

JOURNAL OF *Endodontia*

Volume I Published by the Number 1
 American Association of Endodontists

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MARCH, 1946

Journal of Endodontia

Volume I

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Number I

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BALINT ORBAN

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Chicago 1, Illinois

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Published Quarterly—March, June, September, December—by the
American Association of Endodontists

180 No. Michigan Avenue, Room 2303, Chicago 1, Illinois

Yearly Subscription \$2.00

Single Copies 50 cents

Entry as second class matter applied for at the Post Office
at Chicago, Illinois, under the act of March 3, 1879.

Publication of an article or abstract does not imply endorsement by the Journal or the
American Association of Endodontists.

Printed by: McCormick and Henderson, Inc., 411 S. Wells St., Chicago 7, Ill.

Editorial

When I was asked if I would accept the editorship of this Journal I said yes because at that time there was no Journal to be edited. Then, in February, I learned that funds had been made available for a Journal and it was to be started at once. So, I found myself with a new and difficult job.

I am truly indebted to Louis I. Grossman, Chairman of the Publication Committee, who made the necessary contacts with the printer, called my attention to postal regulations, etc., etc. Without his help this Journal would certainly not be in your hands today.

Some readers may doubt whether it is necessary to start a new dental Journal in view of the fact that a great number of such magazines are in circulation. However, "endodontia" has been a stepchild of dentistry for a long time and is just now beginning to gain its rightful place in the healing arts. Therefore, the founding of the American Association of Endodontists and the publishing of the Journal of Endodontia must be considered as important steps toward establishing a solid foundation for progress in this field.

When more than thirty years ago, the fear of focal infection and oral sepsis swept the lands it was only natural that root canal treatment was accused, tried and sentenced in short order. Today we know that the harshness of accusation, the shortness of trial and the severity of sentence were caused by two main factors. Reports of all but magic cures of almost any disorder by extraction of teeth were unwittingly exaggerated in the first triumphal joy over the new progress in clarification of pathogenesis. Many of these enthusiastic reports held true only for initial successes caused in many instances by psychological more than by physical factors; the faith of the newly won disciple of the concept of dental origin of disease wrought miracles on the patient.

The second and even more important cause for the condemnation of root canal treatment was the inferior technique used by so many dentists; "endodontia" then was part of the general dental practice. The cry of oral sepsis focussed the attention to the inadequacies of root canal treatment but the child was thrown out with the bath. Instead of condemning bad root canal treatment, all root canal treatment was abolished.

Today after much work and thought, things are looking brighter. The "endodontist" is not any more a rebel against the ruling of "science" but a recognized specialist of dentistry. The technique has been refined to such a degree that it gives standing to the dentist even in the eyes of the medical profession, and safety to the patient. Since root canal treatment has been elevated to the status of a specialty, those who intend to do this work must adequately prepare themselves for it.

The practitioner who learns critically to observe his patients and critically to evaluate the results of his therapeutic measures can contribute to his field just as much and often more than the research worker in a laboratory. It is just this cooperation of efforts which is sorely needed.

The membership is requested to consider the Journal of Endodontia as its own Journal and to make use of it. The editor is merely your representative!

Balint Orban

The American Association of Endodontists

The founding of the American Association of Endodontists was the culmination of a desire of many forward-looking dentists to form a national organization of those interested in the treatment of pulpless teeth. Even before its inception, a "Root Canal Study Club" was in existence in Philadelphia "to study and discuss problems concerned with the practice of root canal therapy". This study club continued until 1942 when it ceased to meet because a number of its members had entered the armed service. Possibly similar study clubs existed elsewhere.

During the winter of 1942-43, three dentists in widely separated parts of this country—Nebraska, Illinois and Pennsylvania—thought the time favorable for the formation of a national society devoted to the advancement of root canal practice. In February, 1943 an organization meeting was arranged for in Chicago. This led to the formation of a committee to implement plans for such a society. The committee consisted of Drs. Guy P. Bannister of Cleveland, Lester R. Cahn of New York, Edgar D. Coolidge of Chicago, W. Clyde Davis of Lincoln, Louis I. Grossman of Philadelphia, John H. Hoppers of Chicago, E. A. Jasper of Milwaukee, Harry B. Johnston of Atlanta, George C. Sharp of Pasadena, Ralph F. Sommer of Ann Arbor, E. G. Van Valey of New York, and Morton F. Yates of Boston.

The first annual meeting of the association was held at the Palmer House in Chicago on February 23-24, 1944. At the dinner and business meeting, the name of the association was officially chosen to be: American Association of Endodontists. The following day was entirely devoted to a scientific program at which time more

than 200 members and guests were present. The program was unique in many respects and was well received by those attending the meeting.

No meeting of the association was held during 1945 because of wartime restrictions on national conventions.

The American Association of Endodontists reconvened again on February 14-15, 1946 at the Stevens Hotel in Chicago. After the dinner meeting a paper on "The Objectives of the American Association of Endodontists" was read by Dr. Coolidge. The next day was devoted to a scientific program consisting of lectures and clinics.

The association now numbers more than 280 members, including some from foreign countries. It has encouraged the founding of study clubs by its members and such clubs have been established in Chicago, Montreal and Philadelphia. The association has a lending reprint library of more than 100 papers on endodontia which is available to its members. With this issue it inaugurates a quarterly journal which should do much toward keeping its membership informed of recent progress in the field of endodontia.

Additional plans are under consideration for furthering the following objectives of the association:

(1) to promote interchange of ideas on methods of pulp conservation and root canal treatment;

(2) to stimulate research studies, both clinical and laboratory, among its members;

(3) to assist in establishing local root canal study clubs;

(4) to help maintain a high standard of root canal practice within the dental profession by disseminating information through lectures, clinics, publications, etc."

Louis I. Grossman

Objectives of the American Association of Endodontists

EDGAR D. COOLIDGE, M.S., D.D.S., Chicago, Ill.

The association of men interested in the same occupation or specialized division of a profession is one of the great factors of progress in modern business, industry or science. Many men of mutual interests working together bring about more rapid progress that can be accomplished by individual effort.

It has not been but a few generations since the curiosity of individuals to know more about the mysteries of nature and man had to be satisfied as best it could by secret, usually private study or investigation. To be discovered in the pursuit of such knowledge was to be scorned or even persecuted. Van Leeuwenhoek kept his microscope and his observations in guarded secrecy for most of the years of his life. Harvey spent many unfruitful years in an effort to convince his professional confreres of the circulation of the blood. Pasteur was driven into seclusion because he accused the medical profession of his time with the spread of disease by contamination of innocent patients from unwashed hands. When Rosenow advanced his theory of "elective localization" and "focal infection" he condemned the dental profession for careless and unscientific methods of treating pulpless teeth. Many of the members of our profession within the last quarter of a century bitterly opposed his findings and refused to consider his work as sound.

Independent research of the pioneers for the welfare of humanity was met by scorn and persecution while in modern times government promoted research for destructive purposes has led us to the brink of a yawning precipice. The best minds of science have been called upon to develop evil creations of destruction until a breathless world stands appalled with fear at the

prospect of some future war when helpless humanity may be quickly annihilated by the ingenuity of modern science.

What a sad commentary may be made upon the results of much scientific investigation of the past decade and yet in spite of the suffering of mankind and destruction of property *other* investigation has been carried on at the same time along other lines which has relieved much suffering, saved many lives that could not have been saved a decade ago and has been the means of adding greatly to the comfort and health of mankind now and in the future. This has been made possible by many minds working for the common good. What a different story would be brought back from the battle fields had it not been for the use of the blood bank, the sulfa drugs and penicillin!

Objectives

What objectives should be kept before an association of dentists whose main desire is to conserve the natural teeth with comfort and impunity to health as long as possible? What objective should be necessary other than honest and conscientious devotion to our professional ideals? How readily and how willingly many of our confreres will sacrifice the integrity and continuity of the natural dentition because of an exposed pulp and expound a false philosophy to helpless individuals in order to take a short cut to avoid a tedious operation. The members of our Association must inform themselves more and more about the nature of the tissues that we are called upon to treat. We must understand what provision nature has made to protect itself and to repair its injuries. We must take up the task of assisting nature by the removal of ob-

*Paper read at the second annual meeting of the American Association of Endodontists, February 1946, Chicago, Ill.

stacles that hinder or prevent her own mechanism of healing.

Biological adaptation of pulp remnants has been proven and demonstrated by histologic photomicrographs. If the tissue cells about the apical region of a tooth can replace pulp remnants of a single canal with hard tissue the same cells and similar cells can replace pulp remnants with hard tissue in several canals of multi-rooted teeth just as well. Collateral branches and multiple foramina are not counted by tissue cells in nature's plan. It is our duty to surgically remove pulps and close the wound in a surgical manner leaving the natural forces of healing and repair undamaged and unhindered in their function. This function must be understood and protected.

What attitude should our association take toward pulpless teeth? Not the pulpless teeth from which we ourselves have removed the vital pulp, but those we see in daily practice with unknown histories and imperfect and questionable results. Are these the teeth our neighbor calls "dead teeth" or does he include the ones we treat with scientific methods of practice in the same class? Can one conceive of living tissue harboring anything dead? Can a tooth be dead and retained in living tissue in healthy organic connection? We must first clear the atmosphere of wrong nomenclature which is incorrect and misleading.

One of the first activities the Association of Endodontists might entertain is to engage in a campaign to correct the almost universal custom of speaking about "dead teeth" and "vital teeth". The psychologic effect of the words "dead tooth" is so repulsive and threatening that the patient in the operating chair is easily persuaded to sacrifice such teeth, many times, with no scientific justification. It is often pointed out to the patient that the dark area, which is observed in radiograms around the apical foramen, is an infected area, or the tooth is

abscessed. This is another commonly used term which in a large majority of cases is misleading and scientifically incorrect. Infection always attracts leukocytes and leukocytes form pus. Inflammation of an acute type usually results in pain, temperature, swelling and pus formation. The translucent area in the radiogram around the root apex represents chronic inflammation which forms the granuloma and may, under certain conditions, become a cyst, but these dark, translucent areas are not abscesses. Seldom are these granulomas and cysts infected by bacteria themselves, but by toxins. They are the product of a reaction by the blood cells whose function it is to guard the body from infection or its products. If they become infected an immediate acute exacerbation occurs which then becomes an acute abscess and later may become a chronic suppurating abscess. Both of these conditions have a favorable prognosis for treatment. The profession should understand this and inform the public correctly in such matters of pathology and treatment.

The Association of Endodontists as an organization will grow and extend a useful influence by virtue of the ideals expressed in its programs and objectives. In Article II of the Constitution four definite objects are presented which are well chosen and should be a strong nucleus around which further objectives may be added.

1. "To promote interchange of ideas on methods of pulp conservation and root canal treatment."

Little further comment is needed to clarify or emphasize the importance of such a statement. Can one think of any objective more appropriate than this one? By association with each other we grow and as we grow the organization becomes stronger and more influential. Our problems are similar and the stimulus of contact with others brings about the best within us.

2. "To stimulate research studies, both clinical and laboratory, among its members."

Most progress in any activity is the result of study, observation and application by practice and experiment. We are all devoted to practice, but what about study, observations and experiment?

In most of us there is a desire to learn more about the field in which we work but the pressure of practice and lack of time are usually the barriers over which we seldom climb. Some urge is necessary to make us find time to seek further knowledge except what we may acquire by attendance at such meetings as we are now attending. The building of programs for meetings is not a simple or haphazard matter, but the selection of subjects that are vital to the broadening of our knowledge as well as the improvement of our clinical ability. It is not alone technical skill that makes us better dentists but the knowledge of the sciences which gives us a better understanding of the tissue changes that bring about the conditions we are called upon to treat. One man may succeed where another has failed, not because his method of treatment differs greatly but because he recognizes tissue reactions and understands the factors represented by clinical symptoms in the case.

We, as clinicians, cannot all follow up such research activities as were carried on by G. V. Black. Few minds are as curious and can explore persistently in new untraveled roads to discover nature's secrets as could Black, but he spent many hours of the day and of the night, as well, in his studies and laboratory research. Few have the urge that drives them on in spite of fatigue or pressure of work. Those who have the urge of curiosity always find the time to pursue regardless of the cost. Can those of us who do not seem to have that urge acquire it by belonging to an organization devoted

to such a worthy objective? Certainly research curiosity is more likely to be developed where the way is pointed out. Clinical investigation and the perfection of operative skill should receive an *equal amount* of encouragement and recognition as laboratory and experimental investigation. Clinicians should keep informed and evaluate new drugs and new methods of treatment.

3. "To assist in establishing local root-canal study clubs."

It seems to the writer that a slight change in the wording of this objective is in order. The term "root-canal" does not inspire the thought of living tissue but it seems to suggest more of the mechanical problem. Should we emphasize the root-canal or the living tissue within the canal? The study of the pulp, its pathology and treatment, the relation of bacteriology to pulp and periapical tissue, the mechanism of healing and repair are the important subjects for study. Study clubs organized for such study might be more interesting and more fertile than just root-canal study clubs. Therefore the following change is suggested:

3x. To assist in establishing study clubs for the purposes of advancing the knowledge of pulp pathology, pulp treatment and of the potentiality of healing and repair following root canal filling.

4. "To help maintain a high standard of root-canal practice within the dental profession by disseminating information through lectures, clinics, publications, etc."

Here again a suggestion is made to change the wording as follows:

4x. To help maintain a high standard of practice in pulp treatment and root-canal filling and to keep before the dental profession by lectures, clinics, publications, etc., information regarding approved methods of practice in this field.

There are two important factors at least upon which our success in maintaining a high standard of practice depends.

The first is a broad knowledge of the fundamental sciences of pathology and therapeutics. In broadening our knowledge in these subjects we will encounter the need of bacteriology and chemistry. We cannot all return to universities and dental colleges to take refresher courses in these subjects but *we can* devote a portion of our time regularly in the study of these sciences as they relate to our problem. It is then and only then that greater respect will be reflected by those who as yet do not pretend to approve of pulpless teeth.

The second factor is the improvement of our clinical ability in diagnosis and technical skill. It is becoming more and more difficult for those who disapprove of pulpless teeth to condemn teeth that are mechanically well filled and have no evidence of chronic periapical inflammation. A well cleaned and well filled root canal with healthy periapical tissue brings an exclamation of approval from severe critics of pulpless teeth and those that are interested in endodontia would surely recognize the value of such teeth to a patient and never condemn them, as long as the periapical tissue reveals no pathologic change.

Records of Endodontia

The archives of the society should contain the history of the development of modern pulp treatment and root canal filling. Such an undertaking might be assigned to the Association editor or it might be spread over a period of ten years, giving an opportunity to several different editors to prepare such monograms in chapter form to be published when complete. The contributions of many pioneers in the field of pulp histology, pulp pathology, pulp bacteriology, the mechanics of pulp canal operation, materials used and methods of filling root

canals, when well reviewed and carefully edited would make a valuable record and a valuable addition to dental literature.

A complete bibliography of the articles on Endodontia or of those that are closely related to our specialty would be of great value to the study clubs and to those who are actively engaged in study and research. The work of each author might be listed as well as an alphabetical list of articles by title. Mimeograph copies might be furnished to those requesting them. At least this would provide the names of articles and the references to the journals where they might be found.

Historical records and scientific reports compiled by our association should be published from time to time until we are able to undertake the publication of a Journal of Endodontia regularly.

Summary

In summarizing the suggestions or objectives offered, the following items are enumerated:

1. To discontinue the use of the words "dead teeth" and "vital teeth" and substitute "pulpless teeth" and "teeth with vital pulps".
2. To differentiate between abscessed teeth and chronic inflammation in the periapical tissue.
3. To emphasize the study of pulp and periapical tissue changes and the treatment indicated instead of root-canal study.
4. To establish a ten year program of preparing historical records, biography of those who have contributed greatly to the development of Endodontia and to compile the bibliography of valuable articles on problems of Endodontia.
5. To establish an official publication of our Association or a Journal of Endodontia as soon as it is practical.

25 E. Washington Street

*The Bacteriologic Aspect of the Pulpless Tooth**

ROBERT G. KESEL, D.D.S., M.S.

Professor and Head of the Department of Applied Materia Medica and Therapeutics
University of Illinois College of Dentistry

Does available evidence indicate that all pulpless teeth harbor micro-organisms and are a menace to health? For many years oral infection has been considered responsible for other physical ailments. Hippocrates is credited by Charles Mayo with being the first to call attention to the relation between dental infection and general health. He recorded two cases in which the eradication of diseased teeth relieved patients suffering from rheumatic joints. James I of Scotland, who lived in the early fourteen hundreds, is said to have had badly decayed teeth and to have had severe chronic rheumatism. In 1818 the clinician Benjamin Rush reported on a number of cases of systematic disease associated with dental infection. Similar observations were reported from time to time.

However, it has been only within the last thirty years that the theory of focal infection has received wide recognition and its development has been concomitant with the science of bacteriology. The impetus for the prominence which this theory has received apparently was supplied by the publications of Frank Billings and his associated clinicians and laboratory technicians beginning in 1912.

Immediately this theory was grasped by the medical profession in the hope that many of the obscure conditions it had been treating unsuccessfully would be relieved by the removal of localized infection. Many in the dental profession were amenable to the exploitation of this theory because of a dislike for performing careful root canal therapy and because a fee standard has never been developed commensurate with the value of the service when it is properly rendered.

Early reports concerning the clinical application of the theory were optimistic. But as time passed the professions learned that the elimination of suspected foci was not the panacea that was originally hoped and caution has become prominent in diagnosing foci and in predicting the result of their removal. Numerous articles in recent medical and dental literature illustrate this change in attitude.

In 1927, Cecil¹, who is Head of the Department of Medicine at Cornell Medical College, and one of the country's authorities on arthritis, reported on two hundred cases of rheumatoid arthritis in which foci of infection were suspected, were found and were treated; thirty-three per cent had teeth as suspected foci. He asserted at that time that sixty-two per cent of the patients were benefited by surgical treatment particularly by the removal of teeth and tonsils, especially if the foci were removed soon after the onset of the arthritic condition. In 1937, ten years later, Cecil² made a report on two hundred additional cases of arthritis which had been treated by the removal of suspected foci and he stated that there was little appreciable benefit from the surgical procedure. Tonsils were or had been removed in ninety-two of the two hundred cases and no benefit was obtained in eighty-six; four showed temporary benefit and two had exacerbation of the arthritic condition; fifty-two of the two hundred had been treated by the removal of teeth, some to the extent of full mouth extractions; forty-seven were not benefited, two showed temporary improvement and three exhibited exacerbations.

Consequently, Cecil is of the opinion that the whole subject of focal infec-

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Consequently, Cecil is of the opinion that the whole subject of focal infec-

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tion should be carefully analyzed and he doubts the wisdom of the removal of apparently sound teeth to relieve joint and muscular disturbances and other diseases of the focal infectious order just because the teeth are pulpless. He does believe that grossly infected teeth and tonsils should be eliminated. I have heard Cecil lecture on this subject and when he was asked to explain the difference in his attitude and in his findings as reported in 1937 compared to those in 1927, he frankly stated that he was too enthusiastic and hopeful in his earlier report. He said that there did seem to be a temporary benefit enjoyed by many of the individuals for whom teeth and tonsils had been removed that lasted for a short time following the operations, but that after several months of observation the patients were complaining of the same symptoms they had had prior to the treatment. He believes too that there is usually a certain psychological benefit which results from a surgical operation, that patients seem to feel better whether or not they are actually benefited and that after this psychological effect has worn off they again suffer from their original complaint.

Reimann and Havens³ have made a critical appraisal of the evidence concerning the relation between focal infection and systemic disease. They point out that many authorities do not accept clinical improvement following tooth extraction as necessarily proof that the tooth was the cause of systemic illness; that while such improvement does suggest an etiologic relationship, it by no means proves it. Verhoeff has said according to Reimann and Havens, "Belief in focal infection must be taken like religion, on faith." Also Broderick states that more often the operation does not result in improvement, and Bauer found in a series of three hundred cases that those who were not subjected to operation did better than those for whom teeth were

removed. Results such as these are probably numerous but are not often reported; it is the startling recoveries that get the interest and not the failures and mistakes in diagnosis that are published.

Reimann and Havens review the opinions of a number who have studied the problem during the last twenty-five years and they conclude that the routine extraction of teeth and tonsillectomy for preventing or curing disease has not been justified and the concept of focal infection in this respect is not an established fact. They comment that there is no more justification for the removal of chronically infected teeth than there is for the removal of the primary focus of tuberculosis, tularemia and other chronic infections with which surgeons have long since ceased to tamper.

They point out that incidence of general or systemic infection resulting from acute or chronic infections of the teeth or tonsils may be no greater than similar infections resulting from urethral gonorrhoea, by which less than one per cent of patients are afflicted.

They bring out the fact that there is no constancy in the relationship between infected foci and other disease. Many patients with chronic arthritis, "rheumatic pains," or acute rheumatic fever have no demonstrable area of focal infection, and conversely many persons with known chronic periapical inflammation do not have evident systemic disease.

Reimann and Havens in their thought provoking review state that many patients with arthritis or other rheumatic-like pains are often subnormal, and as a result the teeth, the tonsils, and perhaps many other tissues and organs are adversely affected or become infected or at least infected appearing as a result of diminished resistance. In other words, the dental disease is the result of, rather than the cause of, the debilitated condition of the patient.

While the status of the pulpless tooth still is controversial, it is apparent that a more conservative attitude is developing. Dentists, more than anyone else, appreciate the value of natural teeth and should welcome this change in thinking.

Undoubtedly, the most severe indictment of pulpless teeth during the past thirty years has come from bacteriologic investigations. Bacteriologists have studied extensively the presence and types of bacteria in the apical region of pulpless teeth as related to systemic disorders. The evidence they have obtained has been used most vigorously in condemning all root filled teeth. However, in the light of further analysis and newer knowledge, as pointed out by Grossman⁴ much of the bacteriologic work will have to be reconsidered and the results re-evaluated.

Prominent in the bacteriologic studies have been the work of Rosenow, Hayden, and Rhoades and Dick which were made principally on the apices of teeth cultured after extraction. Many positive cultures were obtained. At the Dental Centenary celebration in Baltimore, Rosenow⁵ gave a lengthy review of focal infection and elective localization and he summed up the results of cultures obtained from teeth by different investigators including himself as follows: eighty per cent of the cultures obtained from the apices of pulpless teeth with and without apical involvement in the radiogram were positive. However, 1,007 teeth with vital pulps radiographically negative, which were used as controls, gave fifty per cent positive cultures. The high percentage of positive cultures from the vital control teeth must be considered in a large measure the result of contamination, not infection, and the source at least in studies of extracted teeth is perhaps the highly contaminated gingival crevice.

Grossman⁴ contends that there exists

the same opportunity for the contamination of pulpless teeth in the extracting process that there is for teeth with vital pulps. We believe perhaps more so because usually they require more time and manipulation in their removal. Thus, approximately fifty per cent of positive cultures from extracted pulpless teeth can be considered the result of contamination and not the result of infection. The difference between this number and the total number of positive cultures is only fifty per cent; this is a more accurate estimate of the number of pulpless teeth that are actually infected than the eighty per cent which a casual check of Rosenow's tabulation might indicate. Yet Rosenow concludes in his centenary paper that "Vital teeth free from pyorrhea and fillings should never be extracted except as it becomes necessary for restorative work, but the extraction of pulpless teeth seems to me to be indicated wholly regardless of the appearance of the roentgenograms."

Rhoades and Dick⁶ made a quantitative study of the number of bacteria that could be obtained from the apices of teeth following extraction. Twenty-nine pulpless teeth which were radiographically negative and fourteen control teeth with vital pulps were carefully removed and cultured. All of the pulpless teeth gave positive growths but so did all of the vital teeth with one exception. These results certainly indicate the difficulty of extracting any tooth without contaminating the apical tissues. However, the number of bacteria which Rhoades and Dick grew from the pulpless teeth averaged much higher than the number from the vital ones, the average for the pulpless being 759,574 while the vital averaged 1,876. But the averaged counts are not a fair comparison. The increase in the counts obtained from the pulpless apices was due principally to high counts from only seven of the twenty-nine teeth. Actually

thirteen, almost half, of the pulpless teeth gave lower counts than did the vital tooth which gave the highest count. No mention is made as to how well or how long the root canals were filled. The comparison is unfair in another respect, that is in the type of teeth used for culture. Fourteen of the pulpless teeth were molars, twelve were bicuspid and only three were anteriors. On the other hand nine of the vital control teeth were anteriors, two were bicuspid and only three were molars. The pulpless teeth which gave the highest counts were all molars. Dentists are aware that the extraction time and the possibilities for contamination are much greater in molar teeth than they are in anteriors. Yet Rhoades and Dick conclude from this evidence that "it seems justifiable to regard all pulpless teeth as probable foci of infection whether they show apical changes in the roentgenograms or not."

Another investigation which makes the significance of positive cultures from the apical region all the more confusing is that which Burket⁷ performed on autopsy material. Previous studies had shown that postmortem bacterial cultures are not altered appreciably for twenty-four to seventy-two hours, if the bodies are kept at 10°C. Sections of jaws were removed from bodies so maintained. They were radiographed and suitable areas selected for study. The buccal mucosa was sterilized with an alcoholic iodine solution and then the apical region was approached in the usual surgical manner with sterile instruments. The apical material when obtained was cultured in suitable media. By this method, seventy-two per cent of the pulpless teeth gave positive cultures, but so did forty-three per cent of the teeth with normal pulps. The difference between the two groups is again thirty per cent which perhaps is the number of actually infected pulpless teeth. Burket states that the exact

explanation for the mode of ingress of these organisms to the periapical tissue of non-carious teeth remains for further study. The organisms most frequently cultured were the streptococci and they were in the same proportion to other types of bacteria that Hayden and various others found.

It is difficult to account for the presence of bacteria in the pulp tissue and periapical region of normal teeth. Some believe that in extracted teeth it is due to the bacteremia which frequently results during the manipulation of the tooth as demonstrated by Okell and Elliot⁸, Fish and MacLean⁹, Burket and Burns¹⁰, Northrop and Crowley¹¹, and others. As the forceps or elevator used in extraction passes over the gingival third of the tooth and enters the gingival crevice, and as the blood vessels in the gingival tissues are ruptured, bacteria from this region may be forced or pumped into the blood stream resulting in positive blood cultures. Perhaps if the extracting process is prolonged some of the positive pulp canal cultures may result from this source. Another possibility is the contamination of the pulp by aspiration of contaminated fluid from the gingival region as the tooth is removed from the alveolus. Supposedly a negative pressure is produced in the root canal as the tooth breaks loose from its attachment. Kanner¹² showed that when extracted teeth with normal pulps were exposed to a bacterial culture in a test tube in a reduced atmospheric pressure, bacteria invaded the pulp for some distance when the pressure was returned to normal.

Bacteriologists and clinicians in general will agree that the most reliable method for culturing the apical region is by the external approach, that is either through a window in the gum tissue and alveolar process such as Burket used, or by aspirating periapical material by the trocar and canula method. The latter has been employed by

Coriell, Grossman, and Bernier, but the difficulty encountered with it is definitely determining the area from which the material is being obtained at the time of its removal. Negative cultures may be taken to indicate that the infected area was not reached.

The method of choice would seem to be that of root resection. One of the earliest reports on this type was made by Garvin¹³ published in 1919. Three teeth which had had their root ends resected previously were found to have no evidence of periapical pathology in the radiogram while another did show bone changes. Upon reopening these areas and culturing the root ends, no growth was obtained from any one of the four. However, two others showing periapical bone changes were similarly cultured and gave positive growths. These results indicated to Garvin that the four teeth giving negative cultures must have been bacteria free or positive cultures would have been obtained.

In 1921, Berwick¹⁴ described the results he obtained in culturing seventy-one teeth by the window method. All these teeth showed periapical involvement radiographically. Nine cases or more than ten per cent gave no growth. Three of the negative cultures were from large necrotic areas, four from cysts, and two from areas that showed definite thickening of the periapical tissue. Berwick stated that his results proved material can be taken from the periapical region, without contamination by the external approach, and showed that all altered areas in the periapical region as evidenced by the radiogram are not infected.

Other reports have appeared in which the window technic was used, but the teeth cultured were invariably those showing root end involvement. We have been using the root resection method at the University of Illinois to study the bacteriologic condition of radiographically normal pulpless teeth.

The work has been done with the cooperation of Dr. Henry Droba of the Oral Surgery Department. The tooth to be studied must be one suitable for root resection which means that invariably it is an anterior and two radiograms from different angles must indicate that the root end is normal. The field of operation is isolated with cotton rolls and the mucous membrane is painted with an antiseptic solution, usually tincture of iodine. After the solution has dried a culture is made of the mucosa surface by rubbing it with a platinum wire loop moistened with culture medium. A curved incision is then made gingival to the apical region, and the periosteum pushed away from the bone over the apical region by periosteal elevators. A culture is then taken of the surface of the bone employing the same technic used for the mucosa. These cultures are made as a check on the possible introduction of bacteria from the surface epithelium. The labial plate of bone then is removed and with a sharp chisel or a taper fissure bur the apex of the tooth is severed from the root. It is then transferred to a mortar and pestle which has been sterilized by autoclaving, and which is especially designed for crushing the apex under sterile conditions. The crusher operates on the screw principle. The mortar is securely held in a vise and the pestle is screwed down firmly with a wrench. The apex can be crushed and pressed out into a thin slab of tissue. After the apex is crushed, it is kept in the mortar, the pestle is removed and 1.5 cc. of nutrient broth is added to the mortar. The pestle is then placed in the mortar and screwed down until the end approaches the top of the broth. Then the mortar is securely fastened in a motor driven shaking machine and vigorously shaken for five minutes. The purpose is to extract and suspend the contents of the crushed apex. Inoculations are made from this suspen-

sion to suitable types of culture media for the growth of both aerobic and anaerobic bacteria. Brain broth and blood agar have been used. Spray dishes were used for the anaerobic blood plates.

I am sure the difficulty which we encounter in obtaining patients with radiographically negative upper anterior pulpless teeth which are to be extracted can be readily understood. As a rule, when teeth are negative radiographically they are not indicated for extraction and patients do not like to part with them. If it is necessary for some reason to extract the tooth, there then comes the problem of obtaining the patient's permission to have the root resected before the extraction is made. We have, however, been fortunate so far in securing twelve cases to culture by this method. In every instance, the apical tissues were found to be sterile—at least no bacteria were grown on the various medias employed. If these teeth had been extracted and cultured in the usual manner, we believe that we would have obtained some positive cultures resulting from contamination.

We have cultured also two periapically involved teeth by this method as a check on our technic. One of them gave no growth similar to the findings of Berwick while the other developed numerous bacterial colonies of non-hemolytic streptococci.

We realize that twelve cases is entirely too small a number to be of much significance and we hope to add many more to the series. We invite the cooperation of any members of this society who are practicing in the Chicago area and who have patients who would lend themselves to this study. A search may be underway in such patients for a focus of infection and if a pulpless anterior tooth is under suspicion, the root end could be resected and cultured before the decision in regard to extraction is made. If nega-

tive cultures result, the tooth could be retained.

Summary

1. The more recent medical and dental literature indicates that the pulpless tooth is not the menace to health that it was deemed to be twenty years ago and focal infection is still a controversial theory.

2. Bacteriologic studies of extracted pulpless teeth are unreliable in determining whether or not the apical tissues are infected.

3. Preliminary bacteriologic studies of radiographically sound pulpless teeth made with the tooth *in situ* indicate that the incidence of infection is certainly not high.

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Discussing the merits of a new 'scientific' book, a reviewer praised it for containing so many original and so many good ideas. "The only pity is that the good ideas aren't original and the original ones aren't good!" he added.

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