JOURNAL OF
Endodontia

VOLUME III NUMBER 3

Table of Contents

☆

JULY, 1948

PUBLISHED BY
AMERICAN ASSOCIATION OF ENDODONTISTS

JOURNAL OF
Endodontia

VOLUME III JULY, 1948 NUMBER 3

Published Quarterly—January, April, July, October—by the
American Association of Endodontists
21 East State Street, Room 418, Columbus 15, Ohio

Yearly Subscription $3.00 Single Copy 75 cents

Entered as second class matter under the act of March 3, 1879, at Columbus, Ohio, June 3, 1947. Publication of an article or abstract does not imply endorsement by the Journal or the American Association of Endodontists.

The Mechanism of Periapical Infections and their Therapy—a Primer for the General Practitioner

By SAMUEL TURKENKOPF, D.D.S.

While preparing this paper on the mechanism of periapical lesions and their therapy, I recalled a statement made by Dr. Louis Grossman some time ago, that post-graduate work in endodontia should not necessarily be pursued with specialization as the goal, but rather with the purpose of creating a more intelligent and efficient general practitioner in the field of endodontia. I myself feel that in so many of the short courses and clinics offered, too much stress is put on techniques and not enough emphasis on the philosophy of treatment. With this point of view, I have prepared a succinct treatment of this subject, which I feel might provide the basis for such a short course for the general practitioner who has only limited time to devote to post-graduate work.

In a consideration of the mechanism of periapical lesions, it is important to recognize the fact that bone is a primitive tissue and will repair itself under the most adverse conditions—with possible exceptions in the case of diabetes, nephritis, tuberculosis, and syphilis. The mechanism by which the periapical tissues respond to injury is inflammation. Regardless of the cause, there is an initial constriction of the blood vessels with acceleration of the blood stream, followed by a dilatation with slowing of the blood stream. The slowing may be so marked that thrombosis occurs, resulting in necrosis. When these changes occur in the pulp and periapical tissues as the result of a blow, occlusal trauma, or irritating filling materials, death of a vital pulp will result. If the irritant is removed soon enough, the thrombosis may be prevented and resolution will take place.

When the inflammatory process goes on to necrosis, gangrene may follow, with the invasion of the dead pulp by micro-organisms either from the blood stream or, when exposed by caries, from the oral cavity. The inflammatory process now becomes an infectious one. In the early stages, there is first, margination of the leucocytes, followed by their migration through the vessel walls. If the irritant is a strong one, such as virulent bacteria, degenerative changes occur, with formation of pus as a result of the battle of the polymorphonuclear leucocytes with the bacteria.

When the acute process subsides by drainage, either induced or spontaneous, if it is left untreated, the infection enters into the chronic stage. In the mechanism of the chronic inflammatory process, as presented in the work of E. W. Fish (1) of England, I feel that there is, for the first time, a scientific justification for root canal therapy. Fish, in collaboration with McLean (1), showed that, contrary to the findings of Rosenow, micro-organisms cannot exist for any length of time in living bone tissue. Fish wondered why infection could be demonstrated bacteriologically in extracted vital teeth, but not histologically. He felt that the micro-organisms could not have been present long enough to cause a reaction. He then reasoned that the micro-organisms must have been pumped into the blood vessels and lymph channels in the process of extraction, and he proved this in the following way. He sterilized the gingival crevice with the actual cautery before extraction, and consistently obtained sterile cultures from extracted vital teeth. He went further and implanted wool fibres infected with various types of micro-organisms into the jaws of experimental animals and showed that the micro-organisms remained in the infected area only. The question now arises: What causes the rarefied periapical area? This question is answered by the work done by Graham (2) who showed that a bacterial filtrate from micro-organisms found in pyorrhetic pockets was highly toxic and destructive to tissue. We

can thus apply the results of these experiments to the explanation of how the mechanism of chronic periapical infection works.

Fish (1) showed three zones of reaction around the infected area. These three zones he called: 1—Zone of contamination; 2—Zone of irritation; 3—Zone of stimulation. The root canal is the area of infection and it is here that we find bacterial activity. The cells predominating are the polys. The toxins liberated by the bacteria diffuse into the periapical tissues, and immediately surrounding the infected area is the zone of contamination. Here is found round cell infiltration and cellular destruction, degenerative changes caused by the strong toxins. Bone lacunae appear empty. Farther out from the zone of infection, we find histiocytes and osteoclasts, the activity of which, according to Fish (1), "results in opening up a gap in the bone all around the center of the lesion, as trees are felled to isolate a forest fire. The space becomes filled with polys and until that takes place, the danger of widespread necrosis remains." The periphery of the area is marked by the zone of stimulation. Here the toxins are mild enough to be a stimulant in response to which new bone is formed. This new bone acts as a wall of defense around the zone of irritation. From these studies we may logically conclude that the periapical area is not an infected area, but is indicative of local tissue destruction caused by toxins liberated from the infection in the root canal. Thus, repair will take place if the root canal, as the source of the toxins, is eliminated by proper cleansing, sterilizing, and filling. It is also logical to conclude from these studies that the role of the pulpless tooth is not too important in the mechanism of the focal infection theory.

Having sketched briefly the mechanism of periapical lesions, it is appropriate to proceed to a consideration of their therapy. In the case of the acute alveolar abscess, if possible, drainage should be established through the root canal and/or the fluctuating area incised at the first visit. Intraosseous injection of one c.c., 50,000 units of penicillin in the region of the tooth apex should follow. Debridement and irrigation with one c.c. penicillin (Bender) of the same strength should be a part of the first treatment. The penicillin should be sealed into the canal until the next visit. This treatment has controlled every one of twenty-four cases of acute abscess treated in my private practice, and at the Beth Israel Hospital Dental Clinic, Newark, New Jersey. In treating acute symptoms, penicillin certainly seems to be the miracle drug, the patient invariably being made comfortable in from one to three hours. The cases treated are surely not enough in number to warrant any definite conclusions, but they certainly show that for the first time in the history of root canal therapy, acute symptoms may be controlled almost at once, and that a canal may be protected from further contamination by sealing in penicillin at the first visit. Reports by Pear (3) and Bender (4) show consistently encouraging results.

In treating chronic infections, thorough mechanical cleansing and enlarging is the *sine quo non* of root canal therapy, and must be accomplished without irritation to the periapical tissues. This should be followed by irrigation with double strength chlorinated soda solution and hydrogen peroxide, or penicillin in cases where a rarified area exists. The next step is to attain sterility of the canal and accessible apical tissues. This may be accomplished by the use of antibiotics, drugs, electrolytic medication, or surgery. Among the antibiotics, first, there is penicillin; 20,000 units per c.c. should be injected into the canal and brought into close contact with the canal walls by the use of files. The penicillin is then sealed into the canal for three or four days and repeated if necessary. Streptomycin is used if positive cultures persist despite the use of penicillin. Penicillin points, as suggested by Grossman (5) are also effective. The following drugs may be used in rotation every three or four days until sterile cultures are obtained, or in conjunction with the antibiotics: (1) beechwood creosote, which seems to be a synergist with penicillin;

(2) camphorated mono-chlor-phenol; (3) azochloramid; (4) cresatin. Through the years, electrolytic medication has proven to be one of the most reliable methods for root canal sterilization. Electrolytes in use are Lugol's solution or Churchill's tincture of iodine. However, Grossman and Appleton (5) have found the following solution, kept in an amber alkali-free bottle, to be most effective: zinc iodide 15.0 grams; iodine crystals 0.6 grams; distilled water 50 c.c.

In cases where we cannot obtain negative cultures by following conservative methods as outlined above, a necrotic nidus may exist either on the root surface external to the canal or in the periapical space. In these cases, we may resort to surgery: either root resection, or apical curettage. Weaver (6) of Cleveland and Barron (7) of Dallas believe that better results are obtained by simply removing the infected tissues with curets from the periapical space and from the root surface, the contention being that the cementum of the root presents a better environment for deposition of the new cementum than does dentine. When the canal has been rendered sterile, it may then be filled or obliterated by any method which will successfully seal it hermetically: gutta percha points or silver points with root canal cement; gutta percha points with chloropercha or eucapercha; or zinc oxide and beechwood creosote made into a stiff paste (Barron), followed by apical curettage.

A word should be said about the necessity of taking cultures in root canal therapy. As I have said elsewhere before, and as I shall say again, if we are to function as a scientific profession, we must work along scientific lines, and empiric methods must not be tolerated. If we are to seal a root canal we must, in justice to our patient and to our own conscience, convince ourselves, by all available means, that the canal is sterile. To test this sterility, the only reliable means available is the bacteriological examination.

Another type of infectious lesion is the granuloma. This is an example of proliferative inflammatory change in response to a mild irritant. It consists of a fibrous outer capsule which is continuous with the periodontal membrane and an inner portion of vascular tissue, in which are found phagocytes, lymphocytes, and plasma cells. Many granulomas are sterile. Kronfeld has stated that a granuloma is not an area in which micro-organisms live, but in which they are destroyed. The therapy consists in destroying the infection in the root canal and in proper filling. The granuloma is then absorbed. When it persists, it may indicate the presence of a cyst. This lesion represents a defensive reaction to a mild irritant in which the epithelial remnants in the periodontal membrane are stimulated. Therapy consists in root resection with cyst enucleation.

Here just a few words about the non-infectious lesion called cementoma seem appropriate. Radiographically the lesion appears, in its early stages, as a diffuse radioluscent area about the apex of a vital tooth. It is found chiefly in the mandibular teeth, especially in the incisors, although it does occur in other teeth as well. It is often associated with traumatic occlusion, but may suggest an endocrine disturbance. It is thought to be a demineralization of the bony tissue in its initial stage. There are three stages in the development of the cementoma: the osteolytic, the cementoblastic, and the mature. In the first, or osteolytic stage, correction of occlusion often brings about a return to normal.

Although the basic factors in the process of inflammation have been well established, and every dentist practicing endodontia should have a thorough knowledge of the mechanism of this process, he must realize that the salvaging of a pulpless tooth needs justification, and that the whole subject is based on a controversial and challenging concept. Dentists reaching out for a short course in endodontia might better be given access to material such as this presented here, rather than to be given only the exercises in technique which have been traditional.

BIBLIOGRAPHY

(1) **Fish, E. W.** J. A. D. A., Vol. 26, 1939. **Fish and Maclean.** British Dent. Journal, Vol. 61, 1939.

(2) **Graham, J. W.** Proceedings Royal Society of Medicine, Vol. 29, 1937.

(3) **Pear, J. R.** Journal of Endodontia, Vol. 1, page 32, 1946.

(4) **Bender, I.** Am. Dent. Journal, Vol. 34, page 99, 1947.

(5) **Grossman, L. I.** Root Canal Therapy.

(6) **Weaver, S. W.** Journal of Endodontia, Vol. 2, page 4, 1947.

(7) **Barron, S. L.** Texas Dental Journal, Feb., 1947.

Report of Endodontia Study Club

After a preliminary meeting of tentative planning held last winter, the first regular meeting of the Toronto Endodontia Study Club was held on the evening of April 15th. The membership of the club is being restricted to those men who have a definite interest in endodontia. It is also the unanimous feeling of the members that four regular meetings of the club be held each year and that the subject matter be basic rather than technical in nature. Problems of variation in technic are to be studied by small groups within the offices of the members. These office visits are to form a very important part in the activities of the club and will be reported upon at each regular meeting immediately preceding the scientific address of the evening. A plan of this nature will ensure the active participation of every member and thus serve to maintain interest at a high level. The speaker at the opening meeting was J. W. Graham, M.D., D.D.S., M.R.C.P. (Lond). Dr. Graham's principal interest lies in the field of Arthritis and his paper, "A frank discussion of the theory of focal infection" gave the members much food for thought. Elections held earlier in the evening resulted in the following executives: President, Geo. C. Hare; Vice-President, C. E. Aho; Secretary-Treasurer, P. W. Arkle.

GEO. C. HARE, D.D.S.

The Practice of Endodontia in the Gay '90's

Root Canal Dressing. Eighty parts iodoform, fifteen parts oil of cinnamon, and five parts finely powdered, ground coffee, packed into a foul root, will disinfect it, and also prove a very agreeable dressing. (p. 12).

Bleaching Pulpless Teeth. It may not be generally known that peroxide of hydrogen is the great bleaching liquid that barbers have been using for several years to produce blonde and white heads. Some time ago, this led us to try it in bleaching teeth, and we are ready to say it far exceeds our expectation, and does more than anything we have tried. (p. 13).

Preventing an Abscess. The apical foramen is the only inlet and outlet of the pulp canal, and, when perfectly stopped, the work is done, and the more quickly you stop it, the better will be the chances for success.

To Remove Chloro-percha from Instruments. To remove chloro-percha from instruments, dip them in hot water, wiping hard with cloth. (p. 17.)

Filling Molar and Bicuspid Pulp Canals. There are not many canals that cannot be filled, if the operator is persevering, and the patient can pay for the time. (p. 40).

Removing Pulps. I have found the most expeditious way to dispatch a nerve, after having applied arsenious acid, is to cook it. I like it fried. My recipe is to take an Evans root drier, heat it nearly red hot, push it into the canal. The nerve and pulp will stick to the instrument. (p. 58).

Treating Fistula with Bougies. Finely pointed bougies may be passed into fistulae from the roots of teeth, and rapid healing will take place from the bottom, much more satisfactorily than when injections of medicines are made. This is a clean method, and worth trying. (p. 66).

Alveolar Abscess Treated by Amputation of the Roots. I take a tube of about 2 or 3 lines in diameter, the extremity of which is a saw, and applying it to the engine, I cut through the gum, alveolar process, and apex of the root, and generally am successful in bringing it away with the sac inside the tubular saw. If it does not come out in this way, it will, after a few days, show itself at the surface of the wound, and can then be readily removed, and without pain. (p. 71).

—**From:** 567 Useful Hints for the Busy Dentist, by William H. Steele, D.D.S. Published in 1892.

Film 1

Film 2

Film 3

Transdental Extirpation of Granuloma

J. PERINT, M.D.

PRELIMINARY REPORT

A dentoapical granuloma can be abolished by a surgical approach such as extraction followed by excochleation, resection, re-implanation and by conservative procedures as diathermy and radix filling.

In a case (film 1), I tried the following procedure: wide exposure of the radical canal (film 2), destruction of the apex by a drill, and excochleation of the granuloma through this canal by means of a straight excavator (film 3).

The exposed cavity has been rinsed with rivanol and filled with gauze. The reactive inflammation ceased within three days. After a second lavage and drying, the cacity has been filled with iodoform paste and the opening closed with gutta percha. Eight days later the canal—as it was free of reaction—has been closed with silver cement (film 4). Care has been exercised that no silver should get beyond the cavity. Eight weeks later the tooth has been replaced by a Jacket crown, lying on a metal ground (film 5). As seen from this film, rarification is of lesser extent and some traces of bone structure are present within the defect. Thus the treatment was followed by good result as could be inferred also from the steadiness of the tooth, the absence of symptoms and complaints, and the intactness of the gingiva showing no reaction. The length of the treatment can be reduced so that replacement can be performed sooner, as subsequent experiences proved.

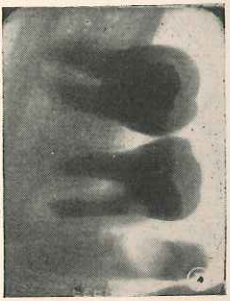
Only chronic and stable (encapsulated) lend themselves to this procedure. A subacute granuloma may respond to the intervention with progression. This is all the more true of all acute apical processes.

Special attention has to be paid to this method if the anatomic conditions of the root are suitable, resection is difficult—molar teeth (film 6), lower teeth—further if the conservative therapy is not indicated because of the great extension of the process.

—VI Andrassy ut 20, Budapest, Hungary.

Film 4

Film 5



Film 6

Preliminary Report on the Use of a Penicillin-Streptomycin Suspension in Endodontia

By LOUIS I. GROSSMAN, D.D.S., Dr. med. dent.
(From the Oral Medicine Department, School of Dentistry, University of Pennsylvania, Philadelphia, Pa.)

The greatest interest in conservative treatment of infected pulpless teeth during the last few years has centered around the use of antibiotics. While early reports were not encouraging, recent reports have been more favorably disposed. From a weak, unstable, aqueous penicillin solution containing 5,000 units per cc., attention has been turned recently to a suspension in oil containing 600,000 units per cc., which is both stable and effective. A report of a study of 200 infected pulpless teeth treated with this penicillin suspension will be published in the Journal of the American Dental Association shortly. In this study it was found that the treatment time with this concentrated penicillin suspension was reduced by about half when compared with older antiseptics. It was noted, however, that Gram negative organisms were encountered in a small number of cases against which penicillin is ineffective. In these cases, streptomycin was used with desired result. From the standpoint of the dentist in practice, however, treatment with penicillin alone might be time-consuming and wasteful unless means were at hand to differentiate organisms by Gram staining. It was therefore decided to combine penicillin with streptomycin in the form of a stable oil suspension in order than a single antibacterial agent effective against both Gram positive and Gram negative organisms may be available.

Penicillin-Streptomycin Suspension

The present study deals with 60 cases treated with a penicillin-streptomycin suspension in peanut oil, 1 cc. containing 500,000 units of each antibiotic. The suspension can be prepared readily as follows: Draw up 2.1 cc. of sterile peanut oil in a dry Luer syringe and transfer the oil to a small, dry, sterile open-mouth bottle. About 0.1 cc. of oil is lost owing to the fact that it adheres to the barrel and piston of the syringe. Transfer the contents of one vial containing 1,000,000 units of potassium penicillin, and the contents of another vial containing 1 Gram (1,000,000 units) of streptomycin calcium chloride complex to the bottle containing the peanut oil. Stir with a sterile glass or wooden applicator until a homogeneous suspension results. This suspension contains 500,000 units per c.c. each of penicillin and streptomycin.

(Note: Do not use streptomycin sulfate as it forms a pink suspension which might indicate incompatibility with penicillin.)

If the suspension should appear granular at first, its texture will become smoother after standing over night.

We shall refer to this suspension of penicillin and streptomycin in abbreviated form hereafter as P+S. In this form, P+S is stable, and if proper precautions are used to keep the material away from heat and to replace the stopper in the bottle immediately after use, less than 10% loss of potency may be expected in a year. The suspension need not be refrigerated. It is recommended, however, that the date of preparation of P+S be placed on the label and that the unused portion be discarded after one year.

Technic

The technic of using the P+S suspension differs from that of sealing the usual medicament in the root canal. Its thick, almost semi-solid consistency will not permit it to be absorbed on a paper point to be sealed in the canal. Instead, the suspension must be pumped carefully into the canal by means of a metal wire such as that commonly used during electrolytic medication ("ionization"). The wire should preferably be of iridio-platinum and tapered to a blunt point so that it may carry the

P+S suspension ahead of it. A steel wire, such as a broach, should not be used, as it will cause deterioration of the antibiotic. Platinum wire is too soft but iridioplatinum has the desired stiffness to serve the purpose best; also, it can be sterilized readily in the open flame. After the P+S is pumped into the canal at least 3 or 4 times to make certain that the canal is well-filled with the antibiotic, a sterile, short, blunt absorbent point is carried into the canal to serve as a plunger in moving the P+S ahead of it toward the apical foramen; and also laterally against the canal wall so as to bring the antibiotics in close contact with the canal surface. The absorbent point is left in the canal and is covered with a sterile pledget of cotton to absorb the excess P+S. The cavity is then sealed with a double seal, i.e., an inner seal of gutta percha and an outer seal of cement. Treatments are preferably given every third or fourth day, but the time interval may be extended slightly.

In this study, a control culture was taken as soon as access was gained to the root canal. A drop of chlorinated soda was then placed in the pulp chamber and mechanical instrumentation throughout the entire length of the canal was completed, in most cases, at the first visit. This is contrary to the usually recommended technic where, in infected root canals, instrumentation is confined at the first visit to the coronal and middle thirds of the canal. In treating such teeth with a concentrated penicillin suspension (600,000 U. cc.), however, it was found that debridement of the entire canal could be done at the first visit with a minimum of postoperative pain or flare-up, provided instrumentation was confined within the root canal. The same procedure was followed using P+S.

After mechanical instrumentation was completed, the canal was irrigated alternately with hydrogen peroxide and chlorinated soda, and the canal was dried. P+S was then inserted in the canal and the dressing was sealed in the manner already described.

Cultures were taken at each visit. The culture media used were thiol medium (35 school cases) and brain heart infusion broth to which penicillinase had been added (25 office cases). It has been shown that streptomycin is inactivated by brain heart infusion broth, while freshly prepared thiol medium inactivates both penicillin and streptomycin.

Findings

Of the 60 cases reported here, 21 were cases of necrosis or gangrene of the pulp; 5 were cases of acute alveolar abscess; 10 were cases of subacute alveolar abscess; 14 were cases of chronic abscess; and 10 were cases of granuloma.

The average number of treatments for all cases was 1.9 treatments. This is slightly below the average number of treatments required in 200 cases treated with penicillin alone, as reported by the author. In this preliminary report data from only 60 cases are available and the average number of treatments is likely to be changed when more cases are reported. In only 3 cases was it necessary to give 3 or more treatments before negative cultures were obtained. In 6 cases, discomfort was reported after the initial treatment, but in only 1 case was it necessary to relieve the pain by removing the dressing and allowing the canal to remain open.

Summary

(1) Sixty cases of infected pulpless teeth were treated with a penicillin-streptomycin suspension containing 500,000 units of each antibiotic per cc. of peanut oil.

(2) Negative cultures were obtained in an average of about two treatments.

(3) While no definite conclusions can be drawn because of the small number of cases reported here, a favorable trend is indicated.

4001 Spruce Street.

Experimental Study of the Efficacy of Penicillin, Sulfathiazole, Sulfanilamide, Beechwood Creosote, Tricresol and Organic Mercurials in Root Canal Therapy

By HAMILTON B. G. ROBINSON, D.D.S., M.S., AND W. E. KOCH, JR., D.D.S.*
Ohio State University, College of Dentistry, and
Washington University, School of Dentistry

Review of Literature

Penicillin has been established as a useful and highly valuable drug for treatment of infections caused by organisms to which penicillin is antagonistic. Crowley and Harner (9) have shown that *Streptococcus viridans* from infected root canals is sensitive to penicillin while *Streptococcus anhemolyticus* and *Streptococcus hemolyticus* from root canals are resistant.

Adams (1) obtained negative cultures after one treatment in nine (75 per cent) of twelve cases, using calcium and sodium penicillin. In one of his cases, *Staphylococcus aureus* was the predominant organism, a second appeared to show *Streptococcus viridans*, alone, and in a third instance the filling leaked. Adams, who had previously used sulfonamides in root canal therapy, concluded that penicillin can be safely and effectively injected into inflamed periapical areas. He had previously indicated his concern over chemotrauma in root canal therapy (2).

Potkin (13), from a study of thirty-two cases reported that teeth which are tender to percussion respond very well to penicillin treatment. Using absorbent points containing approximately 500 units each, he reported three failures in twenty-four cases. Pear (12) used penicillin in thirty-four cases with four cases failing to respond and obtained negative cultures in all of twenty-four treated with streptomycin.

Stewart (15) used a penicillin solution in a manner similar to that used by Adams (1) and reported only two cases of one hundred and twelve failing to respond to the treatment. Buchbinder (6) suggested alternating penicillin with other drugs unless the dentist is in a position to study cultures routinely. He (7) also studied the effect of penicillin on the skin and in periapical tissues. Bender (4) reported sterile cultures after one treatment with penicillin therapy in seventy per cent of fifty-three cases.

Tulacek and Tilden (16), in discussing their study of penicillin, point out that bacteriocidal action, not bacteriostatic action, is desirable in root canal therapy.

Ostrander, Crowley and Dowson (11) used penicillin in a paste and found only twenty of thirty-four cases responding. When penicillin-sensitive organisms were present two negative cultures were obtained with an average of 3.55 treatments.

Coolidge (8) found many drugs being used for root canal therapy to be irritating to periapical tissues. Phenol, eugenal eucalyptol, creosol, chloramine T, Hexylresorcinol solution and oil of cloves produced varying degrees of tissue and cellular reaction when sealed in root canals of dogs. He did not use penicillin and sulfanomides.

From this review of the literature, it appears that if a drug which has little or no chemotraumatic effect is as effective as another drug which produces more chemotrauma, and first drug should be the drug of choice.

To test the effect of antibiotics and other drugs on periapical tissues, a study was undertaken on cats. It was our opinion that the periapical tissues should be infected by controlled methods to simulate actual chemicals conditions. The method used

*The experimental phases of this study were carried out by the authors at Washington University, St. Louis, under a grant from the Mallinckrodt Chemicals Works.

by Boling and Robinson (5, 14) was used to produce anachoretic pulpitis.

PROCEDURE

Fourteen cats were started in the study but eight died in the course of the experiments. The remaining six animals were anesthetized with sodium nembutal and cavities were prepared in various teeth and croton oil applied. In two animals (6 and 9) 1 cc. of a mixture of streptococci, staphylocci and bacilli was injected into a hind leg vein one week later. The remaining animals had one or more exposed pulps allowing entrance of bacteria.

After various periods of time, the root canal was opened and penicillin (about

TABLE I

SUMMARY FOR EACH DRUG

MATERIAL USED	TIME FROM APPLICATION TO STUDY (Days)	CULTURAL REPORT	HISTOLOGY	RADIOGRAPHIC
Penicillin	25	+	Repair.	Normal.
	25	++	New bone.	Bone normal, root removed.
	3	+	Inflammation.	Root end resorption with some bone repair.
P. M. C. (pyridyl mercuric chloride)	25	++	No reaction.	Normal.
	25	++++	Inflammation	Bone destruction.
	25	++	Granulation	Slight bone involvement.
	1	++	Acute inflammation.	No bone change.
Beechwood creosote	25	++	No reaction.	No bone changes.
	25	±		No bone changes.
	3	+++	No reaction.	Root end resorption with some bone repair.
P. C. (propyl mercuric chloride)	1	++	Acute inflammation.	Slight bone involvement.
	3	++	No reaction.	No bone change.
	25	++	No reaction.	Slight root resorption.
Hot sulfanilamide	25	+++	Inflammation.	Slight bone involvement.
	1	++	Little reaction.	Slight bone involvement.
Tricresol	25	+++	Osteoclasia, no inflammation.	No bone changes.
	3	++	No reaction.	No bone changes.
Sulfathiazole	3	+++	Hyperemia.	Slight bone involvement.
Controls	1	++	Acute inflammation.	No bone involvement.
	3	.....	No reaction.	Bone involvement.
	3	.....	Inflammation.	Root resorption on $\overline{IV}$.
	25	.....	Osteoclasia.	No bone changes.
	25	.....	Repair, acute inflammation.	No bone changes.
	25	.....	Inflammation.	No bone changes.

± =Questionable growth.
\+ =Sparce.
++ =Moderate.
+++ =Dense.
++++=Very dense.
Time =days between treatment and culture.

TABLE II

SUMMARIES FOR EACH ANIMAL

	BACTERIOLOGY	HISTOLOGY	RADIOGRAPHICALLY
No. 6. Infected eye. Artificially induced bacteremia. Eight months between cavity preparation and treatment; 25 days between treatment.			
Controls	.....	Inflammation	No significant abnormalities.
P.M.C	Moderate	No reaction	No significant abnormalities.
Penicillin	Sparce	New bone	Root resorption, bone normal.
Creosote	Moderate	No reaction	No significant abnormalities.
No. 9. Artificially induced bacteremia. Eight months between cavity preparation and treatment. Three days between treatment and death.			
Controls	.....	Inflammation	Root end resorption on $\overline{IV}$.
P.C	Moderate	No reaction	Slight root end resorption.
Penicillin	Sparce	Inflammation	Root end resorption with some bone repair.
Creosote	Dense	No reaction*	Root end resorption with some bone repair.
No. 10. Exposed pulps. Three months between cavity preparation and treatment. Twenty-five days between treatment and death.			
Controls	.....	Repair, acute inflammation	Normal.
P.M.C	Very dense	Inflammation	Bone destruction.
Penicillin	Moderate	Repair	No significant change.
Creosote†	Little or none	.....	Normal.
No. 12. Exposures. Three months from preparation to treatment. Death twenty-five days after treatment.			
Control	.....	Osteoclasia but no inflammation	Normal.
P.M.C	Moderate	Granulation tissue	Slight bone involvement.
Hot sulfanilamide	Dense‡	Inflammation	Slight bone involvement.
Tricresol	Dense‡	Osteoclasia but no inflammation	No significant change.
No. 13. Three months from cavity preparation to treatment. Died three days after treatment (no infection).			
Control	.....	No reaction	Bone involvement.
P.C	Moderate	No reaction	Normal.
Sulfathiazole	Dense	Hyperemia	Slight bone involvement.
Tricresol	Moderate	No reaction	Normal.
No. 14. Exposure. One and one-half months from cavity preparation to treatment. Died one day after treatment.			
Control	Moderate	Acute inflammation	No change.
P.C	Moderate	Acute inflammation	Slight bone involvement.
P.M.C	Moderate	Acute inflammation	No change.
Hot sulfanilamide	Moderate	Little reaction	Slight bone involvement.

* Root end not observed.

† Unsealed.

‡ Pulp exposed during preparation.

200 units), sulfathiazole, beechwood creosote, tricresol, PMC* or PC† was introduced into the canal on absorbent points and sealed in with temporary stopping. In two instances hot sulfanilamide solution was introduced into the canals. A number of teeth were left untreated, after cavity preparation, for controls.

After varying periods of time, the animals were sacrificed and the jaws removed. The teeth which had been radiographed at the beginning of the study were radiographed again. Under sterile conditions, the jaws were removed and cultures made from the experimental teeth. The jaws were then trimmed, fixed decalcified and sectioned.

Results

Bacterial studies: All teeth showed some growth after 48 hours incubation in brain-heart infusion broth with the possible exception of the upper right canine on animal No. 10. (Tables I and II.)

Histologic study: The results of the histologic study were not uniform. Some teeth showed no reaction, some acute and chronic inflammation, some acute inflammation, some repair and some fibroblastic proliferation in the periapex. The results are summarized in Tables I and II.

Radiographic: Several of the teeth which showed histologic evidence of periapical reaction showed no radiographic changes, while radiographic evidence of tissue change was seen in some instances in which no histologic evidence was observed. (Tables I and II.)

Discussion

The fact that none of the drugs resulted in sterile cultures when applied once to root canals after infection had been presumably induced one and one-half to eight months earlier indicates the inadequacy of one treatment in long standing infections.

The radiographic and histologic studies had distinct limitations. The radiographic only shows changes in calcified structures along the mesial and distal areas of the tooth and at the "profile area" of the root. The histologic studies, unless made in serial section, show only a limited area of the tooth. In the instance of the long curved roots of the anterior teeth of cats, as used in this study, it is quite possible to miss areas of tissue reaction. For this reason the histologic and radiographic results should be used to supplement each other.

This study confirms the impression of Coolidge that most drugs injure the tissues. Repair was seen in two or three cases treated by penicillin. In no other instance was repair evident although inflammation was noted in the third tooth treated with penicillin and in six other instances.

Analysis of the data and comparative study of the sections and radiographs indicates that penicillin was as effective as any of the drugs and with a minimum of tissue damage.

Summary

The use of penicillin in therapy of root canals is indicated if it can destroy the organisms or lead to their destruction with little or no damage to the tissue. Laboratory and clinical studies indicate that penicillin is effective against many organisms that may invade the pulp and periapical tissues. The least favorable results are those reported by Ostrander, Crowley and Dowson (11). They obtained only 35 per cent effectiveness, against 62 to 74 per cent with other drugs. In view of the low chemo-traumatism with penicillin and the results obtained by Adams (1) and others in clinical studies, it is suggested that penicillin be used at the first treatment and subsequently unless the first culture after therapy is positive. If this culture is positive it might be assumed that the infectious agent is penicillin-resistant and that some mild drug be substituted.

REFERENCES

(1) **Adams, F. R.** Penicillin in Pulp Canal Therapy, *D. Items of Interest*, 66: 1147, 1944.

(2) **Adams, F. R.** Chemotrauma, *D. Items of Interest*, 66: 644, 1944.

(3) **Bartels, H. A.** Penicillin in Roto Therapy, *Ann. Dent.*, 6: 115, 1947.

*Pyridylmercuric chloride (Mallinckrodt).

†Propyl mercuric chloride (Mallinckrodt).

(4) **Bender, I. B.** Penicillin in Root Canal Therapy, *J. A. D. A.*, 34: 99, 1947.
(5) **Boling, L. R.,** and **Robinson, H. B. G.** Anachoretic Effect in Pulpitis, II. Histologic Studies, *Arch. Path.*, 33: 477, 1942.
(6) **Buchbinder, M.** Penicillin in Root Canal Therapy, *Ann. Dent.*, 5: 115, 1947.
(7) **Buchbinder, M.** Laboratory and Clinical Study of Penicillin in Root Canal Therapy, *J. A. D. A.*, 34: 108, 1947.
(8) **Coolidge, E. D.** Reaction of Dog Tissues to Drugs used in Root Canal Treatment, *J. A. D. A.*, 19: 747, 1932.
(9) **Crowley, M. C.,** and **Harner, V.** Penicillin Sensitivity of Streptococci Isolated from Root Canals and Saliva, *J. D. Res.*, 26: 399, 1947.
(10) **Grossman, L. I.** Penicillin Treatment of Pulpless Teeth, *J. Endodontia*, 1: 39, 1946.
(11) **Ostrander, F. D., Crowley, M. C.,** and **Dowson, J.** A Clinical Study of the Treatment of Root Canals and Periapical Infections with Penicillin, *J. D. Res.*, 26: 403, 1947.
(12) **Pear, J. R.** Preliminary Case Reports and Technic on the Treatment of Apical Infections with Penicillin and Streptomycin, *J. Endodontia*, 1: 32, 1946.
(13) **Potkin, N. N.** Penicillin in Root Canal Therapy, *J. Endodontia*, 1: 28, 1946.
(14) **Robinson, H. B. G.,** and **Boling, L. R.** The Anachoretic Effect in Pulpitis. I. Bacteriologic Studies, *J. A. D. A.*, 28: 268, 1941.
(15) **Steward, G. C.** Preliminary Report on Penicillin in Root Therapy, *J. A. D. A.*, 33: 1281, 1946.
(16) **Tulacek, R. S.,** and **Tilden, E. B.** A Study of the Action of Antibiotics in Vitro on Microorganisms Isolated from Root Canals, *J. D. Res.*, 26: 247, 1947.

Editorial

NEW OFFICIAL PUBLICATION OF THE AMERICAN ASSOCIATION OF ENDODONTISTS

THE JOURNAL OF ENDODONTIA came into being in March, 1946, as a quarterly journal devoted to publication of papers of endodontic interest. Since then a number of original papers have been printed in its pages as well as abstracts, book reviews, announcements of meetings, etc. From time to time the Editor of the JOURNAL OF ENDODONTIA has been handicapped, however, in securing enough material for publication. This is due, no doubt, to the fact that an author who spends considerable time working on a clinical problem or laboratory study and additional time in preparing the paper for publication, prefers a journal with a reasonably large circulation. During the first two years, only 17 short papers were published in the JOURNAL OF ENDODONTIA by 14 contributors. The total space occupied by these papers was 58 pages. Although the Executive Committee went on record as approving an increase in size of the Journal, it has not been possible to carry this into action because of the limited amount of material available for publication.

In January of this year a new journal—Oral Surgery, Oral Medicine and Oral Pathology—was initiated under the editorship of Dr. Kurt H. Thoma. It serves also as the official publication of three associations, namely, the New England Society of Oral Surgery, the Seminar of Dental Medicine, and the American Academy of Oral Pathology. Oral Surgery, Oral Medicine and Oral Pathology is a monthly publication and presents a rather wide scope of material which should be of interest to the practicing dentist and endodontist. In the 587 pages which make up the six issues released during the first six months of publication, one may find papers of such diversified interest as untreated tooth fractures, growth of jaws and eruption of teeth, gelatin sponge, biologic function of proteins, sulfonamides and penicillin in dentistry, etc.

In March of this year, while the writer was in Boston, he consulted with Dr. Thoma about the possibility of having Oral Surgery, Oral Medicine and Oral Pathology serve also as the official publication of the American

Association of Endodontists. Dr. Thoma considered the matter feasible. It was made clear, however, that both the publishers and the Executive Committee of the American Association of Endodontists would have to be consulted before any action could be taken. In the preliminary discussions it was agreed that, (1) the Editor elected by the American Association of Endodontists would become a member of the editorial board of Oral Surgery, Oral Medicine and Oral Pathology; (2) the *en bloc* subscription rate to members of the American Association of Endodontists would be $6 instead of $8.50, the usual rate. Later on, it was also agreed upon that the American Association of Endodontists would be allocated one page every three months, without cost, for publishing association activities, announcements of meetings, etc.

The Editor of the JOURNAL OF ENDODONTIA, the Publication Committee, the Executive Committee and officers of the American Association of Endodontists were then requested to vote on discontinuing the JOURNAL OF ENDODONTIA and of having Oral Surgery, Oral Medicine and Oral Pathology serve as the official publication of this association. It was pointed out that this change would necessarily entail a proportionate increase in dues as the per capita cost of subscription would be twice as much as the sum allocated annually for the JOURNAL OF ENDODONTIA. The matter was approved without a dissenting vote. It was also voted to increase annual dues to $10, instead of a proportionate increase to $9, in order that we be not compelled to stint ourselves in putting on the best possible annual scientific meeting, print a directory of members annually or biennially, etc. Beginning with the January, 1949, issue, Oral Surgery, Oral Medicine and Oral Pathology will therefore also become the official publication of the American Association of Endodontists. Those members who are already subscribers to Oral Surgery, Oral Medicine and Oral Pathology will save $2.50 annually by subscribing through the association, while those who are already receiving the journal because they are members of an affiliated group will be requested to state whether the journal is to be charged through the affiliate or the American Association of Endodontists.

LOUIS I. GROSSMAN.

Muhlemann, H. R. Peroral Treatment of Acute Periapical Abscess with Penicillin. Schweiz. Monatsschr. f. Zahnheilk., 57: 741, September, 1947.

In cases of acute periapical abscess where drainage through the root canal or alveolar bone is not possible, peroral treatment with penicillin has proved to be successful. The author treated his cases with Per-os-cillin (penicillin calcium, with salts of aluminum, calcium and magnesium). Intestinal trouble before or during the treatment may influence the successful outcome. In patients with intestinal disease, the average percentage of successful cases was 68%, in cases without intestinal troubles, 89%. Concentrations of 0.019 – 0.156 units/cc. in the blood stream is necessary for successful treatment, which is obtainable in 2–10 hours. An initial dose of 150–200,000 units, followed by 50,000–90,000 units every 90 minutes is recommended until a total of at least 600,000 units is given.

Hess, A., and Spreng, M., Schweiz. Monatsschr. f. Zahnheilk, 57: 95, February, 1947.

In discussing dental focal infection Spreng states that the theory of dental focal infection is a reality, but there are some doubts about the real importance of periapical granulation tissue *in loco* and on the body. The study of the formation of granulomas needs further investigation. The importance of bacteria, the action of medicaments and the allergic reactions of both must be considered. The existence of sterile granulomas at the apices of pulpless teeth seems to prove that in many cases there may be an allergic reaction of the periapical tissue and not an infection.

In discussing dental focal infection Hess gives a survey of investigations made in America and the misconceptions concerning the pulpless tooth which have been greatly overemphasized in the past. Clinical, roentgenological, and histological studies are necessary and may help to determine the real status of the pulpless tooth. The elimination of mechanical, chemical and antiseptic irritation of the periapical tissue gives the opportunity to avoid periapical alteration. The principal task of dentistry is prevention of caries and disturbances of the pulp. If the pulp is inflamed or infected the problem of treatment consists of the principle: *Nihil nocere.*

Schmuzigor, P. Reflections on Apicoectomy. Schweiz. Monatsschr. f. Zahnheilk., 57: 725, September, 1947.

In discussing healing following apicoectomy, the statement is made that a pulpless tooth is not a dead tooth. Only that part of the root which is in the granuloma is considered as dead and as a foreign body. Much importance is placed on a serious treatment of the canal and on the elimination of the ramifications by surgical intervention. The author examined 213 cases of apicoectomy from 1935–1945 with the following results:

Filling the canal during operation—92% success.
Filling the canal before operation—78.9% success.
Retrograde filling during operation—71.9% success.

The author recommends the filling of root canals during the operation.

Prader, F., Root Canal Irrigation with Hot Solutions, Schweiz. Monatsschr. f. Zahnheilk., 57: 383, May, 1947.

The author recommends the irrigation of root canals with hot solutions of disinfectants as Merfin (mercury phenylborate), Oesogen (invert soap), organic mercury preparations (Ciba) and a monomolecular mercury preparation (Katodya). Bacteriological cultures proved the sterility of the root canals. The higher the temperature, the shorter was the time needed for sterility. Temperatures of 60°–70° C. were well tolerated by the patients.

The technic consists in placing a pledget of cotton moistened with the antiseptic in the canal at the first sitting. The next appointment consists in irrigation with the hot antiseptic solution and removal of the solution by means of a suction apparatus.

Other dressings have been used such as Asphalin (paraformaldehyde) or thymol preparations. The thymol seems to give better disinfection of the canal than the gaseous formaldehyde.

The irrigation of root canals with hot antiseptic solutions reduces the time of treatment and the results seem to be favorable. The method demands further clinical examination besides bacteriological and histological controls.

Bernard, P., Recent Work in Iontophoresis—the Accelerated OH Ion. L'Odontologie, 85: 109, March, 1947.

The author who introduced iontophoresis (electrolytic medication) for root canal treatment in France states that there are some inconveniences which hinder the practice of this method such as the long treatment time. The author recommends a new agent, the O H ions which are present in the contents of the root canal. The negative O H ions can wander toward the root apex or the granuloma even though the canal is not enlarged. In addition to the disinfectant and bacteriostatic action, a lysis of the bacteria occurs sterilizing the canals. This may be followed by a filling. A decicoulomb produces 6×10^{18} O H ions and the author estimated 4–6 decicoulomb as sufficient to sterilize the canals. To regulate the amount of current a coulombmeter is applied; 3 decicoulombs are equal to five milliampere minutes which means that the duration of treatment is much reduced. The acceleration of the wandering O H ions makes sterilization of the root canal possible in 5 to 10 milliampere minutes.

This new method of electromedication needs extensive experimentation besides clinical examination and bacteriological control.

TO AN ENDODONTIST

This, too, is art: his fingers move
Precisely, toward root or groove,

As sentient as a cellist's touch,
Never too little, nor too much,

Ligher than an artist's brush,
Cleanly, surely, without rush,

In perfect meter, perfect time,
His work is fashioned like a rhyme.

Here is an inherent skill
Guided by a stubborn will

That sets perfection as its goal;
He works with hands and heart and soul

So deftly, one is scarce aware
Of the genius lurking there;

Outwardly a little stern,
Yet in his eyes blue fires burn

That betray him, for they hold
Understanding manifold.

Flinching when he must give pain,
Gentle as a summer rain,

He makes of dentistry an art
Through the beauty in his heart!

MAE WINKLER GOODMAN.

Dr. Coolidge Honored

Loyola University Confers Doctor of Laws Degree

ED. NOTE: Dr. Edgar D. Coolidge received the honorary degree of Doctor of Laws at the March Convocation of Loyola University, Chicago, March 29, 1948. This honor, which comes at the time of his retirement from the faculty, is applauded by The American Association of Endodontists.

The Journal of Endodontia is proud to reprint the following presentation address of Dean Robert W. McNulty, of the School of Dentistry, which expresses, so well, his colleagues' appreciation of Dr. Coolidge's career.

Dean McNulty's Presentation

"Very Reverand President, I have the pricilege of presenting an Eminent Individual who has merited well of his Country, his Profession and his University.

Serving as Director and Advisor of many social agencies, he has been a Builder of the Health and a Leader in the Education of this country's citizens. He enjoys the gratitude of thousands of his countrymen who have shared the Benefits of his Researches and his Techniques.

Of the Honors which the dental profession can award he has been accorded nearly all. The author of numerous books and articles, whose merit has been recognized beyond this country, an Officer, Prominent Member and Fellow of many learned Associations, the Recipient in the past year of the Callahan Award, conferred for outstanding contributions to Dentistry, he has won acclaim as one of the Greatest Living Men in his profession.

For nearly a half century, both as Student and Teacher, he has been associated with the School which now bears the name of Loyola University. Through these years he has been Esteemed by his Colleagues and Revered by his Students. His Inspirational Influence, going beyond mere Professional Efficiency and imparting a sense of Moral and Social Responsibility, would be difficult to compute. His Patrician Dignity and Fatherly Interest have set their seal on the youth he has served these many years.

Reverend President, because of his Place in the eyes of his Colleagues and in the hearts of his Students, in appreciation of his Singular Service, for Distinction brought to his Profession and to his University, I ask that on the roll of those whom Loyola University honors with the degree of Doctors of Laws there be inscribed the name of Edgar D. Coolidge."