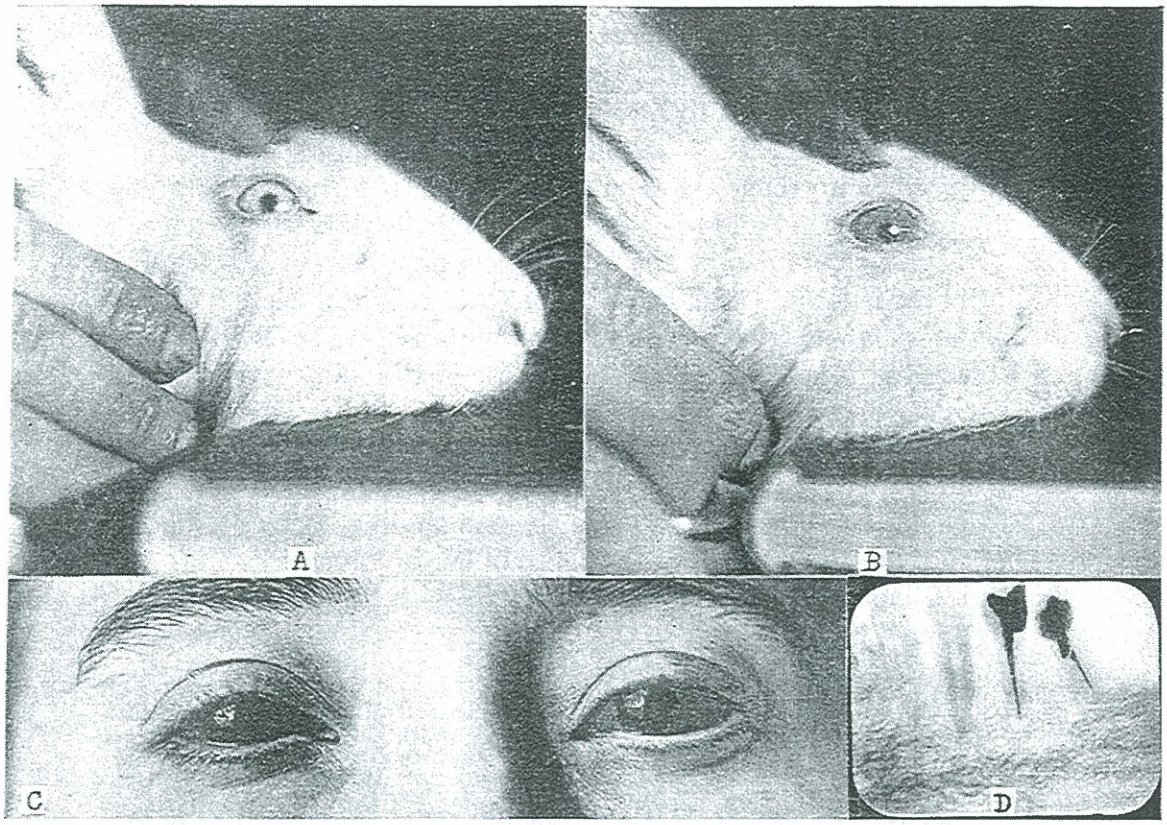


FIGURE 443. AN ACUTE INVOLVEMENT OF BOTH EYES OF PATIENT SHOWN IN C. A, NORMAL EYE OF RABBIT. B, SAME EYE THE DAY FOLLOWING INOCULATION WITH CULTURE FROM TEETH SHOWN IN D. CASE NO. 987.

involvement. The eye finally returned to normal. Cultures taken from this patient's tooth, from the blood stream, and from the eyes, were biologically the same strain of streptococcus. This strain was recovered from the patient's blood by culture three times. By the use of an autogenous vaccine, which probably did as much good to the patient as the removal of the teeth in this type of involvement, there seemed definite but temporary improvement; for if a vaccine treatment was given just as the eyes were beginning their reaction, the eye involvement was very much less severe than regularly developed and the patient largely or entirely escaped the subsequent attack of rheumatism, which quite regularly followed.

It is my belief, that this type of patient, in which group there is a considerable number, has this strain of germ growing in every possible harbor in the system; and that it tends largely to invade new harbors. For example, if a pulp should die by trauma or have its resistance lowered in this patient's mouth, it would cor-

rectly be stated that the blood stream had infected the tooth rather than that the tooth had infected the blood stream; and also, that these patients are in a state of susceptibility or lowered defense which tends readily, if not regularly, to recurrence of the more acute symptoms. These individuals are probably never free from this infection in their blood stream, and unless an accident intervene, the progressively lowering defense enables this organism finally to cause death, frequently as so-called malignant endocarditis. In Chapter 20, we have discussed some of the characteristics of these individuals from the standpoint of our serological studies; and one of the most hopeful signs of improvement in methods of increasing the defense is from the serological aspect.

In Chapter 34, we have discussed the effect on pregnancy of the introduction of streptococcal infection into the blood stream. Two pregnant rabbits were inoculated with the strain grown from the culture from this patient's tooth (and no difference was found in the characteristics of the organisms grown from the tooth, the blood stream, and the eyes, in this case). In one instance a miscarriage was produced. The immature embryos were born lifeless in about forty-eight hours. The other rabbit became very sick and died in about twenty-seven hours. The fetal forms, about half developed, already had been dead several hours and were undergoing decomposition.

Since the above was written, we have made further studies of this patient two and three years after the preceding study. She has presented because the regular symptoms have continued to recur with quite constant regularity, as quite severe exacerbations from time to time. Her vision has become progressively more defective until it is practically lost in one eye and in the other is only sufficient to enable her to distinguish forms but not to recognize individuals. Each rheumatic attack is followed by an irritation of the eye, expressing itself in pain and inflammation with congestion. We have again made a bacteriological examination of her blood and find the same organism present in both the blood stream and her eye. It is particularly of interest to note that with this mild bacteremia, the blood picture is little changed from a morphological standpoint. The biologic classification of the organisms involved is Streptococcus Non-hemolyticus I.

This is a remarkable illustration of the saprophytic quality and adaptability of this type of organism, for, from this blood study

one would not get the evidence without the bacteriological information that she was suffering from bacteremia.

Just here is another illustration that a new truth is a new sense. In Chapter 41 on the Bactericidal Properties of the Blood, I have reported researches that I have been making on the bactericidal measure of the bloods of these various individuals, in order that I may find a quantitative expression as well as cause for the condition of the low defense, by measuring the bactericidal content of the mechanisms of the blood for this strain of organism, and also to determine the capacity of the blood for its normal reaction in the process of defense. This patient's blood has proven to be so low that it would be within the poorest 5 per cent, for it neither has a normal nor near normal bactericidal quality of the blood plasma, nor the leucocytes capable of stimulation to furnish this quality to the blood when the same is stimulated by first subjecting the blood to the presence of the dead organisms. These organisms have increased their capacity for adaptability while she has far below the normal capacity for defense. This immediately indicates the point of approach for the improvement of her condition and the strengthening of her defense.

The importance of vision to comfortable life is so great that every effort that can be made to prevent blindness is, of course, imperative. We present for the encouragement of those with similar symptoms another type of progressive blindness which is of particular interest because of the very marked improvement.

Case No. 1111.—The patient, female, unmarried, age thirty-six, was afflicted with an affection of the eyes, whose chief symptom was attacks of complete blindness, at first lasting a few moments and later developing into periods of several minutes, and at the time she presented had extended to ten minutes, with so great frequency that she was afraid to go on the street, and was about to be compelled to give up her business. She was dependent upon herself for her maintenance. She reported that a careful examination by a skilled oculist had not given her any encouragement. Her eye trouble had been developing, progressively, for approximately five years. The history showed that the pathological conditions about the teeth dated back to and beyond that time. For a year the patient had not been able to do any reading, as even a little use of her eyes would bring on the attacks. She was in great apprehension of being permanently blind and with no means of support.

The condition of her teeth is shown in the roentgenograms Figure 444. With the elimination of the dental infections, her vision was so greatly improved that her periods of blindness entirely subsided and she could spend an entire evening in reading without disturbance. In over a year there has been no recurrence of the acute symptoms. She has again taken up regular office work and the whole outlook on life has changed.

This case also illustrates another in which there is an exceedingly small amount of apical reaction, notwithstanding a considerable quantity of dental infection. The lower left first bicuspid had a putrescent pulp and the tooth did not have a root filling; yet, notwithstanding this quantity of infection, there was practically no apical absorption. Similarly, the upper left first and second bicuspids with partial root fillings were infected and show, practically, no apical absorption, as also the lower right second molar and the lower left second molar.

EARS.

Probably no lesion of the organs of special sense is more common than are those of the ears, particularly in childhood; and all operators will be familiar with many cases of relief of earache by the treatment of an irritated pulp in a carious tooth. While these lesions are much less frequent in the adult, they occur and are, as in childhood, of two types: a sympathetic reflex throughout the otic ganglion and auditory nerve, and as a direct toxic irritation or bacterial elective localization of the auditory nerve. Such a case is the following:

Case No. 1162.—The patient, male, age sixty-three, presented with very acute pain in both ears, more severe in the left. He was sent to us by an ear, nose, and throat specialist who could not find local cause for the severe suffering. Three teeth, the lower left first and second bicuspids (the latter shown as a broken root) and the first molar, were extracted, all with marked condensing osteitis, the roentgenograms of which are shown in Figure 445, and the lower right second molar. With the removal of these teeth his acute pain stopped abruptly for a few days but returned with an infection of the slowly healing sockets, so characteristic of this type of pathology. With the treatment of the sockets, the ear involvement promptly disappeared and did not recur.

For the treatment of these conditions, we have found a solution of a very small amount of iodine and creosote, equal parts in

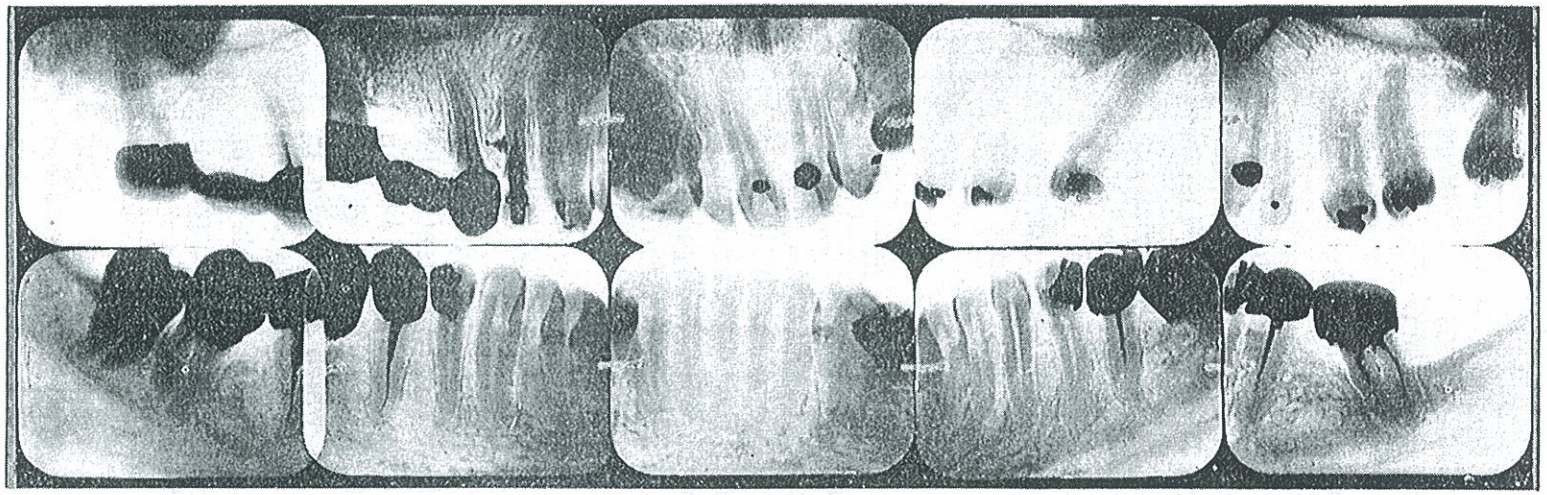


FIGURE 444. DENTAL CONDITION OF CASE NO. 1111, WITH ATTACKS OF TEMPORARY COMPLETE BLINDNESS. NO RETURN OF ATTACKS AT LAST REPORT, TWO YEARS AFTER REMOVAL OF DENTAL INFECTIONS.

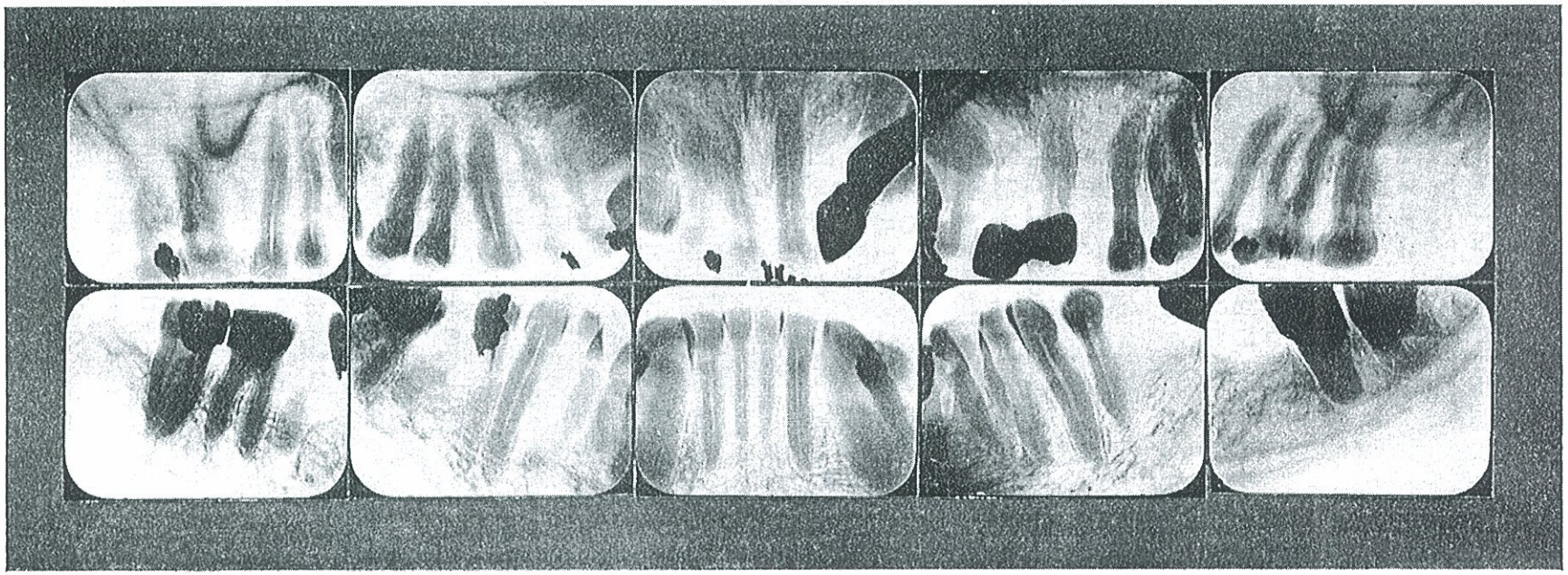


FIGURE 445. DENTAL CONDITION OF PATIENT WITH ACUTE PAIN IN BOTH EARS, CHIEFLY LEFT. RELIEVED BY REMOVAL OF DENTAL INFECTIONS.

eugenol, to be very effective. This may be prepared by adding the mixture of equal parts of iodine and creosote, one part to eugenol, thirty parts. It is neither necessary nor desirable to have the creosote in greater strength than this. An equally good way to prepare the dressing is to dip a piece of surgical gauze, one-half inch square, into the saturated solution of equal parts of iodine and creosote and then carefully wipe off all that can be removed by absorbent cotton, and moistening this gauze with eugenol. The strong iodine and cresote solution is too escharotic and destroys the granulations. This dressing works like magic in controlling the after-pain of so-called dry sockets, which are primarily due to the poor vascularization of the alveolus, as a result of condensing osteitis, characteristic of tissue with low defense, and found in patients with marked susceptibility to streptococcal infection, the local characteristic of which is the absence of normal reaction, of which the chief expressions are pain and rarefying osteitis, connective tissue proliferation, etc.

OBSCURE NEURALGIA.

The members of the laity seem generally to look upon neuralgias as being pains without a physical cause, or at least not due to a localized degenerative process. The reason for this is probably largely due to the use of the term by the medical and dental professions to include those forms of neuritis for which the cause was not known. It is probably true that all disfunction as well as malfunction has its counterpart and cause in abnormal structural and therefore physical conditions of tissue, for chemical processes are ultimately physical. Probably few single groups of disturbances so frequently have their actual causes overlooked as do the so-called neuralgias of the head and face. This condition is still further complicated by the fact, that the nerve structures involved are very often within dense walls and are very difficult to examine except by indirect methods. An acute pulpitis will usually present very little difficulty in location because of the exalted reactivity of the pulpal tissue to temperature changes. A degenerative process, however, may develop within a pulp without considerable change and certainly without an exaltation of its thermal reactivity. Many of these processes have their origin in other structures than the teeth and it must not be presumed that the teeth furnish the only source for these obscure disturbances. They do, however,

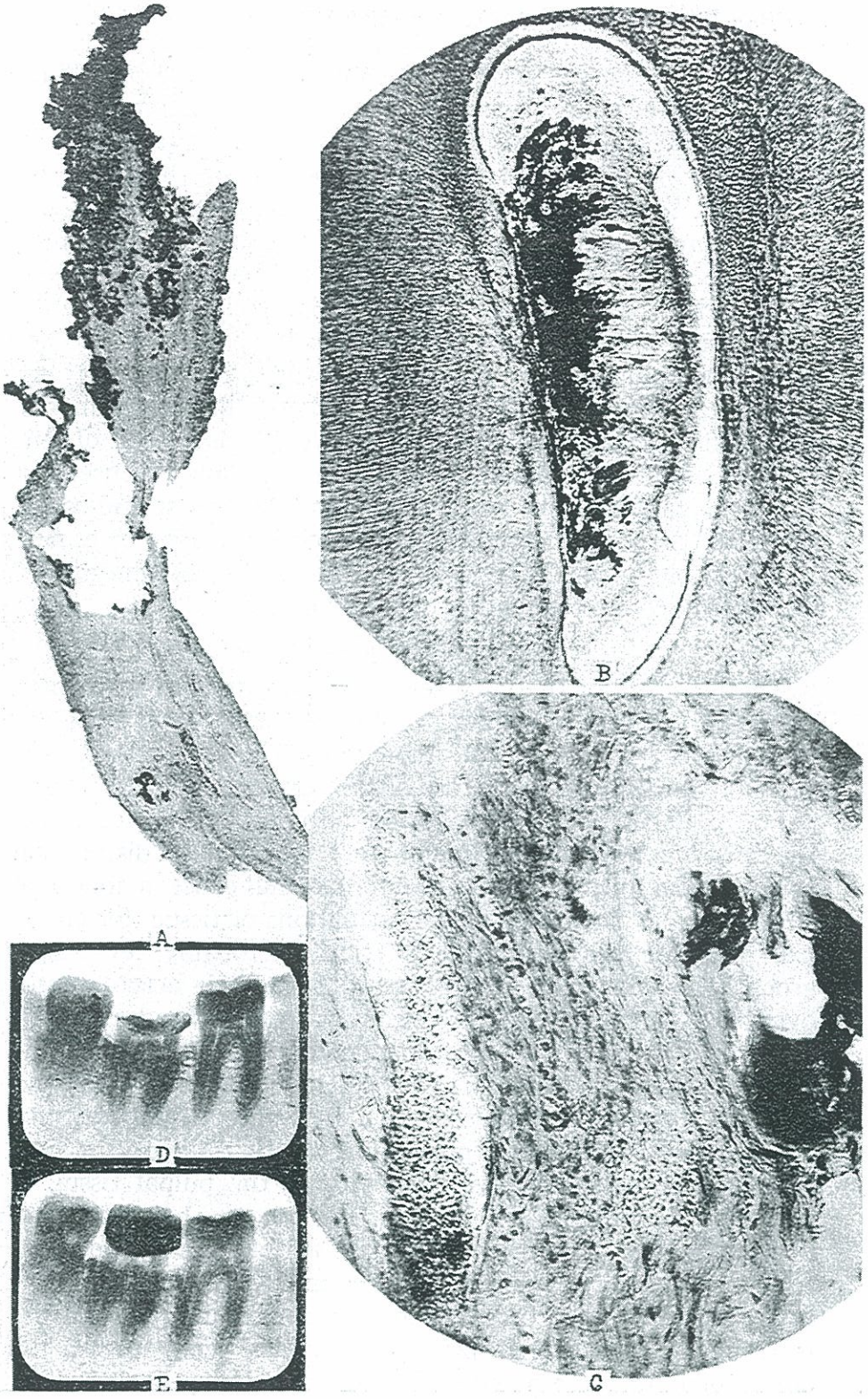


FIGURE 446. OBSCURE NEURALGIA OF DENTAL ORIGIN: E, CROWNED VITAL TOOTH; D, WITHOUT CROWN; A, DEGENERATING PULP WITH CALCIFICATIONS; B, CROSS SECTION OF DEGENERATING PULP WITH CALCIFICATIONS; C, HIGH POWER SHOWING HYPEREMIA AND DILATION OF VESSELS WITH CALCIFICATION.

furnish very many of them and probably more than any other group of tissues. I have undertaken to study the pathology of a number of these processes. A typical one will be seen in Figure 446. The history was about as follows:

The patient suffered from an obscure pain in the side of her head, left side of the face, and neck. This began about a year previous to our seeing her and was most severe in the temple and the ear. At times the neck stiffened on the left side. There were occasions when the disturbance definitely affected her thinking. It was progressively getting worse. It began intermittently and became constant. It was temporarily relieved by the extensive use of Balm analgesic rubbed over the entire side of the face, neck, and head. It had become so severe as nearly to incapacitate the sufferer. All her teeth were roentgenographed, and by that means were negative. All tested normally to temperature change. Naturally, the left mandibular second molar, carrying a gold crown, was suspected, notwithstanding the negative appearance of the roentgenogram. The history of this tooth revealed that there had not been the slightest abnormal symptom during the year that the patient had been suffering. Since it was difficult to test the tooth with the crown in position, a burr was used to drill the dentin at the cervical margin and the dentin responded normally. The crown was removed and contained a large quantity of cement, into which cement bacterial infection practically always extends. There was no recent caries of the dentin. The crown had been set without removing completely the carious dentin. The dentin was tested in several places after the removal of the crown and found to respond quite normally to the irritation of cutting with the burr. The tooth was put under observation, the patient dismissed, with the result that the distressing pain was practically relieved from the time the crown was removed, and did not recur.

In Chapter 17 of Volume One, on Tooth Capacity, I have discussed the role of the toxins and their ability to pass through the dentin and somewhat of their effects. The bacterial growth in cement under a gold crown is very often purely streptococcal, and this organism is practically always present. When the organisms were growing within this gold crown they produced their toxic substances which could not escape through the gold but could through the dentin of the tooth and, of course, to some extent about the margins. These toxic substances tend to pro-

duce in susceptible individuals relatively violent reactions in proportion to the quantity. The result in this case was not only an intermittent involvement of other tissues but it was a direct degenerative process set up in the pulp tissue. This pulp degeneration can be seen in A, B, and C, in Figure 446. B shows a cross section of the mesial root and it will be noted there are extensive zones of calcification. A is a longitudinal section of the pulp of the distal root and also shows very extensive calcifications. C shows a cross section of the pulp under high power and shows a very marked hyperemia, extensive fibrosis, and calcifications. The development of these degenerative processes within the pulp were no doubt contributing to the reflected disturbances. However, there was no evidence of pulpal necrosis as a part of pulpal suppuration. Its normal reactions to mechanical and thermal irritants indicated that it was not a suppurative process. Several things are important in this connection. One is that the original roentgenogram, as seen in E, reveals what would be considered a normal pulp in that there is no periapical involvement and the pulp chamber does not give suggestions of calcification processes, it being much more clear than the pulps of the first and third molars.

The questions will arise: Why did we extract the tooth? Why not remove its pulp and fill the roots? My answer is this: The fact that this patient had at one time developed so severe a reaction in the nerves of her face and head would make them always more susceptible to irritations. Second, the possibility of mechanically filling with perfection the mesial roots of lower molars is always problematical. Third, it would be impossible that the tooth could be put in a thoroughly sterile condition or that it could be maintained in as sterile condition as it would be left when the root filling was placed. Fourth, it would be very probable that in later years, if not months, this tooth would contain within the dentinal tubuli definite streptococcal infection. Fifth, when and if this condition developed, a toxin similar in effect to that which was generated in the cement of the gold crown would be available and would irritate more or less severely the approximating nervous tissues. The fact that this patient had developed this type of disturbance would strongly suggest that she would do so again. While it is true there would be no pulp available to respond to irritation, the pulp is not the only tissue that can so react. For those whose practice it is to place

gold crowns, I would urge the keeping in mind the impossibility of keeping the cement which attaches the crown from becoming infected, the extreme porosity of the dentin, which pores all lead directly to the pulp, and the capacity for the pulp as an end organ to produce profound disturbances through its sensory enervation in the various nerve structures directly and indirectly connected with it.

CHAPTER LXVII.

SKIN.

DISCUSSION.

In discussing the lesions of the skin that are related directly to dental infections, we are probably dealing very largely with anaphylactic reactions to bacterial antigens developed in the dental focal infections and to which that patient has become sensitized. Their variety is so great and the illustrations of success and failure so striking that it is, as yet, very difficult to interpret either the mechanisms involved or the means for determining, in advance, with certainty, whether an obscure dental infection is or is not a causative factor. We have discussed this problem in Chapter 30 on anaphylaxis, and I will not review at this time my interpretation of the principal factors involved. Some of the skin disturbances with dental connections are, apparently, true bacterial invasions with or without a preliminary irritation and sensitization of the tissue by the toxins involved.

The first case I will present is one of herpes, which is probably true bacterial invasion. This patient, a married woman of thirty-one years, had been suffering for about five years from severe nervous affection, expressing itself in indigestion and in skin irritations, typical herpes with a history of herpes zoster, with raised areas as large as a quarter which persisted for many weeks and were very painful. Her affection was so distressing and persisted so long that she confided to me that had it not been for her young family who needed her greatly, she felt she would have given up the struggle, that she felt there was nothing for which to live. Case No. 841.

Her dental conditions are shown in Figure 447. With the removal of the dental infections her improvement was very marked and complete. She has gained in weight from about 125 to 155 pounds, and for three years has not had a recurrence of her herpes until a slight one very recently. It seems very probable that this woman's dental infections either furnished an antigen to which she was very acutely sensitized, or (which seems more probable) that they furnished a toxic substance or

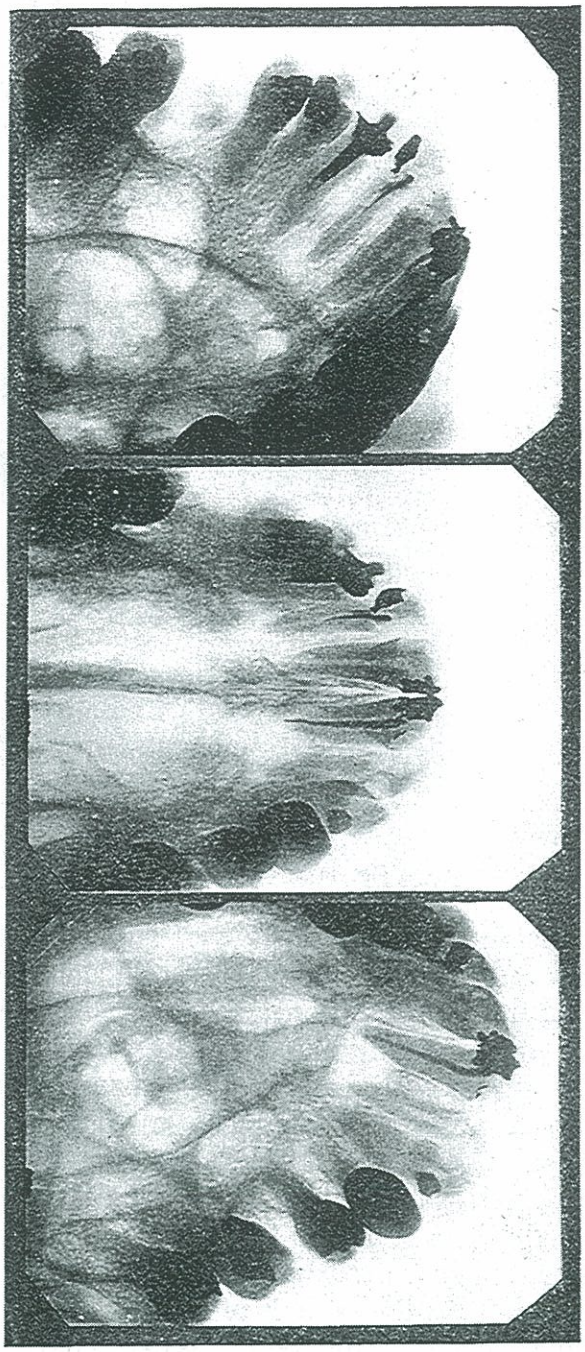


FIGURE 447. RADIOGRAPHIC APPEARANCE OF DENTAL LESIONS RELATED TO AN ACUTE HERPES ZOSTER, WHICH PROMPTLY DISAPPEARED AFTER THEIR REMOVAL. CASE NO. 841.

bacteria which had a specific affinity for certain nerve tissues, particularly peripheral nerve endings.

We more frequently see skin irritations of dental origin in the form of very acute irritation without so much physical expression in the tissues. Sometimes there is an itching like the irritation of nettles without change in the skin. Such a case is the following: Her entire body was itching so painfully that she could not refrain from scratching herself, which, of course, aggravated the

FIGURE 448. UPPER LATERAL WHICH, WHEN REMOVED, COMPLETELY RELIEVED A DISTRESSING ITCHING IRRITATION OF THE SKIN. CASE NO. 1114.

trouble; and, yet, there was very little evidence, physically, of the irritation. She found great difficulty in refraining from breaking the skin with her scratching. Case No. 1114.

An upper lateral tooth, shown in Figure 448, had a history of having recently been acutely inflammed with symptoms of periapical abscess, which symptoms had subsided. The tooth was opened for study; the pulp was found putrescent; the tooth was dressed; and that night she had by far the most severe symptoms of this skin irritation that she had ever had. Its history showed that it had a periodic cycle, which would disappear entirely and return; but the periods of exacerbation were continually getting more severe. This tooth was extracted. This skin irritation disappeared immediately and has not recurred in two years' time. This case should also be considered as probably an illustration of sensitization; and it is very difficult to anticipate how far it will be demonstrated that these sensitizations have contributed to the development of pathological lesions.

It is not uncommon for us to see the dermatosis, expressing

itself as warts about the arthritic joints, entirely disappear with the removal of dental infections; and it is now quite completely demonstrated that these proliferations of the epithelium are often entirely due to infection processes. It is not yet demonstrated to what extent those proliferative skin irritations, which approach malignancy in their type, may be influenced, if not originally induced, by some form of allergy. We would present in this connection for consideration and not as an illustration of a demonstrated fact, the following case.

Case No. 1205.—This woman, age fifty-two, presented with the so-called skin cancer of the nose. These neoplasms tend to have exacerbations with a definite trend toward malignancy. That this lesion may be in part an expression of an allergy is the only point we are presuming to illustrate. I have made an extended discussion of the researches on this phase in Chapter 31. She had very extensive dental infections, as shown in Figure 179, Chapter 31. With the removal of these, this skin lesion, which had been in an aggravated condition for several months, completely disappeared, as shown in the pictures which were taken three weeks apart (Figure 178, Chapter 31). This lesion had tended to have exacerbations but never before had completely disappeared, and tended to have its aggravated stage recur in a few weeks' time. In this instance it was absent, approximately, five months before its return in mild form. I transferred her to a cancer specialist to whom I had referred her at first presentation; and because the lesion promptly disappeared after the removal of her dental infections, she returned the letter of introduction. He gave the lesion a treatment with radium, which is very effective for this type of lesion, and in several months there has been no recurrence.

Since the evidence presented in the experimental chapters strongly suggests that many of the skin diseases are allergic reactions to protein sensitizations of bacterial origin and other forms within the body, many cases would naturally be reported under skin lesions which under a strict classification have been presented in the chapter reviewing researches on sensitization reactions. We would refer to Chapter 30 for the further review of the clinical symptoms and their interpretation in relation to sensitization.

Skin lesions about the face and neck may readily be the result of a systemic expression of a focal infection or may be the external localization of a dental infection probably with direct fistulous

connection with the dental focus. An illustration of the former will be that of the girl of twenty-three illustrated in Chapter 59, who, in addition to her acute rheumatism and heart involvement suffered from pustules over her face, in many respects like acne. With the removal of her dental infection, not only her rheumatism and heart involvement immediately subsided, but this skin lesion also.

There are many lesions, however, of the skin, which seem very directly to be connected with dental infections and which are of the nature of a sensitization. In Chapter 30 on Sensitizations, I presented a number of these. I would, accordingly, stress in this connection the type of condition that may be associated or at least may be under suspicion as of dental origin. Figure 172, Chapter 30, shows a type of scaly dermatitis which is associated with so marked a stiffness of the hand and fingers that the individual, a professional pianist, was prevented from maintaining his regular duty. There was a marked tendency to deep cracking. With the removal of the dental infection, shown in Figure 173, this disturbance of six months entirely disappeared, and in seven months more has not returned.

Another type is a dry scaly dermatosis not tending to crack deeply, but at times quite strikingly sensitive. It was illustrated in Figure 175, Chapter 30. It was present on different parts of the individual's body, but chiefly on both arms. With removal of the dental infections, as shown, the process entirely disappeared. Figure 175 shows this individual's sharp dermal sensitization reaction and also the condition of the arm a few days after the removal of the dental infections, at which time there was no visible indication of where the disturbance had been though it had persisted for months previously.

CHAPTER LXVIII.

ENDOCRINE SYSTEM.

INTRODUCTION.

A discussion of the lesions of the endocrin system will, of necessity, involve a reference to much that has already been presented in other chapters, since a great deal that has been presented in the chapter on Primary and Secondary Sex Organs involves the gonads. To save repetition, we will, accordingly, refer to that chapter, No. 62, for a further discussion of this.

GOITER.

DISCUSSION.

Attention has frequently been called in literature to the fact that dental infections very readily tend to disturb the functioning of the thyroid gland. McCarrison in his splendid work in India found that he could produce the typical goiter of that district. in which he was working, by having the men drink the residue from the filtered water of the water supply of the communities where this disturbance was so predominant. He also demonstrated that the disturbance was more prevalent the farther down stream the villages were located, indicating that the increase in the sewage was an important contributing factor.

Early in our studies, I observed that girls, who were suffering severely from enlarged and over-active thyroids, had these aggravated by the development of dental infections and relieved by the elimination of the dental infections. A typical illustration is as follows:

Case No. 628.—The patient, at the age of twenty, had a thyroid which had enlarged her neck to 36 centimeters. She had a typical group of symptoms: nervousness, rapid heart, excitability, and fear. The condition of her mouth is shown in Figure 449. With the removal of these dental infections the circumference of her neck reduced to 33.5 centimeters; her nervous symptoms entirely disappeared and her heart returned to normal.

This case is of interest because two years later a tooth which I considered to be border-line and had under study because it had had an apicoectomy made upon it, developed slight tenderness

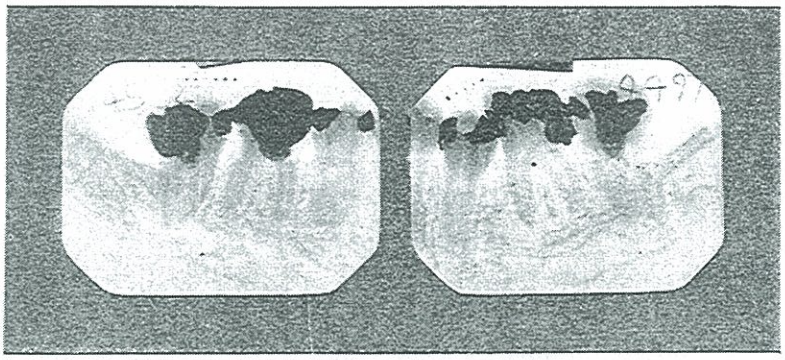


FIGURE 449. DENTAL CONDITION RELATED TO A CASE OF HYPERTHYROIDISM IN A YOUNG WOMAN, AGED TWENTY. CONDITIONS RETURNED RAPIDLY TO NORMAL FOLLOWING THEIR REMOVAL. CASE 628.

though roentgenographically the evidence was not considerable. It was kept under study for a few weeks. Her former symptoms of thyroid irritation developed with a very marked tachycardia. The tooth was removed and her symptoms promptly and completely disappeared.

While a very large number of young girls have thyroid disturbance, usually with enlargement, throughout all those geographical locations that do not have either a soil or water supply from the soil bearing shells of salt water fossils or a supply of iodin directly from sea water, those cases are not so distressing as the acute disturbances of middle life and beyond, which so often seriously involve the heart. Such a case is the following:

Case No. 471.—A woman, age forty-two, with three children, was suffering distressingly from nervous symptoms, exophthalmos, and very severe heart disturbance. She was not able to take care of any of the interests of her home and seemed on the verge of a very critical collapse. For the preceding year she had had a skin eruption and for a few weeks had a very distressing cough, due to the pressure of her goiter. She had marked tachycardia and a murmur had developed some months previous to the time she presented. Her condition was considered too critical for operation.

The type of dental pathology is shown in Figure 450. The upper right central had a history of having abscessed five years previously, at which time it was treated daily for several weeks, tenderness lasting for some time following its root filling. An upper right molar which had abscessed, had had a root amputated about a year previously. At the time of presentation no teeth were giving symptoms of trouble.

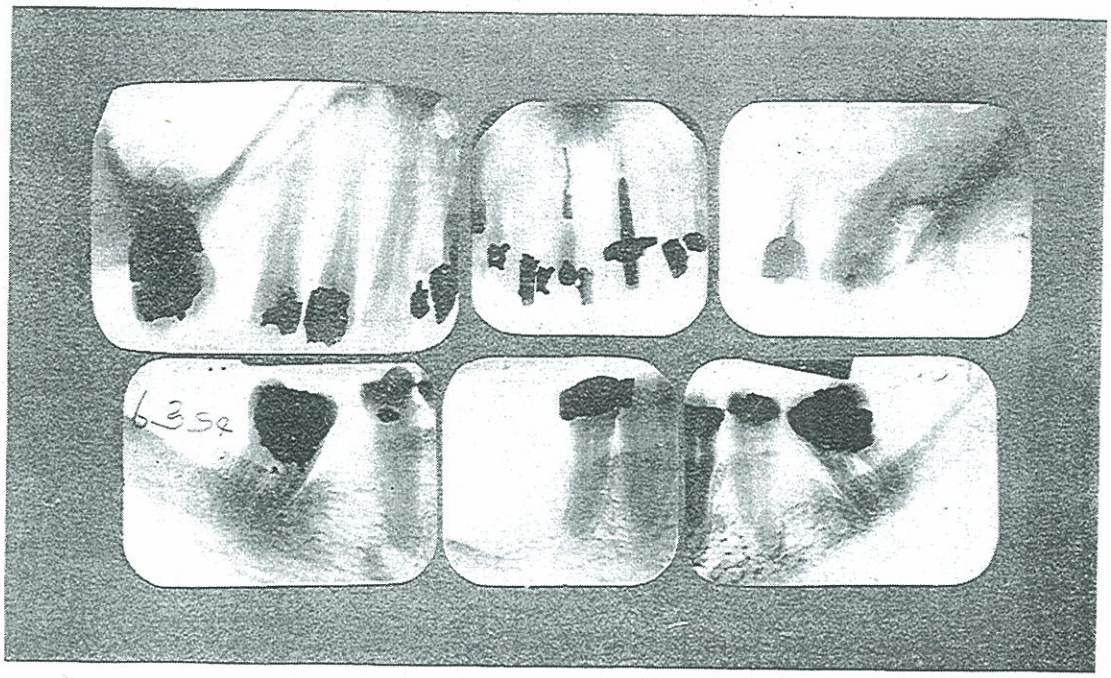


FIGURE 450. ROENTGENOGRAPHIC APPEARANCE OF DENTAL CONDITIONS OF VERY SEVERE CASE OF EXOPHTHALMIC GOITER WITH HEART INVOLVEMENT. PATIENT VERY RAPIDLY RECOVERED AFTER REMOVAL OF THE DENTAL INFECTIONS. CASE 471.

After the elimination of the dental infections her improvement was very marked and rapid. Her goiter reduced in size; the exophthalmos disappeared; and her heart so splendidly improved that in a few months' time she was doing her own housework, entertaining extensively, and for over three years has been carrying both her household and social duties with apparent ease. As an illustration of her improved heart condition, she does not mind a long walk uphill, even when taken rapidly, notwithstanding she is a very large, stout woman.

A study of her susceptibility chart shows, as shown in Figure 451, the following: Her disturbances have been chiefly heart, goiter, and nervous breakdown. Her severest symptoms have developed recently, though she has a history of neuritis and nervousness earlier. She had four brothers and four sisters. Two of her sisters and one brother have had rheumatism. All of her four sisters have had nervous breakdown and her mother suffered nervous breakdown three times. One sister is also recorded as having a goiter. Both her father and mother have had rheumatism. However, the chief disturbances have been in the nervous system and heart. Her father, three of his four brothers, one of

Form No. 13 Serial No. 471

RESISTANCE AND SUSCEPTIBILITY CHART

PATIENT S.A.R. Case No. 471 AGE 42

ADDRESS DATE 10-9-18

CHIEF COMPLAINT Heart. Goiter. Nervous Breakdown

Pt. has now	Pt. has had	Rheumatic Group Lesions and Complications	Own: Brothers	Own: Sisters	Own: Sons	Own: Daughters	Own: Hsbnd Wf	Fathers Side: Father	Fathers Side: Grndfthr	Fathers Side: Grndmothr	Fathers Side: Uncles	Fathers Side: Aunts	Mothers Side: Mother	Mothers Side: Grndfthr	Mothers Side: Grndmothr	Mothers Side: Uncles	Mothers Side: Aunts
		No.	4	4	2	1					4	2				2	2
	#	Tonsillitis		X			#										
	+?	Rheumatism	#	+2				#					#				
	+?	Swollen or Deformed Joints		+									#				
	#	Neck-back or Shoulders		#													
		Lumbago															
	#	Neuritis		#													
		Sensitizations															
	+?	Sciatica															
		Chorea or St. Vitus's Dance															
#	#	Nervous Breakdown	#	#4			#						#2				
		Mental Cloud															
		Persistent Headache		#													
#	#	Heart Lesions		#				⊕			⊕3	⊕	⊕				
		Dropsy															
		Kidney Lesions, Brights															
		Liver or Gall Lesions															
		Appendicitis		X													
	#	Stomach pain or Ulcer											#				
	#	Eye, Ear, Skin, Shingles															
		Pneumonia		#										⊕			
		Anemia															
#	#	Goiter		#													
	#	Lassitude, Chilliness															
		Hardening of Arteries															
		Stroke															
		Age if Living	60 53 52 49 38 46 40														
		Age at Death						75	40		70	70	78	75			
		Flu with Complications															
		Flu without Complications															
		Neuralgia		#													
		Typhoid	⊕						⊕								
		3 Locked foci															
	#	Extensive Tooth Decay		#													
	#	Abscessed Teeth	#	#													
		Loosening Teeth															

Years — Duration of chief Affection — Duration of Dental Infection

KEY FOR CHART: + HAD LESION; #FREQUENTLY; #VERY SEVERELY; +? PROBABLY; ✳ OPERATION; ⊕ FATAL ATTACK

PATIENT	CARIES	LOKD	CONDSNG	SL. HG.	SYST. RELF.	COMP.	PART.	RECR.	NONE	FACTOR OF SAFETY				
	#	#	#			+				V.HG.	HIGH	FAIR	LOW	V.LW.
	PYRRH	OPEN	RFVING	RA.HG.	SUSC. TRLT.	INHT. ###	ACQD.	ABST.	SC. NO					#

FIGURE 451. SUSCEPTIBILITY RECORD OF CASE NO. 471, WITH HEART AND GOITER INVOLVEMENT AND NERVOUS BREAKDOWN. NOTE MARKED HEREDITARY SUSCEPTIBILITY FOR NERVOUS SYSTEM AND HEART, WITH SIX DEATHS FROM THE LATTER.

his two sisters, and her mother, all suffered from heart trouble during life, and their deaths were recorded as being due to heart trouble. The fact that these people did not die young, but in after years, would indicate that their heart trouble was one of irritation rather than a severe organic lesion. It is very difficult to get definite information, as to whether the disturbance, that will have been recorded as rheumatism in a member of the family, is an involvement of the nervous system as neuritis, or of a myositis, synovitis, etc., of the skeletal and muscular system.

In studying this woman's factor of safety, we should expect it to be low in both the nervous system and heart, which, doubtless, was a contributing factor to the extreme expressions in those tissues of either the direct irritation of the toxic and bacterial products of the dental focal infections, or the indirect effect of their reaction upon the thyroid gland and the general endocrine system. Whatever the mechanism may have been, the extreme reactions are strongly suggestive of a very marked sensitization and the fact that she recovered so completely and quickly without operation illustrates the necessity for careful study to determine whether the disturbance of the tissue to be operated upon is not a symptom of the focal infection rather than an independent lesion.

I have no doubt that many, who will look at the roentgenograms of this woman's teeth, will shrug their shoulders and say or think there is little or no roentgenographic evidence that these teeth are infected. To these I wish to say that that fact of absence of evidence of reaction is one of the saddest I know of in connection with all humanity's interests and afflictions, for if this woman had an adequate capacity for reaction she would be establishing about these seriously infected teeth (for they were proven to be infected by culture and animal inoculation) a quarantine against the dental infection which would prevent either it or its toxins from reaching the balance of her system. Incidentally, such an adequate reaction would produce destruction of bone which would be replaced by highly vascularized granulomatous tissue and which, of necessity, would readily be recorded in the roentgenogram. It is the absence of this reacting capacity that is this woman's undoing. As I have shown in other chapters, the most important factor is the capacity for reaction of the patient, and an understanding of its expressions.

In our animal inoculations it is not unusual to find very marked involvement of the endocrine system. Such a case is the following:

FIGURE 452. AN ENORMOUSLY HYPERTROPHIED THYMUS WHICH DEVELOPED IN A RABBIT INOCULATED WITH A DENTAL CULTURE.

Rabbit 156, shown in Figure 452, was inoculated with the culture from a patient with streptococcal blood stream infection with multiple symptoms, including rheumatism, eyes, heart, nervous system, and skin. This figure illustrates a greatly enlarged thymus as the result of this inoculation. We do not interpret this to indicate or even suggest that this patient had a thymus involvement. We do not know; but present the case only as illustrating this extreme effect upon this rabbit, a lesion which has seldom occurred to so great an extent. To what extent this patient's symptoms of endocrine derangement were the result of thymus irritation we cannot even guess.

PANCREAS.

In the chapter on Chemical Changes in the Blood, I have discussed some of our studies on the relation of dental infections to pancreas function and carbohydrate metabolism, and have shown that dental infections tend distinctly to increase the sugar retention in the blood in experimental animals in certain instances.

Since carbohydrate metabolism is so closely related to, and dependent upon, the functioning of the islets of Langerhans of the pancreas, it seems very probable that any process, which may disturb the normal functioning of that tissue, will in turn disturb both carbohydrate metabolism and acid-base balance. The processes that are involved in these disfunctions, while not clearly understood, have been greatly elucidated, as shown in Chapter 20, by the researches of Banting[5], Best, Collip, Hepburn, and Macleod.

It is, of course, impossible for us to present evidence to establish definitely that the dental infections *per se* have been responsible for the disturbance in carbohydrate metabolism by producing a lesion in the pancreas of the patient. We can, however, be justified in making some observations which will relate the patient's clinical condition to carbohydrate metabolism. This has expressed itself with a marked diminution of a hyperglycemia, coincident with a reduction of the glycosuria, which has occurred in a number of instances. In Figures 192 and 193 there will be seen two specimens of pancreas tissue; 192 is taken from a normal rabbit and 193 from a rabbit inoculated with a strain taken from a dental infection. It will be noted that there has been a distinct change produced in the islets of Langerhans in these two tissues. Of course, it is not possible to take a section of a pancreas from a rabbit and then inoculate it and later take some of the same tissue. We are presuming that the rabbit selected as normal had a normal pancreas, which was evidenced by the fact, that in a large number of sugar determinations of normal rabbits we have never found any divergent from the normal though we have frequently found this factor distinctly disturbed by the inoculation, as cited in Chapter 20. It is my belief that further research on this important problem will disclose further evidence of this relationship.

[5] See bibliography.

CHAPTER LXIX.

OTHER TISSUES.

DISCUSSION.

Under the head of other tissues we will discuss a variety of tissues not included in the foregoing subdivisions, first of which will be the salivary glands. The involvements of the parotids, as parotitis or mumps, is familiar to all as an acute infection of relatively short duration and, except for the complications, is not frequently serious. Acute parotitis has frequently been produced by dental infections and the organism found in mumps has been classified as a strain of streptococcus. This, however, is not the type of lesion that is of greatest concern; not because it is not severe, but because it is not frequently serious, and its duration is relatively short.

XEROSTOMIA.

This disease has been considered relatively rare and its etiology has been unknown. It is fortunate it is rare because its fatality is so very high. There are only a few dozen cases of the disease in the medical and dental literature, and, so far as we know, practically all have proved fatal.

Its cause has been supposed to be in the central nervous system. The symptoms are a lack or absence of the normal secretions and dryness of the mouth, increasing in severity until the tissues crack, suppuration sets in, and the patient dies a most agonizing death. The first case we will study is as follows:

Case No. 955.—A woman, age fifty-seven. Her history showed that she had rheumatism which began acutely fifteen years previously. At the time of presentation her joints were swollen and her hands could not be closed. She had had acute indigestion which produced fainting, on two occasions. A heart lesion had developed thirty years ago with la grippe. Her dry mouth began eight years previous to my examination. At this time it was parched so that it was like feeling a piece of dry tissue paper. The tongue and the inner surface of the cheeks cracked readily. There was complete absence of both mucous and salivary secretions. Owing to the fact that we could find no reference to the

development of the pathology or its etiology, I removed a part of the right sublingual gland for histological study and also some mucous membrane from the cheek for similar study.

A characteristic of these cases is the persistent and rapid caries, the crowns just melting from the roots, requiring almost weekly care; and in this patient's case it had only been because of the exceeding faithfulness of her dentist that any teeth were left. It is necessary for these patients to take water into their mouths very frequently in order to moisten the tissues. As the disease develops, the dryness extends to the throat and eyes, the latter as xerophthalmia.

By manipulation of the parotid glands and compression of the cheeks, it was possible to cause to exude from the Steno's duct a small quantity of a gelatin-like mass which was so dry that it would not moisten a cover-glass or mirror. Culturing of this mass always produced streptococci, growing chiefly in diploid form. Owing to the dryness of her mouth, it was very difficult to get roentgenograms, since the dry tissue tended readily to be lacerated and healed slowly from laceration.

On sectioning the tissue taken from the sublingual gland, very definite structural changes were found, as shown in Figure 453. A shows a normal lobe and lobule, and B one as found in her tissue. Note the degenerative necrosis of the lobe, with its infiltration of leucocytes, degeneration of the excreting cells, necrosis and fibrosis with a tendency to proliferation so pronounced as to be even suggestive of malignancy. A high power view of this tissue is shown in Figure 454, and of lobules of other cases in 455.

The roentgenographic studies of her teeth are shown in Figure 456. It will be observed that the lower left first molar gives evidence of a curved, if not a deformed root, which condition had presented great difficulties to the operator who undertook to fill it. This tooth was extracted, at which time it was found that the mesial root was bifurcated, as shown in Figure 456. This is a very unusual condition and is not disclosed in the roentgenogram. One branch of this bifurcated root did not have a root filling. The tooth, due to the mechanical difficulties, had not permitted the root filling to be placed to the end.

The history of this and similar cases had been that the use of sialogogues was not beneficial. The placing of the whip on these exhausted tissues was always followed by the making of the conditions more aggravated than before. This had been tried many

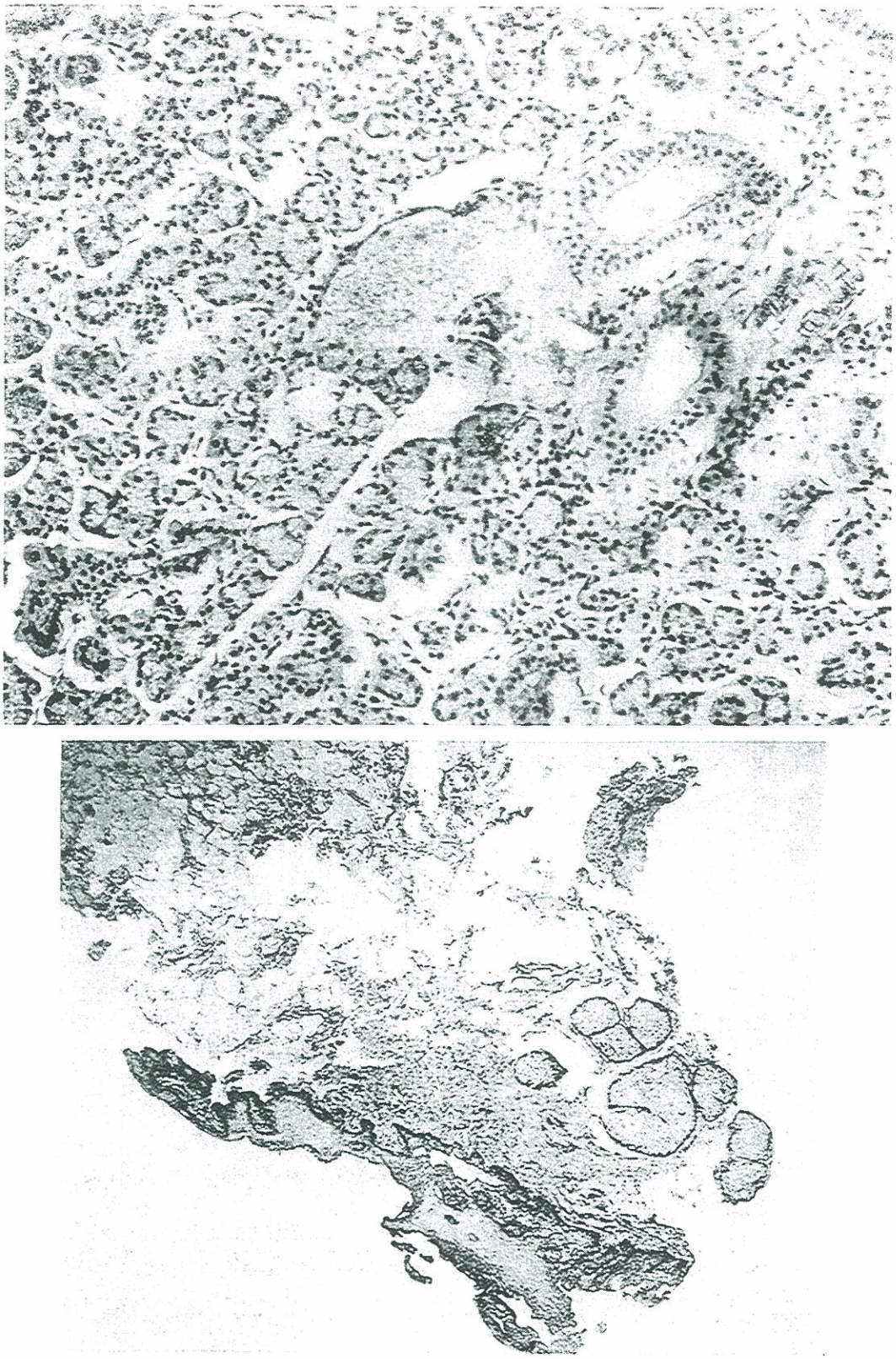


FIGURE 453. UPPER, NORMAL SUBLINGUAL GLAND SHOWING LOBE AND DUCT AND NUMEROUS NORMALLY FUNCTIONING LOBULES OR ACINI; LOWER, PATHOLOGICAL SUBLINGUAL GLAND OF CASE NO. 955, SHOWING DEGENERATED LOBE. THE LOBULES, OR ACINI, ARE NEARLY ALL DESTROYED, A FEW INTACT BUT BREAKING DOWN.

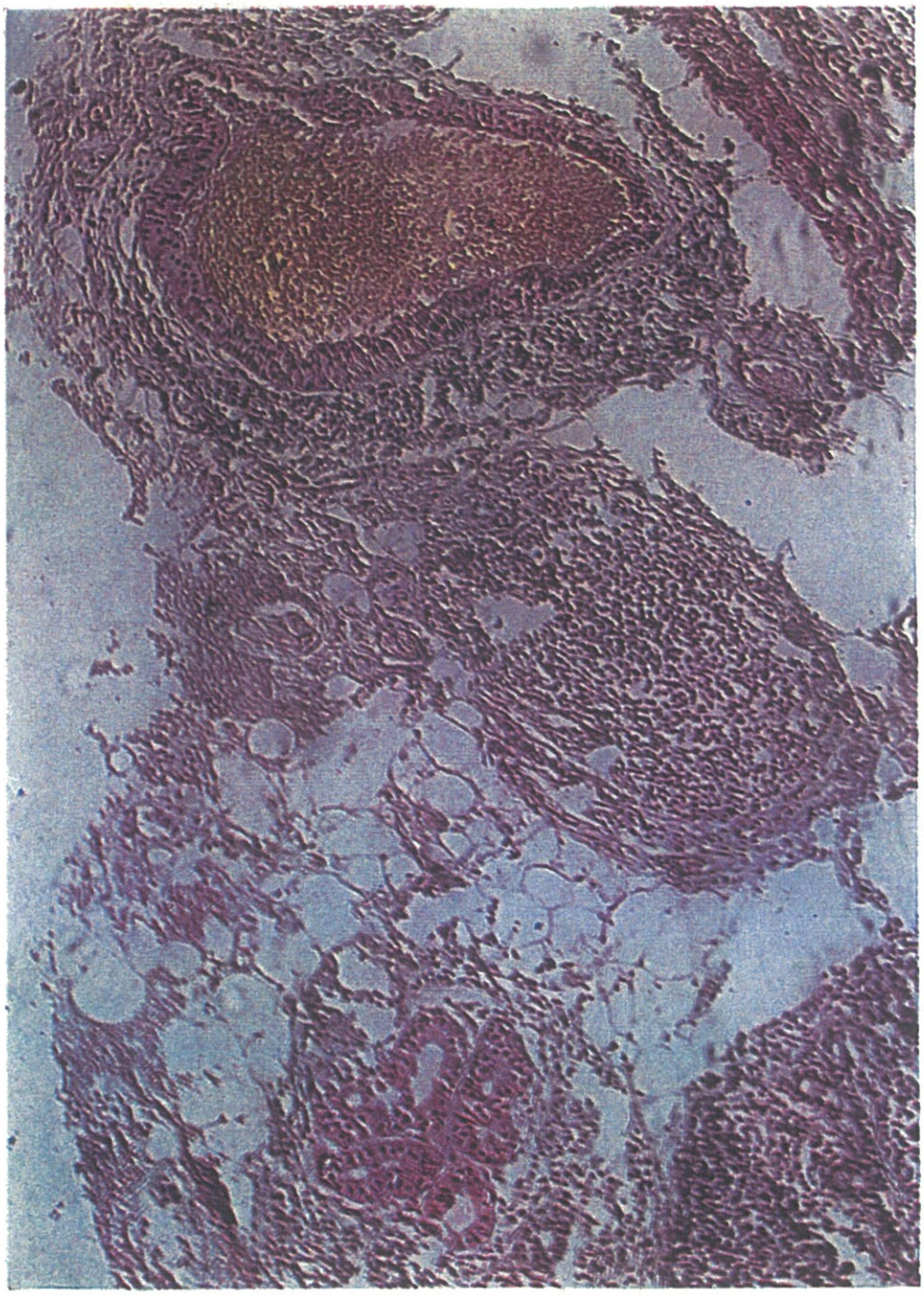


FIGURE 454. XEROSTOMA (DRY MOUTH) SECTION OF SUBLINGUAL GLAND OF PATIENT, CASE NO. 955, SHOWING A CHRONIC PROLIFERATIVE INTERSTITIAL INFLAMMATION, WITH NECROTIC DESTRUCTION OF ACINI. THE INFECTION IS WITH DIPLO- AND STREPTOCOCCI.

[OTHER TISSUES XEROSTOMA.]

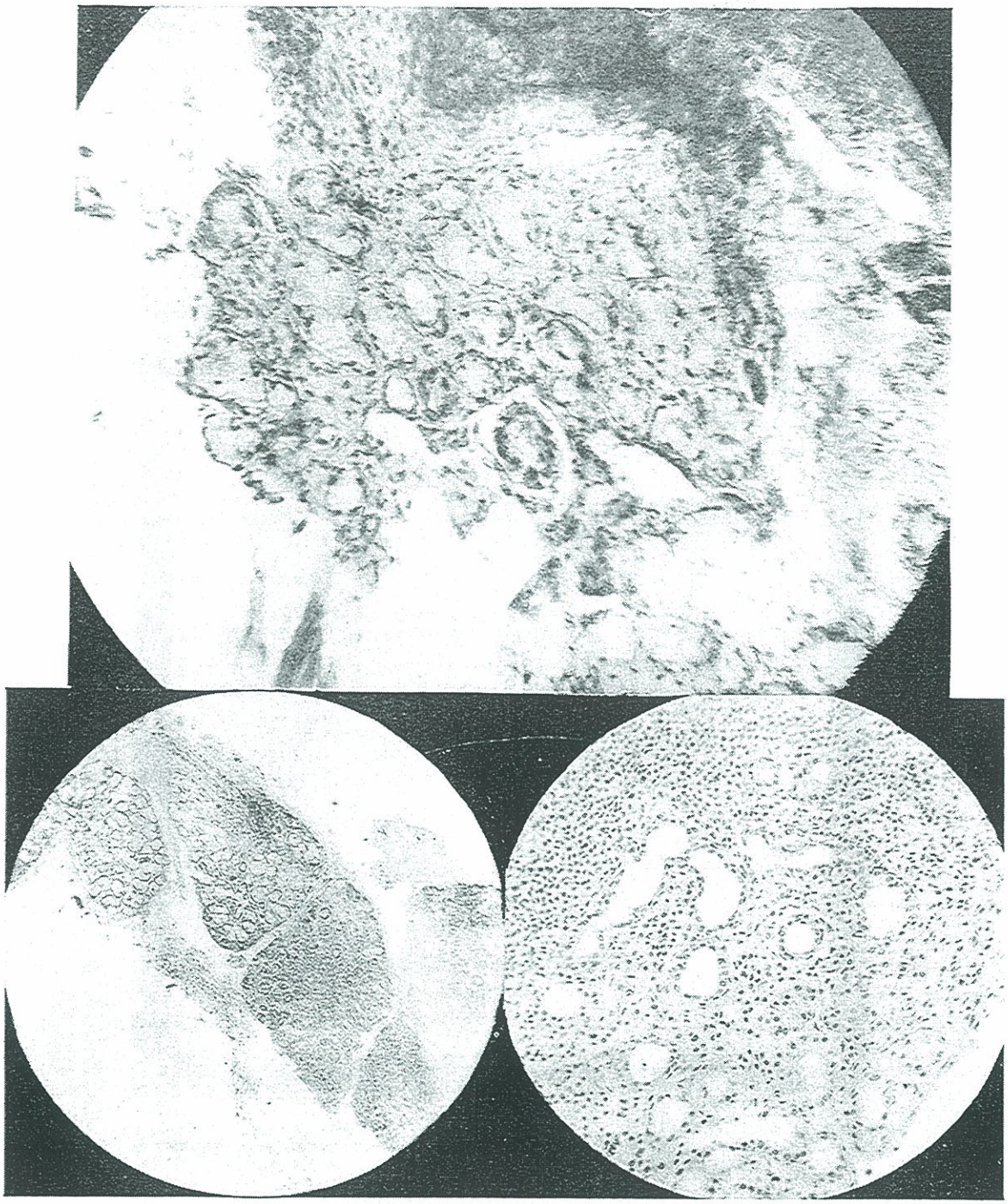


FIGURE 455. TYPICAL DEGENERATIVE NECROSIS OF SUBLINGUAL GLANDS OF DIFFERENT CASES OF XEROSTOMIA.

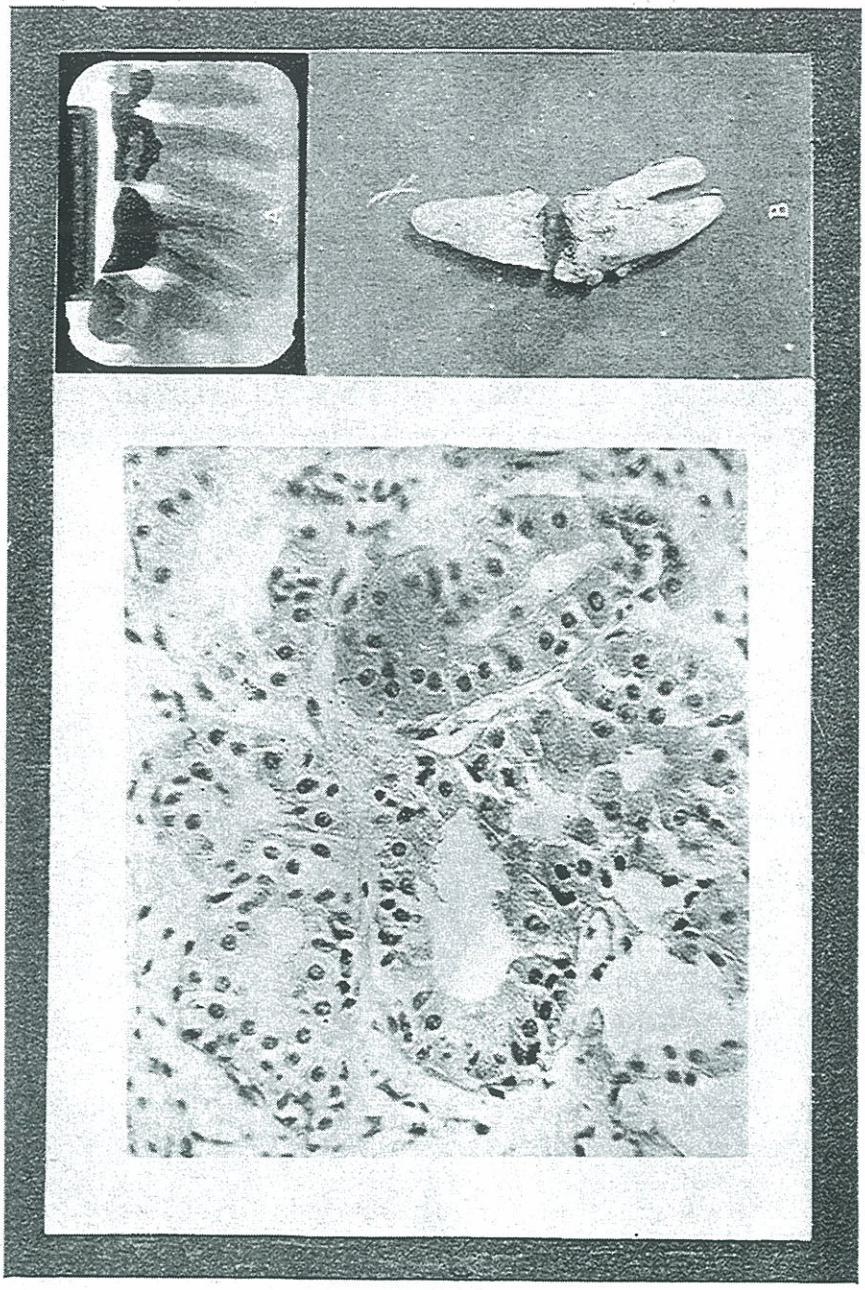


FIGURE 456. XEROSTOMIA. CASE NO. 955. A, ROENTGENOGRAPHIC APPEARANCE OF LEFT MANDIBULAR SECOND MOLAR; B, PHOTOGRAPHIC APPEARANCE OF BIFURCATED MESIAL ROOT; C, HYPERTROPHIED LOBULES OF PATIENT'S SUBLINGUAL GLAND.

times and always failed, and always seemed to leave the condition worse than previously. Since cultures taken from the glands always produced the same organism in pure culture, and since the same organism was found in the root of the extracted tooth, it was

deemed wise to use an autogenous vaccine made from this organism as grown from the tooth with the hope of boosting the patient's defense.

Studies of the blood showed hemoglobin 80 per cent on four occasions, and the erythrocytes varied from 3,400,000 to 4,400,000, and the leucocytes varied from 12,000 to 21,000. The mononuclears, when we started our vaccine treatment, were 18 per cent, and the Arneth Index was very low. After the use of the vaccine, the hemoglobin advanced to 90 per cent (and later to 95 per cent), and the erythrocytes to 5,200,000, and the leucocytes remained at about 12,000 to 13,000. The mononuclears reduced 1 to 5 per cent; the Arneth Index improved.

The effect on the secretion of moisture was definite. The material exuded from the ducts frequently without much effort. The general condition of the mouth was more moist. For the first time in a few years she was able to lick a postage stamp and seal a letter; and also for the first time in a few years, she had enough moisture in her mouth to swallow when awakening. When talking or otherwise keeping her mouth open, it rapidly dried out so that it was nearly as dry as the surface of her face. It was necessary for her to avoid continued conversation, public speaking, etc.

While this patient had been treated in several of the best institutions of the country, she stated that, practically, no improvement had been made; in one, after studying her case for a couple of weeks, she stated that they advised her that since there was nothing known about the disease, all they could do was to give her the Greek name of it. The evidence at hand strongly suggested that the patient was suffering from a streptococcal infection of both the salivary and mucous glands, with the resultant necrosis and toxic poisoning which was progressively advancing.

In order to determine whether the organisms secured from these diseased glands had elective localization qualities for those tissues, several animals were inoculated with these cultures with the result that in many instances extensive involvements of the sublingual, lingual, and submaxillary glands were produced. Figure 457 shows in A a sublingual, submaxillary, and parotid gland of a normal rabbit in the upper row, and in B the corresponding glands as removed from one of the experimental animals, in which it will be seen that they are practically doubled in size. In Figure 458-B there is shown a dissection of the sublingual glands

FIGURE 457. SUBLINGUAL, SUBMAXILLARY, AND PAROTID GLANDS: IN A, FROM A NORMAL RABBIT: IN B, FROM A RABBIT INOCULATED WITH A CULTURE FROM A TOOTH SHOWN IN 456.

in another rabbit, enlarged and exposed *in situ*, and in A an acute suppurative arthritis produced in the same animal, which is a common complication with this disease.

Another patient suffering from xerostomia in a more aggravated form, if possible, has shown on section of a piece of her sublingual gland (See Figure 459) the same general pathological changes, as seen in Figure 454. In A will be seen one of the functioning tubules, enlarged and degenerating, and in B the extensive degeneration and necrosis of the secreting acinus. In one of the rabbits inoculated with culture from the gland exudate, which at times was purulent, most profuse involvement was produced in the sublingual gland with hemorrhage and infected areas about to break down with necrosis, as shown in Figure 460.

The prognosis of these cases is always bad. However, we have more hope from the result of another case that has been under our observation which was of shorter duration (approximately one year since its onset) and which under treatment with removal of dental infection and the use of cod liver oil returned practically to normal. This I administered on the presumption that since xerophthalmia, a similar dry affection of the eye developing into suppuration, is influenced, if not produced, by the absence from the food of a special fat soluble vitamin which is found abundantly in cod liver oil, that substance might be of benefit in these

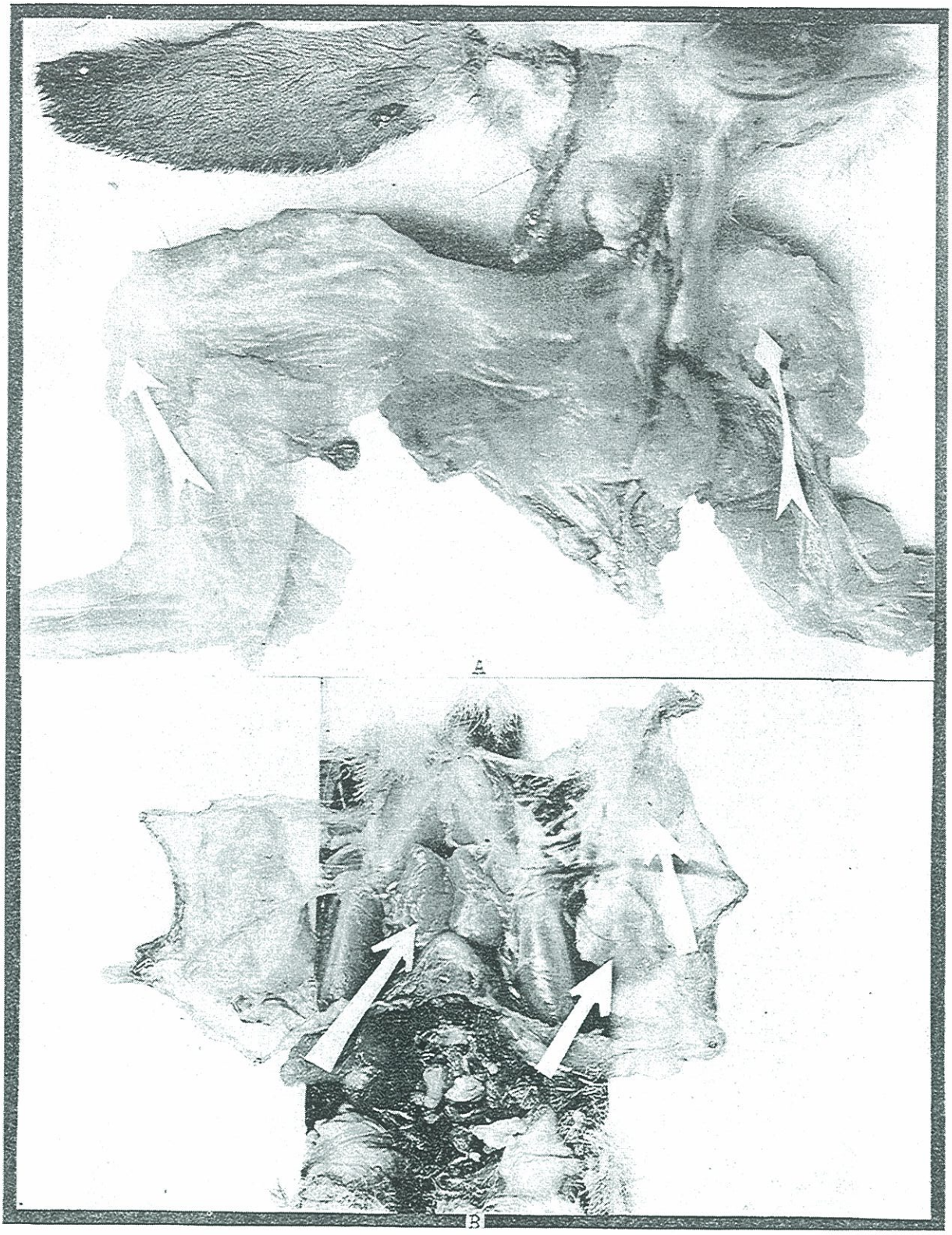


FIGURE 458. B, A PAIR OF GREATLY HYPERTROPHIED SUBLINGUAL GLANDS PRODUCED IN A RABBIT FROM CULTURES FROM CASE NO. 955 WITH XEROSTOMIA AND RHEUMATISM. A, AN ACUTE SUPPURATIVE ARTHRITIS IN SAME RABBIT.

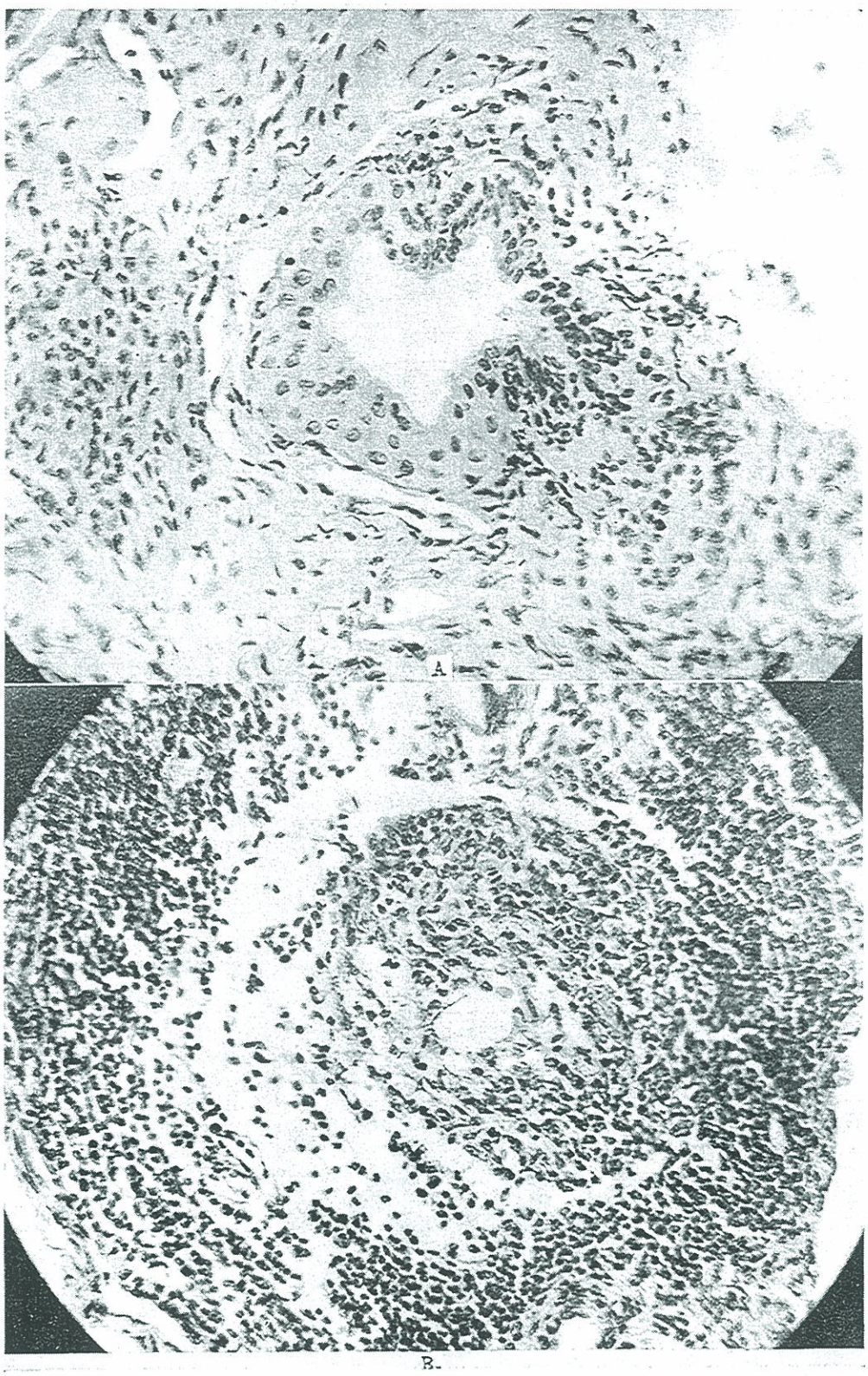


FIGURE 459. SECTION OF SUBLINGUAL GLAND FROM CASE NO. 1136, SUFFERING FROM XEROSTOMIA. NOTE MARKED DEGENERATION OF ACINUS AND SECRETING LOBULE.

FIGURE 460. A SUPPURATIVE AND HYPERTROPHIED SUBLINGUAL GLAND OF A RABBIT INOCULATED FROM CASE NO. 1136.

cases. Figure 461 shows a histological section of a piece of the sublingual gland of this patient in which it will be seen that the destructive changes and necrotic processes had not progressed nearly so far as in the preceding cases.

While, so far as we can find in literature, this is the first suggested interpretation of the pathology based on either dissections of the glands of the patient or animal experimentation, we do not feel that the explanation is so simple as a simple bacterial invasion of a streptococcal strain having elective localization for this tissue. Because of the marked beneficial effect in the last case cited of the use of cod liver oil, it seems very probable that the bacterial invasion is either related as a destructive factor to some essential hormone which is concerned with salivary and mucous production, or that such a substance has a counter part to some extent in the fat soluble vitamins, whether A or D, or some other with which we are not familiar.

ORAL HERPES.

It is not uncommon either in association with dental infections or following operations for their elimination, that patients are affected with herpes which may extend over a considerable area or be limited to local zones. The local structural pathology of this condition has been obscure. Our histological sectioning of these tissues has shown a diplo-streptococcus growing within the tissue. These tend to produce minute subepithelial abscesses

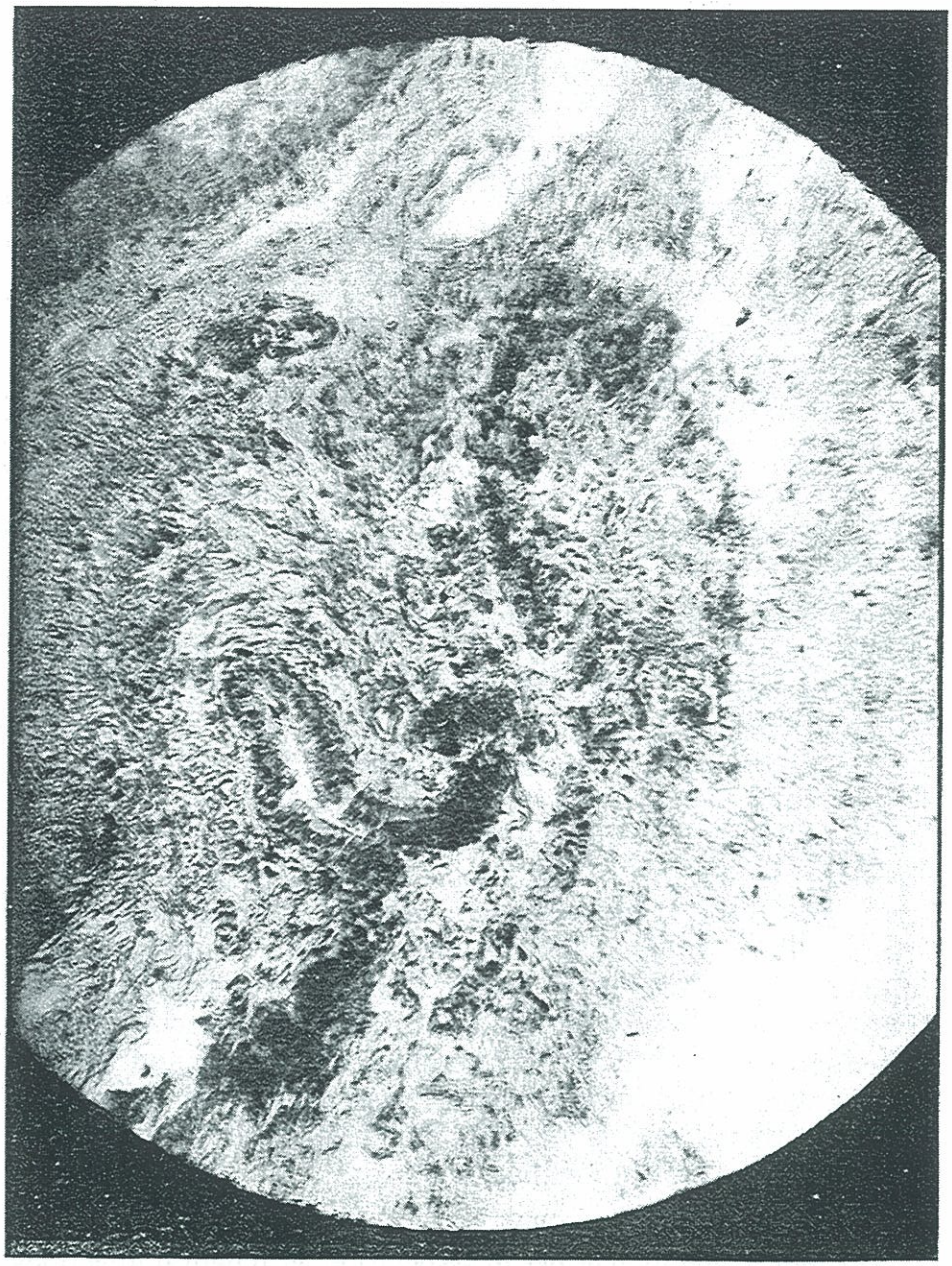


FIGURE 461. SECTION OF SUBLINGUAL GLAND OF CASE NO. 1185, SUFFERING FROM XEROSTOMIA. SHOWS A DEGENERATIVE LOBULE WITH FIBROSIS.

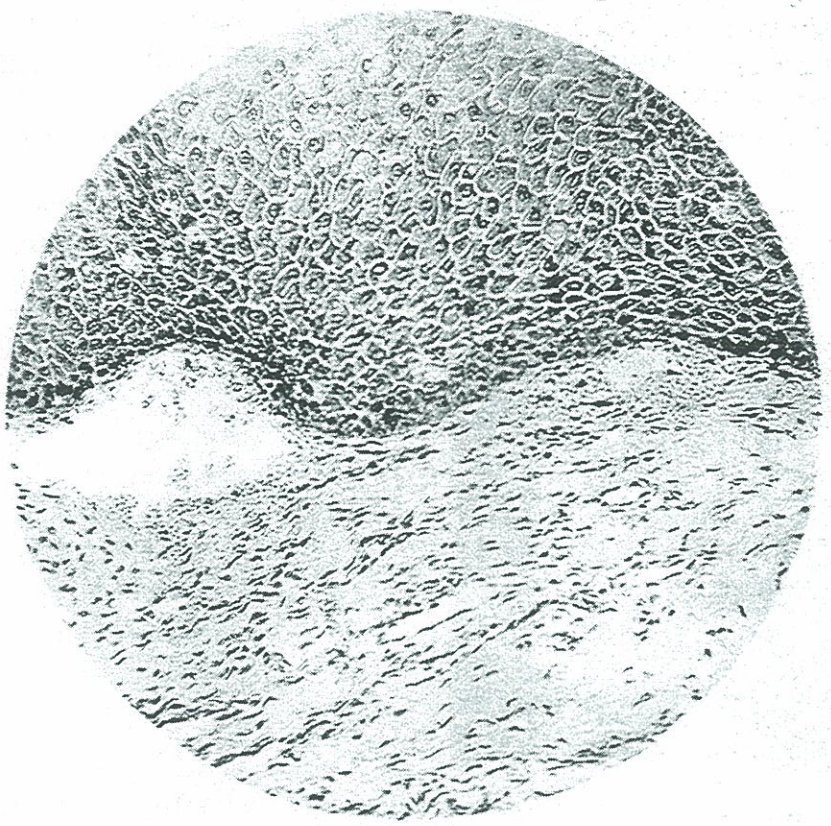


FIGURE 462. ORAL HERPES. AN ACUTE STREPTOCOCCAL ABSCESS BENEATH THE EPITHELIAL LAYER OF THE MUCOUS MEMBRANE.

immediately beneath the epithelial layer of the mucous membrane. A cross section of one of these is shown in Figure 462.

DENTAL CYSTS.

Probably no single dental lesion presents more obscure and at the same time serious systemic involvements than do dental cysts. It is probably because of the subtleness of the involvements that they are so generally overlooked except as they are accidentally found in general roentgenographic procedure. As an illustration of the extreme severity of the symptoms that they may produce, I present the following case. I was called at night to see a boy of about fifteen years of age, who had so acute a heart involvement that his pulse was running at 160, with very marked dyspnea, and conditions getting so progressively worse that I was called in consultation with his physician who was unable to find a contributing factor that could account for the extreme involvement.

An examination of his mouth disclosed that a deciduous cuspid had been retained and gave a history of complete freedom from local inflammatory processes. Over the position of the unerupted cuspid there was a tumor-like mass, entirely free from tenderness on pressure. A careful examination of the deciduous cuspid revealed that the pulp was non-vital. I decided that the tumor-like mass was a cyst and, accordingly, under a local anæsthetic perforated its bony wall and evacuated a quantity of cloudy cyst fluid not at all purulent. Later a roentgenogram was made of this

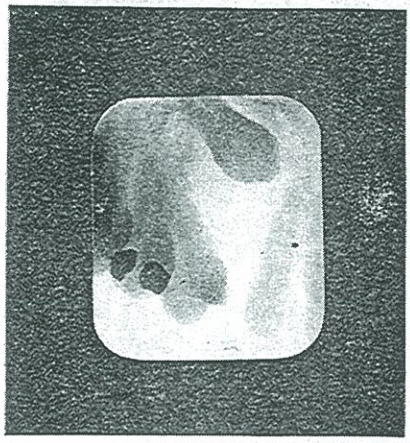


FIGURE 463. A DENTAL CYST WHICH PRODUCED A VERY ACUTE HEART INVOLVEMENT IN A BOY OF FIFTEEN. PULSE RATE DROPPED FROM 160 TO 80 IN A FEW HOURS AFTER EVACUATION OF CYST, WITH RAPID AND COMPLETE RECOVERY.

condition, which is shown in Figure 463, with the cyst chamber surrounding the crown of the permanent cuspid. In a few hours' time this boy's heart rate was down to approximately half its rate for the twenty-four hours preceding this evacuation; and, though it was taken several times in the next few days, was never found above 90. That this cyst fluid contained, and was elaborating a toxic substance which had an elective localization for irritating his heart is very strongly suggested by his and several other cases. This boy has two brothers, both of whom have had heart involvement. His father died of heart involvement, and the evidence indicates that he has a predisposition, therefore, for sensitization affects or irritation of that tissue.

Sometimes the cyst elaborates a substance which produces an effect on an individual very similar to that of cerebral hemorrhage. Such a case is the following: This patient, at seventy-five, was brought by a physician with the statement that one foot was in the grave and that I must be very careful. His life had nearly passed out several times with an affection similar to a stroke. This affection would sometimes have a motor expression

only, as, for example, on one occasion when he went to walk toward the door, he involuntarily would turn to the right, a direction he did not wish to go and keep on walking, resulting in a circular movement. This would happen sometimes in the house and sometimes in the street. At times his speech would be thickened for a few hours. His blood pressure would vary from very high to very low in a short period of time.

A most important and significant incident happened in connection with the care of his case. A local anæsthesia was used for the drainage of this very large cyst, which had its origin beneath the lower left bicuspid and extended from the molar region on the left to the cuspid on the right, with the denudation of the roots and the devitalization of all the intervening teeth. Prior to his being brought to me, he had had an involvement which had kept him in bed for a day, similar to a stroke, involving his entire left side, including his speech. The operation, which I used for the drainage of this cyst, involved a liberal opening which uncovered the inferior dental nerve and blood vessels passing through the floor of the cyst; and in order that these might not be destroyed, the procedure involved the extending of the mucous membrane of the mouth to include the entire cyst chamber and thereby displace the pathologic membrane lining that orifice, sections of which are shown in the discussion of the next case. The chamber was, accordingly, packed lightly, while under the anæsthesia, to protect the sensitive structures. When this packing was removed on the following day, the reaction on the patient was to bring on instantly all the symptoms of a cerebral hemiplegia, which involved all of the motor control of his left side, including his speech. This paralysis was so complete that his foot and arm hung lifeless by his side. This paralysis lasted several hours.

A most remarkable factor in connection with these cysts is that mechanism of the progressive absorption in advance of the pyogenic cyst membrane. In this instance, as I have stated, all the teeth from the lower left bicuspid, about the apex of which the cyst started, to the lower right cuspid, had their apices denuded and were, accordingly, devitalized. Photographs of them are shown in Figure 464.

Two things are important in this case. The first is that the heart block and disturbances of arterial tension quite completely disappeared. Another is that notwithstanding this man's far

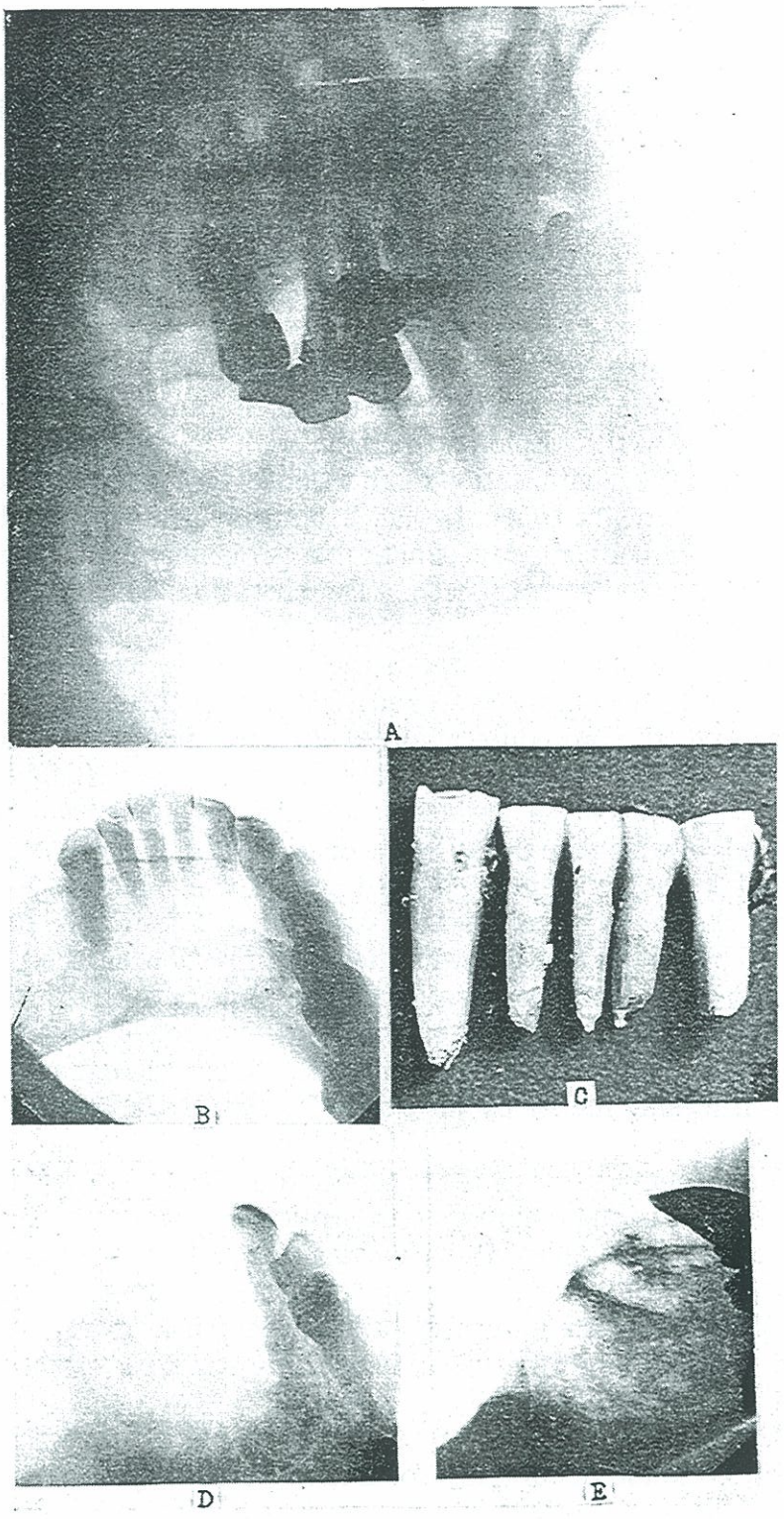


FIGURE 464. A DENTAL CYST WHICH STARTED WITH THE LEFT MANDIBULAR BICUSPIDS AND EXTENDED TO THE RIGHT CUSPID, SHOWN IN A AND B. C SHOWS THE ABSORBED ROOT APICES OF THE LOWER INCISORS AND LEFT CUSPID. PATIENT, SUFFERING FROM HEART BLOCK AND SYMPTOMS OF STROKE, HAD A REMARKABLE RECOVERY.

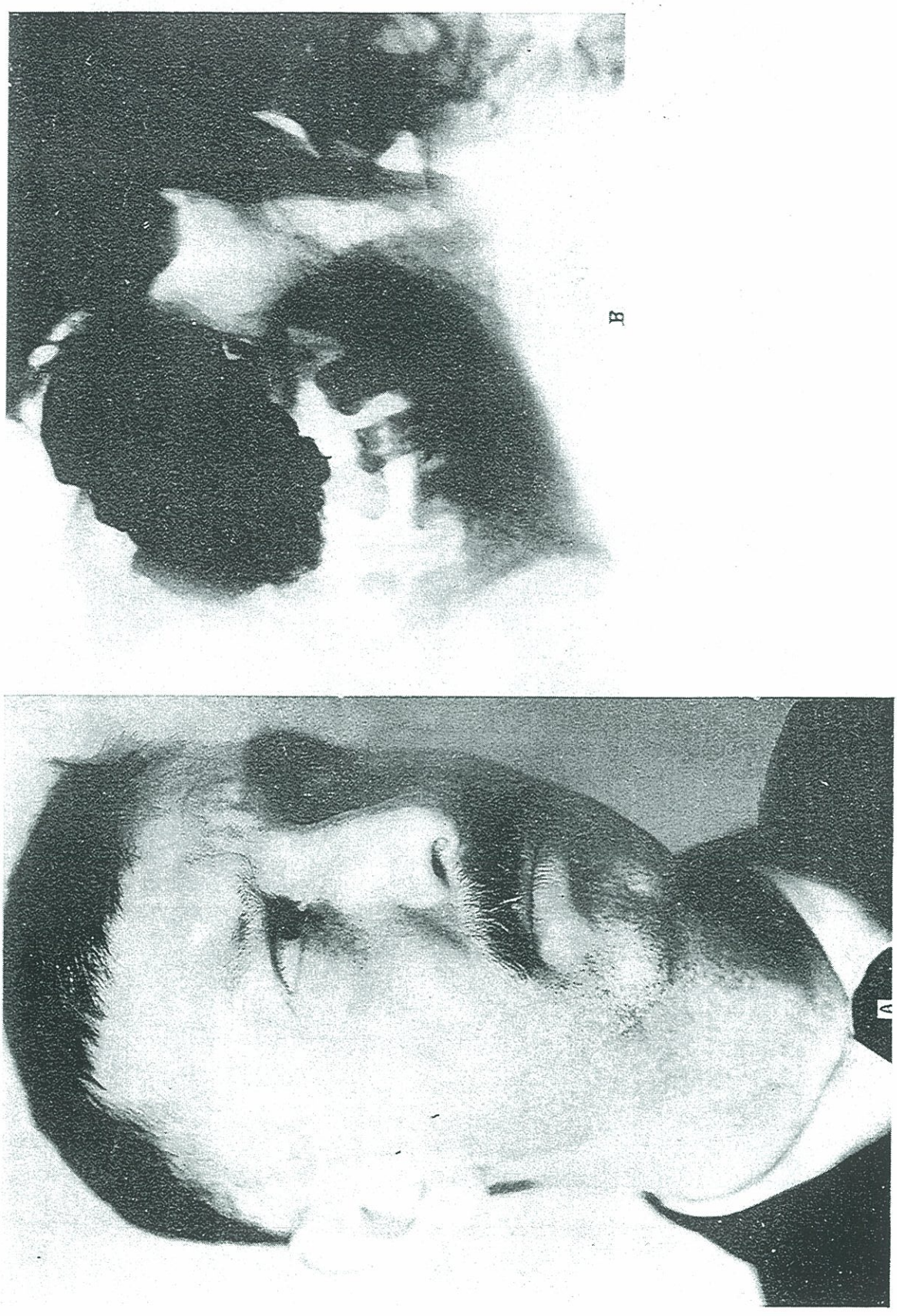


FIGURE 465. A, HUGE CYST BULGING THE CHEEK AND EYE. B, ROENTGENOGRAM OF ENORMOUS CYST CHAMBER FILLED WITH OPAQUE. THE MAXILLARY SINUS HAD BEEN ENTIRELY OBLITERATED.

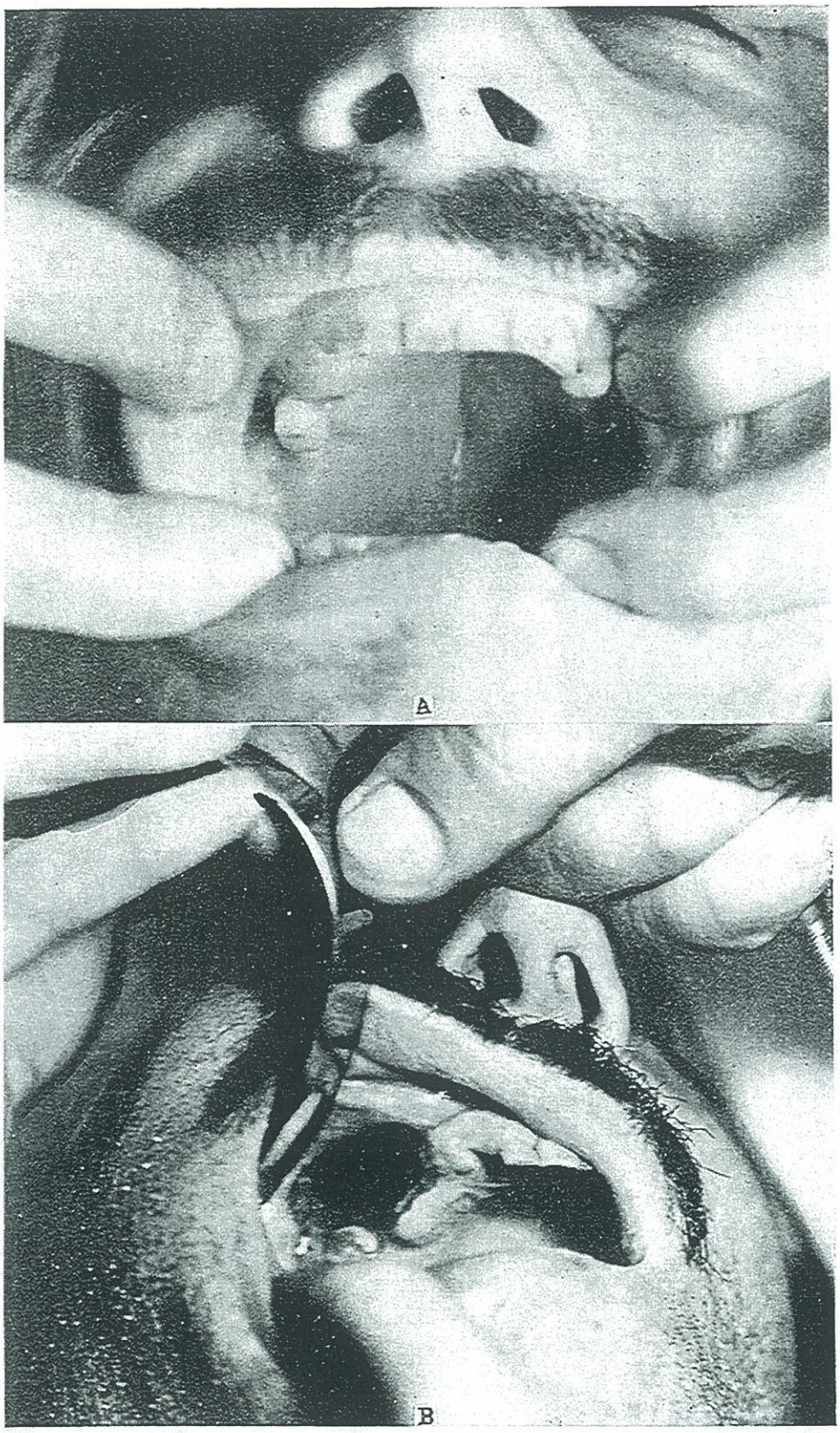


FIGURE 466. ORAL APPEARANCE OF CYST SHOWN IN A. B, ENTRANCE MADE TO THE CYST IN THE ORAL CAVITY. CASE NO. 1098.

advanced age, in a few weeks' time he was able to walk five to ten miles without tiring, and for about three years has had most remarkably good health.

In another chapter, Figure 390, Chapter 65, I have shown a third molar that was pushed from its normal position nearly to the base of the condyloid process. This process of pressure may produce an extreme distortion of tissue, even to the extent of very serious facial deformity. Such a case is shown in Figures 465 and 466. This man, age forty-two, had a dental cyst developed to the enormous size shown in Figure 465-B, which is a roentgenogram, reduced size, of the cyst chamber temporarily packed with an opaque gauze. This chamber developed, pushing its walls in all directions until the maxillary sinus was entirely obliterated, the right naris was nearly obliterated, the eye was bulged, and the floor of the orbit pushed upward. The cyst extended mesially to the eye, up about two centimeters higher than the floor of the orbit. A digestive disturbance was an important factor in this case.

A section of the cyst membrane and bone adjoining it, is shown in Figure 467-C; and it will be seen that the osseous structure is being torn down by the osteoclastic cells as the hydrostatic osmotic pressure pushes the pathogenic membrane closely against the tissue and reëstablishes, continually, the pressure reaction which on the outer surface of this membrane results in the taking down of bone. The content of this and similar cysts is shown in Case No. 978 in the chapter on Skeletal and Muscular System.

In all these cases it is necessary to maintain a free opening into these chambers for sufficient time to permit the mucous membrane of the mouth to extend to all parts of the cyst chamber and make the new chamber a part of the oral or some other natural cavity, at least for a considerable period of time. Both because of the great size of this cyst, which made the surgical development of a connection with the oral cavity very simple, and because of the necessity for maintaining this opening and at the same time preventing the passing of food into this chamber, the dental restoration that was made carried a huge plumper which passed up into the face nearly to the eye, into the zone formerly occupied by the maxillary sinus and now a part of this cyst chamber. Results have been exceedingly gratifying, if not ideal. The external facial deformity has rapidly disappeared, for his cheek was badly bulged and the eye displaced, as shown in the photograph. The

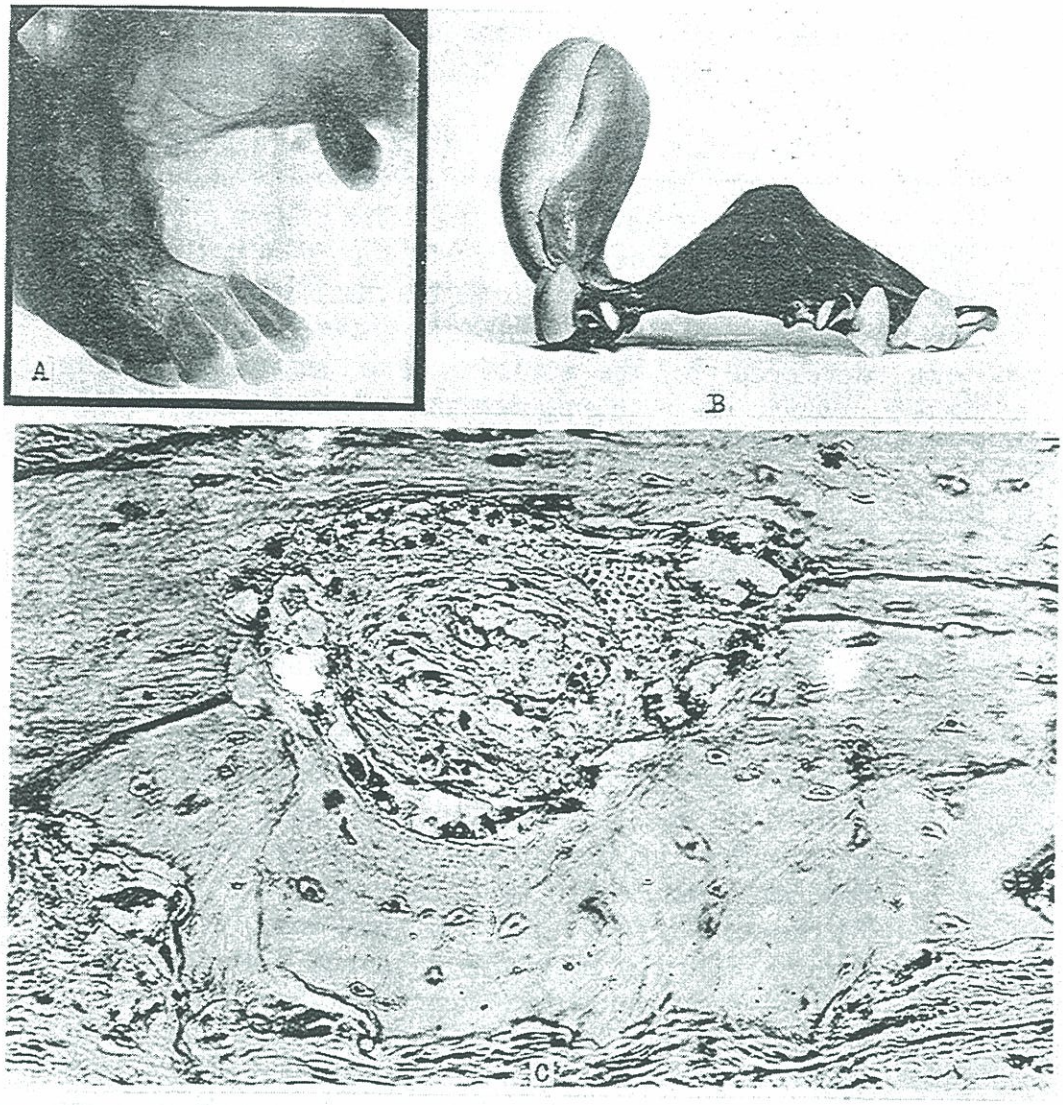


FIGURE 467. A, A ROENTGENOGRAPHIC VIEW; B, ARTIFICIAL DENTURE AND SPLINT TO SUPPORT THE DESTROYED CHEEK BONE AND PERMIT ORAL MUCOUS MEMBRANE TO EXTEND AND DISPLACE ALL CYST TISSUES. RESULTS EXCELLENT. C, SECTION OF BONE ADJOINING ADVANCING CYST. NOTE THE ACTIVE OSTEOCLASTIC PROCESS. CASE NO. 1098.

cyst chamber has slowly reduced in size and he wears this restoration with complete comfort and masticating efficiency.

A phase of this case is of particular importance. I have been advised that arrangements had been contemplated for a major operation, entering this zone from the external surface to remove a malignant tumor. Our method of study in this case, as in many of these cases where there is any doubt regarding the content, is to make a microscopic examination of aspirated material,

which in this case readily revealed the nature of the cyst. When cholesterol accumulates in these cysts to a concentration in which the osmotic pressure is greater than the osmotic pressure of the lymphatic circulation and of the blood stream, there is a flow of serous fluid to this salt of higher concentration in the pathological fluid than in the blood fluids. The membrane lining the cavity takes on a state of semipermeability, allowing the serous fluid to pass readily into this chamber, but not allowing the cholesterol to pass out. There is, in consequence, an ever enlarging chamber, which, by its own hydrostatic pressure, pushes back all flexible tissues, and by pressure on hard tissues accomplishes their absorption. It is a force analagous to that which makes plants grow.

The history of this case shows that four years prior to his being brought to me he had suffered a toothache on the right side of his face and had presented for treatment for same, a part of which included the placing of a bridge on the affected root. The symptoms reported indicated that he had suffered from an abscessed root. The evidence available seems to demand the general recognition of the fact, that teeth, and particularly roots of teeth, with an involvement for sufficient length of time for the peridental membrane to be destroyed at the apex of the tooth, will produce a condition which will in most instances constitute a potential factor of danger in that there is no evidence available that the cementum, when once denuded and devitalized, will ever again permit of the normal attachment of tissue; nor is there evidence that such tissue, even though it may be sterilized, which is questionable, can be retained in a sterile condition. Cyst material taken from this patient and inoculated into rabbits, produced the serious heart involvement of the rabbit shown in Figure 468. The patient complained of a marked lassitude, which symptom quite completely disappeared with the drainage of the cyst.

But dental cysts seem also to produce toxic substances which have a marked affinity for nerve tissues, and whether or not gravity is a chief factor, it seems probable that it is a contributing one since the cervical nerves are more readily involved with toxic invasion than those of any other part of the body. A most logical route for the toxic material developing under pressure from dental abscesses or dental cysts will be through the lymphatics draining that area, and these have a very wide anastomosis into the neck and thoracic cavity. A striking illustration of this will

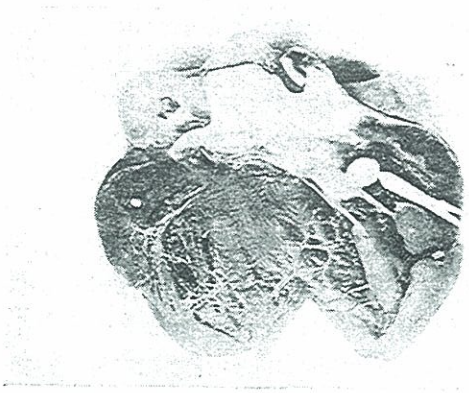


FIGURE 468. HEART OF A RABBIT WITH ENDOCARDITIS PRODUCED BY THE INOCULATION OF CULTURE FROM CASE No. 1098.

be found in Case No. 978. Photographs of this patient's lesion are shown in Figure 367, Chapter 64, on Skeletal and Muscular System. The cyst in that case was in the maxilla. The most striking feature of it was that a lesion, which had dominated and greatly diminished the efficiency of this individual for many months, was greatly relieved within five hours after the draining of the cyst. It is also important that these symptoms returned at one time during which he failed to maintain drainage when the artificial substitute, which was closely adapted to keep food from getting to the chamber, was left in position for several days, the result of which was the development in the chamber of the characteristic cyst fluid, with a concentration of cholesterol and other substances, and which symptoms rapidly disappeared again with the complete irrigation and reëstablishment of the proper treatment. The inoculation of a rabbit with the material contained in this cyst produced an acute involvement with the spasmodic contraction of the hind leg, which is shown in Figure 367.

In the chapter on Digestive Tract Disturbance, I have discussed a case of extensive cyst, to which I have just referred, in which the third molar was pushed backward and upward (See Figure 390). In that case the patient was suffering from a very acute digestive tract disturbance. The significance, then, in that case was that the patient had a colitis with evacuations on an average of every thirty minutes. Rabbits inoculated with the content of the cyst of that patient developed acute diarrhea in about forty minutes, and several of them developed very severe colitis, and, on posting, had extreme distention of the colon with typical spastic colitis.

APICOECTOMY.

It will not be possible to cover all of the involved phases of dental practice in this general analysis of the fundamentals of oral and clinical dental pathology. It is, however, important to emphasize again the type of individuals for whom certain operations should be considered more favorable than for others. It is not necessary for me to review here why individuals, with a broken defense or who by inheritance have never had a normal defense for streptococcal infection, should not have produced in their bodies conditions which can furnish the type of organism which even in small quantities may bring upon them their most to be feared disaster: namely, a streptococcal involvement of an essential organ or tissue. These individuals should in my judgment have all questionable teeth removed, by which I mean teeth that modern science cannot demonstrate not only the capacity of the operator with certainty to make them free from infection, but the capacity of the patient carrying them to maintain them in a sterile condition, assuming they have been made so; in other words, individuals with any of the following—a serious heart, kidney, or central nervous system involvement—not only should not have root-filled teeth left in their mouths, but should not have involved pulp chambers of teeth of such individuals root-filled. I am presenting this as my best judgment and I will ask those, who with perhaps a great deal of enthusiasm challenge my position, to measure carefully whether they have as good a basis for judgment in dental pathology as I am presenting in these volumes. If so, I would greatly desire that they will put me in touch with the data.

Nor is it my judgment that individuals with these serious handicaps of broken or absent defense should have the operation of apicoectomy with the expectation that these teeth will be safe. In the thousands of teeth that we have cultured from various individuals, a very large number of which were from individuals of this group, we have not found one in one thousand from the inner structure of which we could not grow streptococci. The

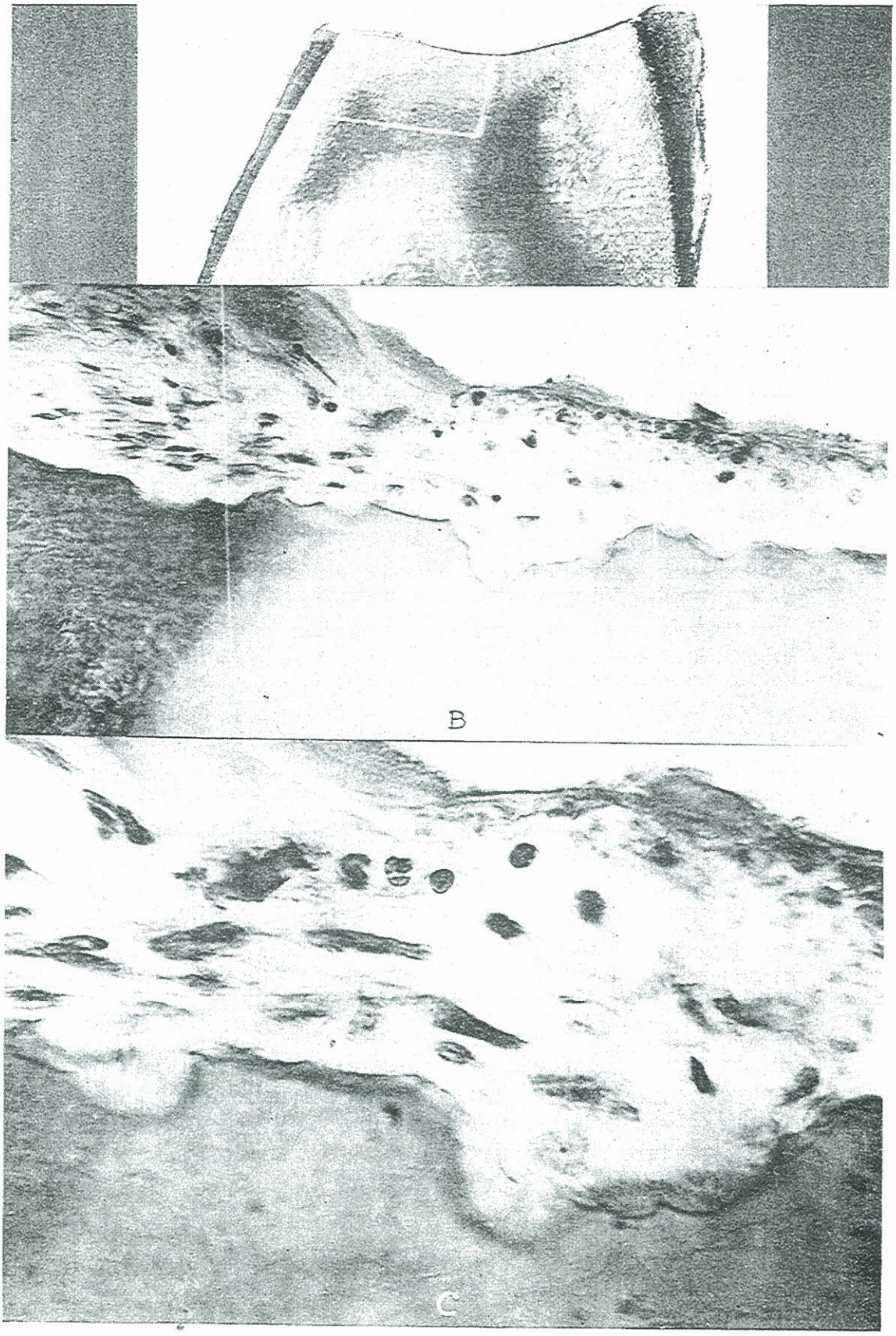


FIGURE 469. REACTIONS ON A RESECTED TOOTH: A, LOW POWER VIEW OF STUMP; B, ABSORPTIVE MEMBRANE, MEDIUM POWER; C, OSTEOCLASTIC ACTIVITY ABSORBING TOOTH.

problem, therefore, is not solved by placing a root-filling and taking off the apex. If, however, root resections are to be made with the expectation that they will conserve a very valuable tooth and therefore render an important helpful service, they should be made for those individuals with a high defense; and for those who are in a mood to resist or react against the sentiments I am expressing, I will ask them to turn quietly to Chapter 64 of the second volume or Chapter 41 of the first volume, and note the difference in the bactericidal properties of bloods of individuals of these two groups. These people only look alike because of our inability to see what they look like; and in no department of dentistry is a new truth so truly a new sense as in this matter of being able to see people more nearly as they are, than we have been accustomed to do when we used as our glasses comfort and serviceability as the evidences of efficiency and defense, and freedom from infection. With this new sense, these have little or no weight when compared with the bactericidal capacity of the blood, etc.

There is, therefore, an exceedingly great difference in the reaction that will be made by different individuals about either an infected root or an infected root apex. Individuals of one group make almost no effort and show by the results almost no capacity for neutralizing the toxic products, whereas those of the group of high defense may show a very great effort to get rid of and neutralize the toxic irritant. This will be illustrated in Figure 469, which shows three views of a root apex under different magnifications, demonstrating the activity of the host in trying to remove the infected root. A shows a cross section of a tooth from which the tip had been resected some months previously. The light line in A shows the zone removed for sectioning in B. In B it will be seen that a membrane has been formed over the excised surface which is showing a marked activity in absorbing the root, which to the host has become a sequestrum, for whether we are ready to acknowledge it or not, the dentin at least of every pulpless tooth is a sequestrum and often an infected sequestrum, but different from an ordinary sequestrum in that it is surrounded in part or in whole by vital cementum, which latter is surrounded by vital supporting tissue. Unfortunately it seldom, if ever, is true that it is surrounded in whole by vital cementum. Since the foramen or foramina become port holes of exit for toxins, and usually for bacteria, even though the dentino-cemental border

may be impervious to one or both. In C, which is a higher magnification, we see the osteoclasts actively engaged in the process of taking down the tooth structure to remove this tooth.

The type of individual that produces this type of reaction is carrying the fight right up to the point of contact and is closing in upon and making smaller the boundaries of that contact by tearing down the foreign process. In individuals of the groups with lower defense, we do not get this type of reaction. The fight is not carried up to the tooth, for little, if any, fight goes on immediately surrounding the tooth but must ultimately be waged far afield from this (the proper) battleground in the various organs and tissues of that individual's body. Nor does the presence of such an active process guarantee that this patient will always be safe from injury from this type of involvement. It is very probable that this type of reaction will mean for the individual who can make it, a tender tooth, as it did in this case. Comfort is not a measure of safety or assurance of success. It may mean just the opposite.

THE REPAIR OF DENTIN AND CEMENTUM.

Of all the structures of the body the teeth have the poorest capacity for repair. So far as I know there are no acceptable data demonstrating that a cavity of caries in enamel and dentin has actually been filled in by a normal tooth structure. I have seen cases where this was alleged to have transpired but I think they were mistaken. The very nature of these structures and of their formative processes precludes a reparative process except in vital tissue, and carious enamel and dentin cannot be considered to be vital. When, however, an injury happens to vital dentin and cementum, a reparative prccess may occur. This most frequently occurs at the pulpal surface of dentin, due to peripheral irritation, and produces a secondary deposit of dentin within the pulp chamber, which may very efficiently protect the pulp tissue from the disturbing irritant. When irritation disturbs the cementoblasts, they too may throw down a deposition of cementum, structurally quite similar to the normal. In the chapter on Skeletal and Muscular System in the discussion of Osteomalacia, I have illustrated different types of reaction in bone in patients of different groups. The process of building up and taking down cementum is dependent upon physical forces and may be physiologic or pathologic in accordance with contributing factors. In the treatment of periodontoclasia it will be a matter of exceeding great value if, in addition to checking the progressive destruction of the supporting tissues, they can be made to rebuild. I have demonstrated to my complete satisfaction that this process can occur, though I am convinced that the conditions necessary for it to take place extensively can be secured only relatively rarely.

In the case of a fracture through a vital tooth root, if the pulp tissue remains in situ, the dentin of the root may remain vital, the peridental membrane may fall over the fractured dentin and may build up on the root an osteoid structure. Such a case is shown in Figure 470, in which A shows the roentgenographic appearance of a long imbedded mandibular third molar root. B

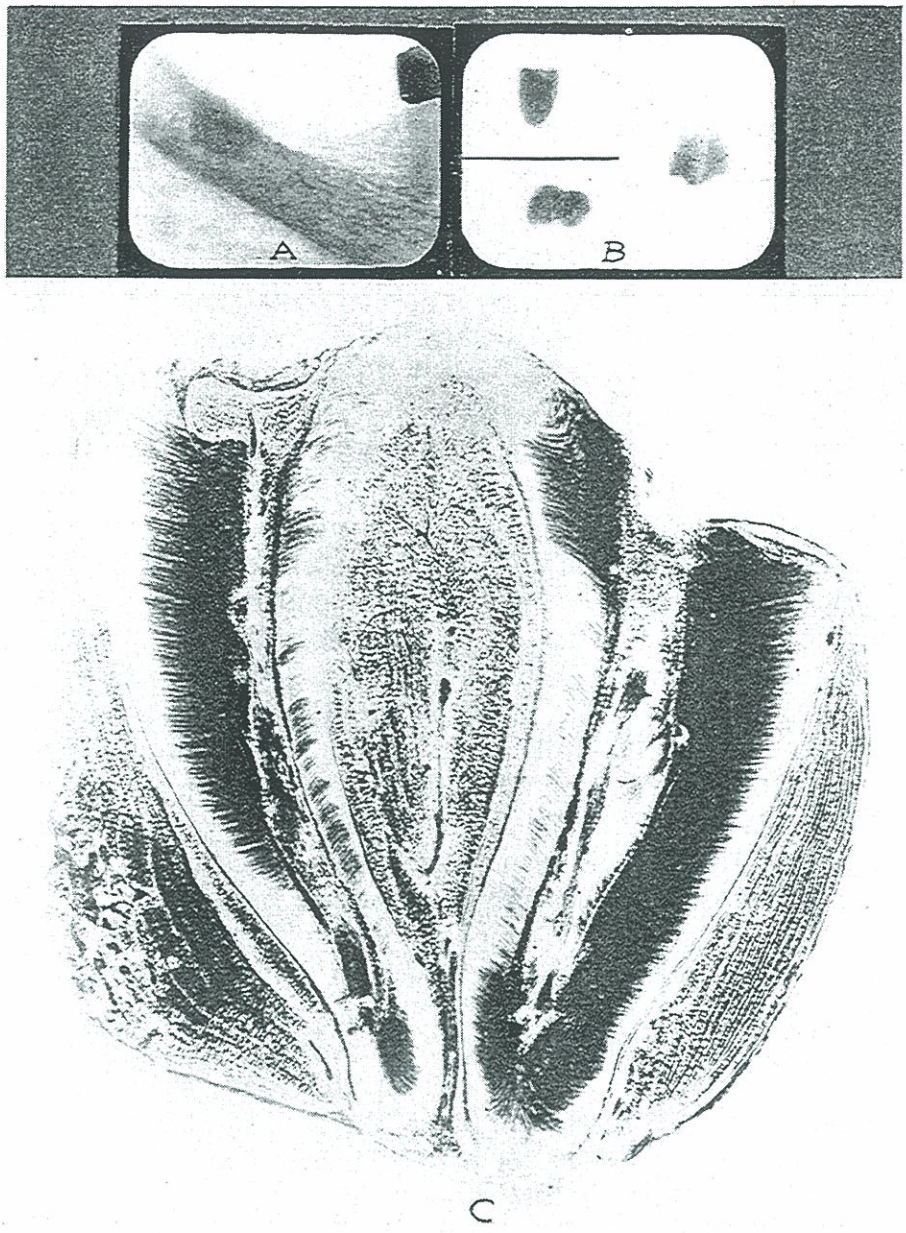


FIGURE 470. AN APPARENT REPAIR OF DENTIN OF AN OVERGROWN THIRD MOLAR ROOT LEFT BY A PREVIOUS EXTRACTION: A, ROENTGENOGRAPHIC APPEARANCE OF ROOT IN MANDIBLE; B, ROENTGENOGRAPHIC APPEARANCE OF IMBEDDED ROOT; C, SECTION THROUGH MESIAL AND BUCCAL ROOTS.

shows the roentgenograms of the root when surgically removed, and C a mesiodistal section through the two roots. It will be noted that there has been considerable excementosis by a process of successive laminations, greatly increasing the size of the root. The pulp chambers were filled in with an osteoid bone, and where the peridental membrane fell over the freshly fractured dentin, it has built a structure, very similar to cementum, onto the dentin. Higher powers of these different structures are shown in Figure 471, in which in A there will be seen the lumen for a blood vessel passing through the osteoid structure, which has displaced the pulp tissue of the mesial root. Note the lamination of this osteoid structure. B shows a higher magnification of the distal root, and the osteoid cementum can be seen in direct apposition with the fractured surfaces of the dentinal tubuli. D shows a higher magnification of B, and C a higher magnification of A.

It is not probable that this process can so readily obtain on dentin which is not potentially vital. In Volume One I have shown in many places, illustrations of an osteoid structure built into the dentin following an absorption process. It would be highly desirable if some such reparative process could be induced to develop about apical areas that have been rendered free from irritation products. Whether or not remote instances of this can be presented, it will make little difference to the clinical fact that the percentage of cases where it occurs is exceedingly small. There is, however, a structural approximation which takes place about excised root ends, which suggests either a very small amount of irritating material from the root end or, as is very frequently the case, a very low capacity for reaction to such irritant as does obtain in that tissue. This type of reaction is also ideal in periodontoclasia pockets.

In thirty years of very critical search for illustrations of such a process, the instances where I have been satisfied that it had actually occurred to any considerable extent are few. The following is an illustration. The patient, a young man, Case No. 935, was suffering from an exceptionally acute gingival inflammatory process with pocket formation. As a matter of experiment I used a burr beside the palatal root of an upper molar, thoroughly to curette the surface of the tooth and the alveolar bone adjoining, to and including healthy tissue. The case was watched carefully and there seemed to be quite perfect reattachment of tissues to the root surface. The tooth was

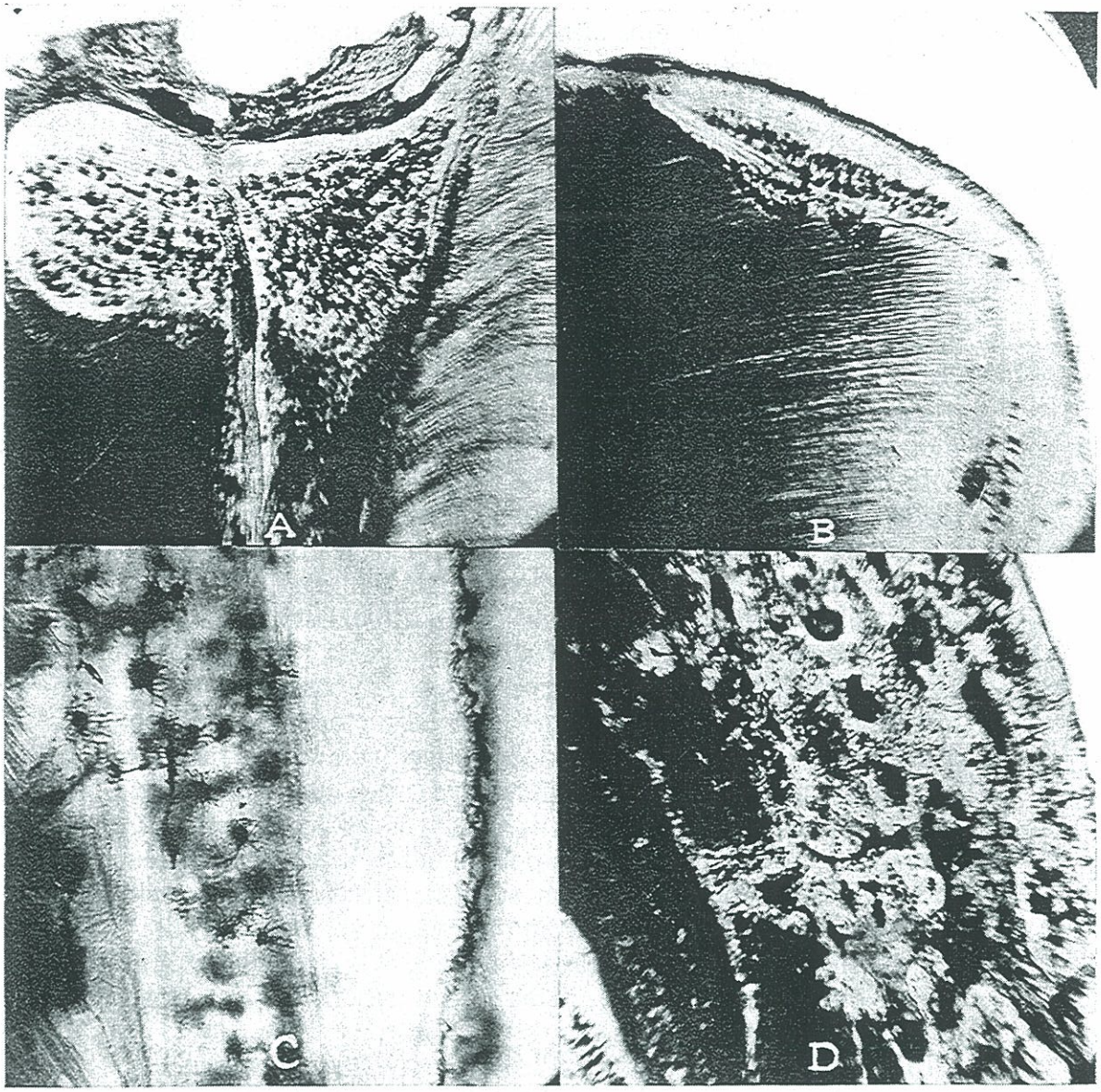


FIGURE 471. HIGHER POWER OF AREAS OF FIGURE 470. A SHOWS FILLING IN OF THE PULP CHAMBER WITH AN OSTEOID BONE THROUGH WHICH A BLOOD VESSEL WAS PASSING; B, AN OSTEOID BONE BUILT UPON THE FRACTURED SURFACE OF DENTIN, OVER WHICH IS A LAYER OF CEMENTUM; C, A HIGH POWER OF THE OSTEOID BONE OF A; AND D, A HIGH POWER OF THE OSTEOID BONE OF B.

carried for years with but little return of the periodontoclasia about it or in other parts of the mouth, part of the reason for which was a program of prophylaxis in which the patient splendidly coöperated. By a fortunate circumstance I was later able to secure this tooth and the attached alveolar bone. I persuaded the patient that he owed it to science to make a provision in his will so that that specimen would be preserved for proper study. He suggested that since the circumstances of his death were so uncertain I had better take it while I could control the conditions of its preservation and sectioning and urged that I do so, which I did. In cross section, the burr marks on the cementum could be seen and had been filled in with an osteoid structure so closely adapted to the tooth as to be apparently perfectly fused. This cementum was apparently vital at the time of the operation and in this particular was probably a quite exceptionally favorable condition.

CHAPTER LXX.

GENERAL DISCUSSION.

INTRODUCTION

In Part One, Chapters 1 to 45, I have outlined in detail a series of researches and presented data developed therefrom. These have dealt with fundamental problems underlying diagnosis, prognosis, and treatment of local and systemic dental infections. In Chapters 45 to 56, I have analyzed the various data and from them have made interpretations on which I have suggested a new basis for dental diagnosis, prognosis, and treatment. In Part Two, Chapters 57 to 70, I have presented a large series of typical cases, illustrating the application of these principles of interpretation and methods of application, together with special researches on both the patients involved and on animals with cultures and tissues taken therefrom. These latter researches on the patients have thrown a flood of new light upon the whole problem of dental pathology when studied in the light of these new interpretations. We have seen from the experimental data that the strain of organism involved is a very secondary matter to the environment in which it is growing: namely, the host who furnishes the soil for it; and this host is an extremely variable quantity when one individual is compared with the majority, while each one except under overload tends to maintain his or her own general characteristics. The elements of chance are almost entirely removed from the problem.

The bacteria, we have found, have the remarkable ability of adapting themselves to changes of environment through exceedingly wide ranges so that they will ultimately grow and flourish in a medium that at first would entirely inhibit their growth, if not kill them. It is an extremely important matter that streptococci can so accommodate themselves to such extremely toxic substances as formaldehyde, iodoform, phenol, alcohol, etc., for this completely changes our problem of rendering a tooth so toxic to them that they not only cannot take up and maintain a residence in it at the time of its treatment but that they shall not be able to take up residence in it again during the rest of the lifetime of that

tooth. We not only have now the problem that bacteria have been killed off in the tooth but that they may be able to take up residence in it again by becoming accustomed to an environment which at first was intolerable. It is for this reason that we find organisms growing in teeth, previously treated with iodoform, which still is present in sufficient quantities to be distinctly and even abundantly present by its odor, when they are opened years afterward.

We have also seen that with varying changes of oxygen tension, hydrogen ion concentration, the type characteristics of the organisms may be completely changed. We find we are dealing with forces that are very changeable and with units of life that are the sum total of these changing forces in terms of their reaction to them. In other words, we are dealing with problems of physics, physical chemistry, and biology, quite as distinctly as in quantitative chemistry or pure physics. The older methods of cut and try with the hope and expectation that, by chance, we shall stumble upon some drug or chemical that is specific for the condition at hand, gives little more hope of being the means of prognosis in the future than the past has so unhappily demonstrated it to be worthy of being. Nor are we justified in reading symptoms as evidences of either reactions or absence of reactions. It is not sufficient that a diabetic insists that he feels well; nor is it safe for the individual with a definite streptococcal susceptibility to carry the forces which will with mathematical certainty subtract from his already reduced factor of safety. The fact that he feels well does not prove that the corner stones of his health are not being slowly undermined by physiochemic processes which are drifting him, though unconsciously, toward a shorter life of health and usefulness. It is not so simple a matter as a bacterium skulking out of the corral about an infected tooth and taking up its residence in the far-away heart or kidney or nerve cell. It may be that, fundamentally, it is primarily a breaking down of the defensive mechanism by the pouring into the system, in ever so small quantities at first, of substances which destroy the efficiency not only of the defensive mechanisms but of fundamental nutritional processes.

It is no accident that there is a great variation in the type of local reaction about dental infections in different individuals. Nor is it a mere coincidence that different individuals of certain types and groups tend to have similar variations from the normal,

and that there are distinct and quite exact relationships between the local structural changes and physical expressions of focal infection. We begin to see some of the forces at work in the production of dental caries, of acute and chronic inflammations of the supporting structures of the teeth, the nature of chronic diseases of the organs and tissues of the body, and the role of heredity.

While there are doubtless many factors involved, regarding which we as yet know little, some others are becoming quite apparent. It is not an accident that, different elements which may be introduced, may produce the same symptoms, as, for example, a deficiency diet and a dental infection, such as a polyneuritis. Nor is it accidental or a mere coincidence that these two forces produce quite similar chemical changes in the blood or that physical overload will aggravate these very disturbances, particularly those which primarily disturb the very elements which are fundamental to the maintaining of the metabolic balance. Nor is it accidental that the same general laws obtain in the vegetable kingdom as in the animal. The gardner has learned to use ether and chloroform to put his plants to sleep, in order that he may hold them back without injuring their vitality, and allow his bloom or fruit to perfect on the very day that he shall desire. Nor is it an accident or a mere coincidence that just as plants cannot grow in a soil in which the ionic calcium is not available in a definite minimal amount and that the cells of our body cannot maintain their health except the ionic calcium of the body fluids does maintain a minimal balance. It is a truth that makes us stand aghast and more and more appalled as we realize our dependence upon the presence or absence of these simple elements. Have we realized that no civilization has ever been maintained on any soil that did not have either a limestone foundation or a water supply from such a foundation?

CHAPTER LXXI.

GENERAL SUMMARY.

INTRODUCTION.

If we would summarize the work of the preceding chapters and the suggestions presented, it would be somewhat as follows: Dental caries, deficient dental and osseous calcification, disturbed metabolism, and deficiency diseases are, fundamentally, expressions of a disturbed physical chemistry of the system. Some of the forces involved are enzymatic, some physical, and some quite purely chemical; and it is probable that when we have come to understand these, we will understand life itself, for disturbed life is but slightly different from the normal. This suggests, if it does not illustrate, how extremely involved the problems of defense and susceptibility are. We do not presume even to suggest what the final answers to these questions will be. We do find, however, in the data from these studies, suggestions as to the probable course that should be taken for future explorations. From the information available to date I would give as the most probable explanation for the various phenomena herewith presented the following:

Growth and health of the hard and soft tissues of the body are dependent upon the maintenance of definite concentrations among other substances of calcium in ionic form. The difference between the minimal and the maximal for health is small, and these limits are close to the optimal. Just as the range of variation from an isotonic sodium chloride solution is very small for it to become hyper- or hypo-tonic to cell tissues, just so the calcium in ionic form must have a very exact concentration; and this does not mean the total quantity of calcium to be found in either the blood, saliva, lymph, or tissue cells, but the amount of calcium in such a structural form as enables it to be available as an enzyme, both for the interchange of other chemicals and for contributing directly itself to life processes.

The total amount of calcium that is required to maintain the wear and tear of body function day by day is sufficiently great, frequently to tax the normal body when in environments where

foods are not available which have a ready supply of this element. Similarly, the calcium itself does not become available except in different ratios and proportions with phosphorus. Fundamentally, then, we are dependent upon bases of supply for these fundamentals as well as many others. But even the available calcium in the system becomes available only because of other substances, particularly the endocrine system, of which probably the parathyroids are the chief contributors. These endocrine glands doubtless are dependent upon the accessory food factors, such as Vitamins A, B, C, and D. The normal calcium of the blood of healthy individuals remains quite constant at about 10½ milligrams per hundred cc. of blood. In the normal blood in the blood vessels, approximately 6½ milligrams of this is always free in the ionic form and 4 milligrams in a combined form with normal constituents of the blood, but 10½ milligrams go into ionic form in the serum when the blood is entirely clotted, the total calcium being the same before and after that process. Forces which tend to destroy this normal calcium balance, destroy a fundamental of the environment of the various cells and tissues, and, thereby, destroy one of their most important factors of defense. Yet there are many forces which tend to disturb this balance, one of the simplest and most common of which is nutrition, both by the starvation of the individual for the very calcium itself and for those elements which, by their reaction upon the glands of internal secretion, establish and maintain the calcium metabolism.

Another force seems equally important: namely, the toxic substance developed by streptococcal infection, particularly in conditions of low oxygen tension and putrefactive tissue. We have shown that by the injection of this substance, bacteria-free, into animals, the ionic calcium has been immediately lowered and the pathologically combined calcium directly increased; also that the long continued tying up of part of the available calcium of the body fluids brings about chronic or diseased states; that these diseased states develop in the organs and tissues whose defense has been lowered either by trauma, starvation, physical or mental overload, or by heredity; and in case there has been no physical force to determine what tissue will break first, very often, if not generally, heredity answers the question; and hence we have in one family the kidney breaking first, in another the heart, in another the joints, etc.; and we call it "Heart disease running in

the family." And if to the toxic neutralization of partly available calcium, we shall add an excessive or undue overload of demand for calcium, such as pregnancy, we have enormously aggravated the pathological state; and if, perchance, the individual is not taking enough calcium to maintain even a normal calcium balance, let alone supply a large and new demand for the growing fetus, it then develops to be more than an embarrassment but a real tragedy to the system, for the neutralized calcium of the toxic element reduces the available to far below the minimum that is possible for the maintenance of health, and the defense is broken. A physiological strain becomes a pathological lesion.

Before we can know the full answer to this difficult problem of the role of calcium there are several additional things we must know, among them the following:

To what extent is the disturbed ionic calcium a primary condition, and to what a secondary expression or symptom? I have shown in the various experimental chapters that the same gross clinical symptom may be present in two different individuals and one of them have an abnormally high ionic calcium and the other have an abnormally low ionic calcium. For example, of all the cases that present to me for study of their rheumatism, probably nine out of ten have a low ionic calcium and one in ten an abnormally high ionic calcium. This proportion is not based on analysis of data and is only relatively correct, but for our purpose answers for an illustration. The symptoms, as presented by the patient, would under casual observation seem to be similar. Yet these groups represent two entirely different pathological states. The group with the low ionic calcium tends to have a proliferative type of arthritis; the other tends to have a degenerative type. Similarly, of the various patients presenting with pathological changes resulting from reactions from irritants and infections about teeth, some will have very marked diminution of bone, again a degenerative type of reaction, and others will have a marked condensation of bone, corresponding with the proliferative type; and in these two types the ionic calcium of the blood is low in the group with the proliferative calcification reaction, and is high in the group with the degenerative type of reaction. We, therefore, see that we have comparable conditions in these two pathological states, which we have used to illustrate divergencies, or what might be taken to be anomalies. They are not anomalies but are evidence of disturbance of entirely different

types of disturbances in calcium metabolism and general tissue reaction. It is evident, therefore, that it is not so simple a matter as the mere presence or absence of ionic calcium of the blood, but it has to do with factors which relate to fundamental processes in which calcium is a factor but only one of several.

I have shown that several other factors are variable quite parallel to that of the variation in ionic calcium. One of these is the alkalinity index and another the bactericidal property of the blood and leucocytes. If the maintenance of the alkali reserve of the blood or any fluids or tissues of the body comes to be dependent upon the utilization of calcium, the symptoms will be entirely different, as in practice we find them to be, from those which obtain if this abnormal demand does not exist. Hence in periodontoclasia we have a very extensive wastage of organized calcified tissue to maintain a large factor of defense as alkalinity of the bathing fluids. The cost of the maintenance of the defense of the host is paid for in calcium currency which is taken from alveolar bone. We do not know what all these abnormal demands are, but some of them seem clearly to be the neutralization of imperfectly oxidized acids which are not reduced to carbon dioxide and eliminated as gas, but are neutralized in the blood stream and tissues by calcium in the absence of cheaper bases. A perfect combustion will reduce all of the food taken into the blood to carbonic acid gas, urea, and water. Intermediate acids will, therefore, have to be neutralized and will be excreted largely through the kidneys where they may be identified. The mechanisms, by which the alkali reserve is maintained in the body, have not been disclosed. There is a strong suggestion, however, that the parathyroids play an important part in this mechanism as well as in the neutralization of the toxic products of bacterial invasion. We do not yet have tests to determine the efficiency of parathyroid function. The clinical data that I have herewith presented, however, seems abundantly to demonstrate that in many individuals the administration of small quantities of parathyroid for a few days greatly assists in reëstablishing a broken defense.

But these researches have thrown a very important new light on the nature of these pathological lesions which result as a systemic expression of a focal infection. They have demonstrated not only that various forces, such as heredity and overload, predispose and that the predisposition carries with it tissue specialization for localization, but also strongly suggest, if they

do not demonstrate, that after the bactericidins of the leucocytes are exhausted, defense itself for streptococcal infections is under certain conditions almost exclusively a local quality of the various fluids, tissues, and organs of the body; in other words, individual cells in the various organs and tissues make the fundamental last stage warfare against streptococcal infection in strong contrast, for example, with the antitoxin that is developed by the body for the general circulation as a defense against the toxin produced by the Löffler bacillus which produces diphtheria. There have been many clinical conditions to suggest that this was true before it was demonstrated, as, for example, organisms of the streptococcal group, which are biologically similar, produce a very wide range of systemic involvements, almost as wide as the assortment of organs and tissues of the body; and also by the local tissue reactions to stimulation, such as heat, massage, etc. We have, therefore, two factors which are paramount, if not the most important, in this combat between the organism and the host: First, *the almost unlimited power of adaptability on the part of the type of organism which develops in dental infections;* and, second, *the reacting capacity of the various tissues of the body.* One of our greatest difficulties in combating focal infections will therefore be the raising of the defensive mechanisms of local tissue cells in a host in whom they are by inheritance or acquirement depressed or absent. We see very little hope for changing the biologic characteristic of this organism to deprive it of its marvelous ability for adaptation. The two most hopeful methods are by more efficient vaccines and by the development of synthetic bactericidins.

CHAPTER LXXII.

GENERAL CONCLUSIONS.

INTRODUCTION

It is too early, because the information available is too limited, to make more than general conclusions, and these should be considered tentative until further data shall be available from as large a number of sources as possible.

Conclusions.

1. Dental infections are not local, oral problems.

2. Dental caries is primarily a local expression of a systemic condition in combination with abnormal local physical conditions.

3. Periodontal infections with periodontoclasia (pyorrhea, Riggs' disease) in the primary stages are fundamentally the expressions of a vigorous reaction to local irritation, combined with a systemic exaltation of the defensive mechanisms.

4. Calcium metabolism disturbances are fundamental factors in both dental caries and periodontal diseases, though dissimilar disturbances.

5. The absence or presence of susceptibility to systemic involvement from dental infections is fundamentally an inherent quality inherited as other unit characters are, or a matter of broken defense due to overload, or a combination of both.

6. Inherited susceptibility, or Mendelism, as applied to susceptibility of various organs and tissues, is a unit quality pertaining to individual organs and tissues independently of other organs and tissues.

7. Dental infections are fundamentally chiefly an expression of the biologic qualities of the host or culture medium rather than of the invading strain or organism.

8. The phenomena of tissue reaction is in many instances a true allergic reaction of antibody and antigen.

9. The so-called rheumatic group disturbances are in part symptoms of systemic sensitizations, an important factor in which is an inherited or an acquired calcium metabolism disturbance.

10. Calcium disturbances are themselves secondary to the acid-base and toxin neutralization governing mechanisms, one of which is parathyroid functioning.

These suggest as imperative, exhaustive researches on the following problems:

1. The fundamental factors involved in calcium metabolism.
2. The role of calcium and its physicochemic relations to dental caries.
3. The mechanisms of sensitizations of various types.
4. Determination of Nature's chief defensive factors for the neutralization of toxins.
5. Determination of the nature of the toxins developed in both apical and gingival infections.
6. The role of oral toxins in the development of tissue sensitizations.
7. Artificial substitutes for natural defense.

These will require hundreds of skilled workers with every convenience and assistance that can add to their efficiency, which will be discussed in the following chapter.

CHAPTER LXXIII.

RESEARCH INSTITUTES FOR DENTAL DISEASES.

Some great new biological facts have come to the knowledge of the best students of public health, which establish the conviction that a great many of the affections which we have looked upon as diseases are only symptoms (of which there are many), of a general systemic invasion by a strain of organisms residing protected in special tissues and against which the body is not capable of making a successful warfare which can culminate in their complete elimination. A distinguished scientist and world surgeon, stated in substance in my hearing recently that of the several hundred people in his audience it was his belief that, when they died, the final blow would be struck in nine out of ten cases by an organism which they would be carrying, at the time, as an apparently harmless invader so long as their resistance was high, but that it would wait its chance, and when their resistance was lowered sufficiently from any cause, it would strike and strike hard, perhaps not suddenly. He stated that he was figuring that the other ten per cent would die by accident.

What he was saying is the thing that we are seeing in various ways and do not recognize. For example, we do not realize, until we study the statistics, that in one in ten of all the funerals that go by, a life has gone out by premature failing of the heart, due to its being diseased. A very large number, though not quite so large, dies from kidney involvement; another large group from nervous system or lung complications produced by this same organism. It is estimated that more than ninety per cent of the heart involvements are produced by germs of the streptococcus group (diplo-streptococcus) which also produce nearly all of the rheumatic group lesions, including many of the kidney lesions and many of the fatal complications of nervous breakdown and pneumonia, also rheumatism, neuritis, appendicitis, gall-stones, etc. This is the germ that in more than ninety-nine per cent of cases is found in infected teeth, though other organisms may often accompany it; and it is the one, and usually the only one, found

in the lesions developed in animals by inoculating them with infections taken from the teeth. It is also estimated that in about ninety per cent of cases of streptococcal infection, it finds its entrance into the body from the teeth or tonsils; and of this ninety per cent, before six years of age, the tonsils play the most important part, but after six and eight years of age the teeth are the portal of entry in by far the largest proportion of cases.

Applying this, then, to the premature funerals that we see going to the cemetery from heart infection, the data available at this time seem clearly to establish that the teeth are by far the most important contributing factor. In other words, the available evidence today indicates that the *average* span of human life is shortened by years, because of the direct and indirect effects of dental disease; or stating it otherwise, if there were no dental diseases, the normal span of life for individuals in civilized communities would be many years more, than at present.

We have not said anything about the great scourges which make life less to be desired than death, such as acute inflammatory rheumatism and deforming arthritis which so often make their victims steadily turn into castings, bound in every joint, suffering in many and sometimes apparently in every nerve, and chained to a rack of torture, unable to feed themselves or do themselves either good or harm. Of this affection, Sir William Wilcox[6] has stated in a recent issue of a British Medical Journal (Jan. 13, 1923) that he agrees with Dr. Beddard that over ninety per cent of the cases of non-specific infective arthritis are due to infection arising from the teeth.

The progress of the past twenty-five years has brought about simply an awakening of a danger, but the great public is nearly as helpless as it has been in the presence of any of the plagues during the past centuries. Its members do not know where their danger is nor how to prevent it; nor can their guides, the members of the dental and medical professions, tell them, for the information is not available. So far as humanity is concerned, there are practically as many cases of periodontoclasia today as there ever were. This disease takes, as its toll, more teeth than most, if not all other dental diseases combined. It is not at all probable that one in a hundred of the citizens of the United States has either the information or the equipment to keep that disease under control; nor is it probable that one per cent of the dental profession could furnish the information and equipment adequate for so doing,

6 See bibliography

certainly not five per cent. There is, today, as much or more dental decay, and statistics seem to indicate very much more, than ever before in the history of the world. This can be judged by the indelible records written in the skeletons for of all the tissues of the body the teeth last the longest and the cavity of decay will be present relatively unchanged, regardless of the age of the skeleton.

And why is it that with the efficiency of modern social organization and the greatly advertised dental science that all this has not been, and cannot be corrected in a few months or years at the most? First, because the universally accepted fundamentals of dental diseases and their symptoms are based on fundamental misconceptions or half truths; and second, because the amount of effort that is being made is so small, when compared to the enormity of the task, that it will take many generations before humanity, even in far advanced and cultured communities, can be saved as a mass. The present generation of dentists cannot solve this question for they have neither the fundamental education to make them capable (and many have not even the disposition to acquire it) nor the facilities with which to correct their misinformation and establish the facts. Dental diseases are so related to the special dental anatomy, physiology, and pathology that these problems must be solved by individuals with special training in both of these broad fields. Neither the medical profession alone nor the dental profession alone can solve them. There is little more general knowledge about the causes of dental decay and the causes of periodontoclasia today than twenty-five years ago, and very little more then than twenty-five years before that. In other words, during the thirty years that I have been in active dental research, not five per cent of the necessary new information has been acquired. I recently asked a distinguished dental educator how long he thought it would take before the dental colleges would be teaching an adequate and safe program of prevention, and his estimate was forty years. The medical profession has been trying for fifty years to solve the problems of dental decay and mouth infections and has made exceedingly little progress. This work must be done by men with a very broad training in the minute clinical and structural pathology of dental disease as well as of general medicine and the biological sciences. It will take several centuries to accomplish the solution of these problems at the rate we are going under the present arrangement of having

the research work done at night by men who are exhausted from the efforts of the day to earn the bread and butter for themselves and their families, either in dental practice or in preparing lectures and teaching dental and medical students. This work must be done in institutions in which every function and detail is adapted to the fundamental requisite of research on dental diseases.

This has been a physical impossibility in the past because there have been no institutions in which these great problems could be adequately studied. For example, it is estimated that there are funds available today for general medical research, as endowment, aside from equipped laboratories, amounting to over $250,000,000; while there is not $1,000,000 available as endowment, according to recent evidence, for research on dental diseases, which is a problem that is second to none in all the interests of humanity.

It is because of a realization of these important facts that I have so earnestly endeavored to create a spirit of research and to organize an adequately endowed institution and by assisting in so far as I can in organizing its work on an efficient and permanent basis, and start a new order of progress which will go forward with as much dispatch as possible. I have no doubt that in my dental practice, single-handedly, I have added several hundreds of years to the sum total of the efficient and comfortable life of my patients, and I am only one of forty thousand practicing dentists. I am very sure that my efficiency is far short of what it can be and will be for the coming, better informed, efficient members of the dental profession.

Hence, who can estimate the value in years that may be added to the comfort and life of the individuals of the nation in coming generations? Nor is this all. Much of the dentistry of today not only is not intelligently removing from individuals those sources of available infection which the undisturbed decay and gingival infection have produced, but many of the operations of the so much heralded American Dental Science are establishing and retaining the very conditions, which if Nature were undisturbed she would more readily throw off, for in spite of the splendid service of the majority, modern dentistry frequently takes infected roots and with elaborate structures anchors them solidly to other teeth. In this way incalculable harm may be done by some of the legally practicing members of the dental

profession. For some of these it is gross ignorance; for some, we are sorry to say, it is indifference plus ambition to make money as fast and as easily as possible. My observation is that a considerable number of the members of the dental profession of today do not want to hear the message that condemns the teeth upon which they desire to make operations. It is necessary for this and for other reasons, including politics and jealousies and institutional ambitions and pride, that for the greatest efficiency the institutions that will do the most fearless and aggressive dental research will be independent to function in every way that will best accomplish the attainment of new truth.

They should have as a minimum an available annual income for prosecuting their researches of not less than $50,000, and preferably much more than that amount. The former would be equivalent to an endowment of $1,000,000 at five per cent. Buildings adequate for housing the work in an efficient manner that would be represented by an annual budget of $50,000 would probably cost $150,000 or more, if built, especially for the work of brick or stone. This would not include equipment which would cost approximately $50,000.

In addition to developing the new truths which underlie both correct living and adequately improved medical and dental methods of practice, there must be developed a new type of practitioner. He will be neither a physician nor a dentist, nor both in the sense that he will be a combination of the two as they exist today. The science and art involved in the interpretation of the profoundly obscure and involved relationships, which may exist between the local and the systemic expressions of dental disease, can only be provided by men who have had a special training, quite unlike that that can be furnished by any dental or medical schools of today.

These researches, which I have recorded in this book, illustrate splendidly how neither the medical nor the dental profession has been able with its training and equipment of the past to diagnose, prognose, and treat these most intricately involved pathological interrelationships; and while we have arrived at the point where we can see the necessity for this new type of practitioner, we could not develop him today in any institution, available for teaching, that now exists. There must be developed both a new foundation of combined special medical and dental science and new methods of application.

The progress that has been made in the researches reported in this volume has been accomplished, largely, by changing the method of approach to this whole problem. In the past, effort has been made, mostly, to solve fundamental problems, etc., by either one of two chief methods, namely, the clinical or the laboratory point of attack. If I have made progress, it is because I have combined the two methods in one institution. Neither can ever accomplish it alone.

Efficient research institutes for dental disease must have exceedingly good clinics which will not only provide a great variety of types of associated local and systemic dental pathology, but a sufficiently large number of the different groups which may be considered comparable, to make possible the tabulation of data and thereby enable the research workers to trace the symptoms through the maze of confusions to their source; and these institutions must be so well equipped with trained scientists and the newest apparatus that it will be possible to apply all the available newer methods to these studies. Nor will it be sufficient to have great clinics and equipped laboratories manned by skilled scientists. They must have, and this is the most difficult of all to find, directing minds and hands whose vision is as far in advance of the teachings of the profession as it is possible to obtain. These men are rare and they can only be interested by furnishing an environment and equipment that supplies as nearly ideal working conditions as possible for a life devoted to scientific research. Such an atmosphere will not only attract men already possessing a well developed vision, but it will create such a vision in its developing staff.

Probably the greatest source of wastage in all world progress is the lack of understudies. Men climb through weary hours of almost endless struggle over the foothills to the watershed range, and just as they get to a point of vantage, where they can see somewhat of the probable course of the stream they are seeking to explore, they fall exhausted and a new explorer must start again at the foothills. We must keep pushing our advanced bases continually so that as little as possible of the ground that is gained will be lost, for the lifetime of any worker, at best, is short. Probably no worker in the field of dental bacteriology has ever climbed so high on the watershed as Professor Miller twenty-five years ago; nor has anyone arrived again at the milestone reached by Michaels in sialology twenty-three years ago. Therefore, the

competent research institutes for dental diseases would be organized not only to develop men for their own enlarging staffs, but men for going out to other institutions to build up similar work and, particularly, to man the dental colleges.

The most important change that must come in all the applications of dental science is in the viewpoint. Dentistry was born as a mechanical art. The whole attitude of medicine has been to treat it as such and the attitude of the dental profession, until recent years, has been to recognize it only as such. Before any dental operation whatever can be given even preliminary consideration, the problem of the tissue involved must be considered from the standpoint of human economy; and in that problem, the future as well as the immediate present must be considered. In the future it will not be: What mechanical art is dental science able to apply to a given broken or disfigured tooth? but, first of all, What is the relation of that affected member to the health and efficiency, as well as the comfort and appearance, of the individual? The dentistry of the future must be fundamentally based upon a foundation of pathology rather than of mechanical skill and art. No less art and skill will be needed in the legitimate restorations, but the operation of choice will not be decided on mechanical bases. Therefore, the dental colleges of tomorrow must have as their controlling motive, health and efficiency; and every motive, policy, and purpose, will first be decided on the basis of pathology; and I will make a prophecy that every dental school in the land will go out of business that is not organized upon that basis.

Accordingly, adequately organized research institutes for dental diseases will provide for very advanced postgraduate work on the fundamental knowledge of the relation of oral infections to systemic disease and the most advanced means for their application, since every operating dentist, no matter what his specialty, must be, primarily, a dental diagnostician unless he be so fortunate as to be associated with a group, some member of which is skilled in that important branch and is able to suggest the course that should be pursued. *It follows, therefore, that the organization of adequate institutions for most advanced investigation and most helpful professional assistance will have the following:*

(1) An ample endowment to make possible both a large and a permanent work;

(2) Adequate buildings, well lighted and well

located;

(3) Most up-to-date scientific equipment;

(4) A director with an appreciation of the problem from the standpoint of the patient, the healing professions, and the development of their sciences, the most advanced methods for scientific research, the needs of the scientist for his most efficient service, the skill in the organization of the clinic, the needs of teaching institutions, and familiar with methods of publication;

(5) A staff of skilled scientists, trained in the application of various branches of biological science; and

(6) Last, because it is first, a board of trustees with a love for humanity, which makes possible the consummation of this great work, and in whose hearts must come a joy that is known only by the world's greatest benefactors and is that one quality which makes man a superman because he becomes a coworker with his Creator.

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