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By Joseph H. Nicolson, D.D.S.

I HAVE been invited to speak to you this morning, ladies and gentlemen, on the integration of dentistry into the general scheme of public health. It has been suggested that the matter be treated in a general way. I shall, therefore, take full advantage of the latitude given me.

Twenty years ago Dr. Chas. H. Mayo made the following statement: "The next great step in medical progress, in the line of preventive medicine, should be made by the dentists." What a challenge from a man of such distinction! But, as if that were not enough, he added the query, "Will they do it?" These words have been echoed, and re-echoed, within our ranks these twenty years, and have burned like hot coals into the hearts of all men with pride and ambition, for, truth to tell, we were taken off guard; we had fallen into a rut. But a new day has dawned. It is a new dentistry with which you are now confronted. It no longer pins its faith upon technical and artistic excellence, worthy though these may be, and necessary to the achievement of its higher ends. Grounded now on a broader foundation, and, having caught a wider vision, dentistry is going forward with faith in its greater destiny, looking to the health of the people as the main object of endeavour. Hear what the late President Elliot of Harvard University had to say about the matter. "The greatly improved standing of the dental profession among the professions * * * is one of the most striking changes in public opinion that I have witnessed during my seventy years of observation of educational progress. * * * I do not think I have seen, during my seventy years of observation of the professions, and the means of training them, any change so great as that which has taken place in regard to the dental profession, and to the means of training dentists."

Now, what are the reasons for this rapid change; why this new outlook? A new idea had to be born to bring about so spectacular a change. But new ideas must have time to be conceived, to quicken, to be born, and to have a voice; and often it is a voice that cries in the wilderness. Take, for example, the idea of the mouth as a focus of infection. Hippocrates, the father of medicine, no doubt had a glimpse of it. He made

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numerous observations on the relationship of sound teeth to good health, and he is said to have extracted teeth to relieve rheumatism. In 1801, or thereabouts, Dr. Benjamin Rush wrote, "I have been made happy by discovering that I have only added to the observations of other physicians in pointing out a connection between the extraction of decayed, and diseased teeth, and the cure of general diseases." Yet, after one hundred and thirty years, this fact is accorded only an academic interest by some, who are engaged in the business of healing, in spite of its having been rediscovered again and again.

W. D. Miller, an American dentist who practised in Berlin, takes a leading place among the pioneers of the "New Dentistry." In 1891, he published a series of original communications in the Dental Cosmos, as follows: September, "The Human Mouth as a Focus of Infection," with thirty illustrations; October, "The Pathogenic Mouth Bacteria," with twenty-three illustrations; and November, "Prophylaxis," calling the attention to measures for the control of diseases, which he had indicated as resulting from the oral flora. In 1899, he published a book entitled "Micro-organisms of the Human Mouth." In February, 1891, in an article entitled "Bacteriology as a part of the Dental Curriculum," he gave an outline of what he thought a dental student should know about this subject. Miller wrought well. His views are accepted even now, with some modifications in keeping with recent investigations. It was on the basis of Miller's researches that G. V. Black was able to elevate operative dentistry from chaotic empiricism to the status of a legitimate science. Before Black gave his monumental work to dentistry, the filling of carious teeth amounted simply to the "plugging of holes," a procedure analogous, in medicine, to the treatment of diseases upon the basis of symptoms only. Cavities are now prepared for filling in an orderly, scientific manner, and the operation is predicated upon biologic principles.

Sir William Hunter, an English physician, was destined to burn into the consciousness of his confreres the truths which Miller had in some degree held up to his dental colleagues just twenty years before. In January, 1911, he published in the *Lancet,* one of the leading medical periodicals of Great Britain, an article which literally brought the medical and dental professions to their feet. With your indulgence I shall quote a portion of Hunter's article: "In my clinical experience septic infection is, without exception, the most prevalent infection operating in medicine and a most important and prevalent cause and complication of many medical diseases. Its ill effects are widespread, and, extend to all systems of the body. The relations between the effects, and the sepsis that

causes them, are constantly overlooked, for the chief seat of that sepsis is in the mouth; and the sepsis itself, when noted, is erroneously regarded as the results of various conditions of ill health with which it is associated, not, (as it really is), as an important cause of complication."

"The casual connection between the two sets of processes—the sepsis and its ill effects—can be demonstrated by the simple expedient of removing the sepsis and noting the striking effects which the removal has upon the existence, character and intensity of the ill effects. The ill effects referred to include every one of the diseases included in the foregoing sections, and regarded as strictly medical in character, viz.: the general ill health; dirty, sallow complexions; the indigestions; the gastric and intestinal troubles; the anemias which resist treatment; tonsillitic, pharyngeal, and glandular troubles of children; chronic rheumatisms; obscure fevers and blood poisonings, etc."

The clinical observations of Hunter and others, in England, have been verified by an army of laboratory investigators in this country, and they have pushed their inquiry far beyond the limits reached by Hunter. Among these investigators Billings and Rosenow, and, more recently, Russell L. Hayden, should be especially mentioned. They have taken the theory of focal infection out of the speculative realm, and have made for it a place in the orthodox doctrines of medicine. As to the manner in which this and other matters have reacted on dental education, you may judge for yourselves from daily contact with dental students. You are witnesses to what is required of them.

It is only on terms of equality in the ministry of healing that dentistry can do the greatest good. The dentist is just as competent in his particular field as is the physician in the field of internal medicine, or is the surgeon, or is any member of the constellation of specialties into which statutory medicine has been split up, to meet the ever increasing demand for efficiency in restricted fields; and, be it remembered that this tendency to specialization is not absent, even in the specialized field of dentistry itself. We have the oral surgeon whose designation explains itself. The orthodontist restricts his activities to the correction of dento-facial deformities. The periodontologist treats that conglomeration of pathological complexes known commonly as pyorrhea; and we also have the dental pediatrician, the specialists in the various forms of restorative dentistry, the radiologist and diagnostician, and others. Now, if the complexities of dental practice warrant this degree of specialization, and, assuming that dentists are men of ordinary intelligence, the medical man should, after satisfying himself as to the qualification of his dental collaborator,

repose in him the same confidence in consultation as he would in any other specialist.

The traditions of medicine are rooted in the ages of antiquity. They spring from the bosom of religion itself, and give to the physician an influence over the common people that is hardly surpassed by that of the priest. His word is respected in all matters pertaining to his immediate sphere of activity, and in many matters outside his sphere. The possession of such influence should inspire, in a wise man, a feeling of circumspection. He should know also his limitations, lest, by commission or omission, he jeopardize the rights of others.

The tissues of the teeth are, in structure and in function, unlike the tissues found in other parts of the body. The articulation of the teeth, with their supporting bony tissues, belong to a distinct anatomical classification. The pathology of this assemblage is a special pathology, and, it is upon this basis that dentistry has developed a character of its own among the specialties of the healing art. It seems reasonable, therefore, that, unless a physician is specially trained in dental physiology and pathology, he would do well to restrain himself from attempting any diagnosis, prognosis, or treatment in this field when the services of a competent dentist are available. Any transgression in this particular is subversive to the best interests of the public and harmful to the prestige of the medical profession. In all cases the physician should, of course, make a careful inspection of the oral cavity as a part of the physical examination of his patient, but he should remember that the most significant dento-alveolar lesions are usually without symptoms, and can only be diagnosed by a roentgenogram interpreted in the light of a very careful clinical examination. Indeed, some of the most dangerous foci of infection are negative even to the roentgen-ray and must be judged by circumstantial evidence, dentist and physician acting as jury.

Not infrequently the family physician is the first called to treat a complication, or imaginary complication, arising from a dental operation. His plain duty in such a situation is to communicate at once with the dentist. He may, with propriety, administer such general remedies as may be conducive to the comfort of the patient, or, for relief of symptoms of a constitutional nature. Any interference with the field of operation, when the services of a dental surgeon are within reach, presumes a superior knowledge of the case, on the part of the doctor. A number of cases have come under my observation in which an ordinary office case has developed into a hospital case because some well-meaning, if not well-

thinking, family doctor advised a hot poultice where cold packs were indicated.

Taking into consideration the complexity of the mouth as an organic unit, its wealth of pathogenic organisms, the impossibility of operating under aseptic conditions, its intimate connection with vital structures, the vast number of difficult operations that are performed daily and the infrequency of accidents connected therewith, one cannot escape the conviction that dentists as a class are worthy of their charge. But they are a modest lot; they lay no claim to greatness. The fact that they discovered anaesthesia does not make them proud. While Lister and Pasteur have found their place among the immortals, Morton and Wells, the fathers of anaesthesia, have been almost forgotten. But their divine art has not been neglected; it has been improved and transformed to meet the needs of all sorts and conditions of men. Medicine should inform itself, or be informed of, the range and safety of anaesthesia and analgesia in dental practice. It is inimical to the public health to perpetuate ancient beliefs, and worn out traditions, relating to dangers that are supposed to inhere in dental service. The physician should lead the people in these matters. Intelligent co-operation should supplant unreasonable dogmatism. The physician, who arbitrarily places a taboo on dental care to a sick person, without consulting the dentist, may be standing in the way of his patient's recovery. I can hardly think of a situation in the practice of medicine in which the dentist may not be able to aid the physician in placing the patient in a more favorable condition by the use of prophylactic, therapeutic, or surgical measures, as the circumstances indicate. And this holds good for pregnant women and bedridden patients as well. In febrile diseases for example, when the patient is "low," and the mouth reeks with decomposing matter and infection, the tide may be turned by hygienic measures skillfully instituted, or serious complications may be prevented thereby. And who is more competent to render this service than the dentist?

In the interest of the public welfare, the physician must take the dentist into his confidence in a larger measure than heretofore. By a closer alliance between these two arms of social science, many valuable lives may be saved through early diagnosis of grave diseases. The dentist occupies a strategic position to serve in this regard for two reasons. First, there are many diseases of an important and serious nature in which the early symptoms appear in the oral cavity, and, inasmuch as some of these diseases are of an infectious or contagious nature, their early diagnosis is of the utmost importance from the standpoint of pub-

lic health. Second, there are certain ambulatory cases, the symptoms of which are so mild as to excite little or no notice on the part of the patient. Frequently, it is the dentist, not the physician, who first sees these patients in his ordinary routine practice.

The old school of dentistry gave inadequate attention to the pathology of the mouth which lay outside of the immediate dental field; medicine has all but missed it. The mouth as a whole has therefore become a sort of "no man's land" to the detriment of public health. The two professions must therefore get together to mend this breach; it is their common meeting ground. The institution of a course in stomatology, designed for medical and dental students in common, would go a long way to bridge this gap. Pending such a happy consummation, dentistry and medicine should bury their supposed difference and pool their resources in this common field of opportunity. While the teeth and maxillary processes are the particular care of dentistry today, the new dentistry envisions the adequate care of the entire oral cavity as its ultimate objective. The idea of dentistry as an oral specialty, in its widest sense, is captivating to the minds of some, and all forward looking dentists feel it a moral obligation to pay some attention to the duties implied in this concept.

A full discussion of the diseases, and symptoms of disease, which the dentist may early recognize and, therefore, play an important role in their successful treatment, or, in preventing their spread among the people would, no doubt, occupy a large volume. By way of illustration I shall mention a few.

Measles. Koplick's Spots appear in the mouth from two to five days before the skin eruption. These are bluish white specks surrounded by a bright red ring; they are located on the mucuous membrane of the cheek at the level of the first molar teeth. At first, one or two appear, later they cover the entire mucuous membrane of the mouth, which becomes swollen, bluish red, and lusterless.

Scarlet Fever. The mouth is involved early, as in measles. The first symptom is a sore throat. The mucuous membrane becomes necrotic and is replaced by scabs. The tongue is dry and fissured and bleeds easily, the blood forming black crusts, which later peel off leaving the papillae red and swollen.

Typhoid Fever. The mouth is early involved. The tongue is heavily furred, grayish yellow in color, bright red at the sides. The dorsum also presents a bright red triangular area.

Mumps. Patients frequently seek the dentist first, in the belief that an abcessed tooth is responsible for their trouble, because of swelling of the cheek and difficulty of opening the mouth.

Smallpox (*Variola*). The mucuous mebrane of the mouth is sometimes involved in the prodromal period of this dread disease. Vesicles appear which burst and form ulcers. These may spread and unite, producing a severe stomatitis with salivation.

Chickenpox (*Varialla*). Small vesicles surrounded by a red area may appear on the mucuous membrane of the hard palate before the rash develops.

Syphilis. The mouth is frequently the seat of a primary lesion. Secondary and tertiary lesions are common. The teeth may show evidences of congenital syphilis.

Leukemia. Mouth symptoms appear early and are prominent throughout the course of the disease. The gums are hemorrhagic, swollen, and ulcerated and may even become gangrenous. Hemorrhagic spots appear in the mucous membrane of the lips and cheek.

Mercurial poisoning. The teeth are tender and raised in their sockets, the gingivae are inflamed and ulcerated, the breath foul, salivation is profuse. The patient complains of a metallic taste.

Lead poisoning is becoming common from the practice of dyeing the hair with lead compounds. The mouth symptoms are similar to those of mercurialism, but the taste is sweetish and the breath has a peculiar odor. Bluish black granules of lead sulphide are deposited near the gingival crests.

Vincent's Disease (*Fuso-spirillary infection of Vincentini*) *usually* makes its apperance first in the gums around the teeth. It may spread to the fauces and be mistaken for diphtheria.

Cancer (*Carcinomata*) and other malignant diseases of the mouth take a considerable toll of human life. Inasmuch as they are usually the result of dental irritation due to neglect, the dentist may play an important part in their prevention or early diagnosis, when they may be successfully treated.

Oral infections of the dento-alveolar type are accomplished principally by the following routes: (1) Through a break in the hard tissues of the teeth (enamel and dentine, or cementum and dentine), or, (2) Through a break in the investing tissues of the teeth, beginning at the gingival margin, or, through pockets formed by partially erupted or impacted teeth.

The lesions of the first group, which are usually the result of dental caries, comprise the most prevalent disease found in man. It is estimated that 97 per cent of the people of this country are victims of dental decay. So common is this disease, that, it has come to be regarded with a tolerance that is beyond comprehension among a people who have made such notable advances in the sciences that promote health. An intelligent person looks with alarm upon a break in the skin or in other visible defenses of the body. A scratch sends one off in search of suitable antiseptics. We are informed by competent authority that a defective tooth is an open wound; yet we regard with composure the sight of the teeth of our children literally rotting away by the millions. Now let us consider the effect of dental decay (caries) upon the health of the people. A cavity appears upon a tooth; it goes untreated. The enamel is gradually dissolved by the products of acid forming bacteria; the dentin is reached. This tubular structure with its rich organic matrix is a veritable paradise for the growth of micro-organisms, and it is quickly reduced to a hyaline mass. The pulp is reached; sooner or later it dies, either from irritation, or by direct invasion. Even before this event an open route has been established to the investing tissue at the apex. If an acute infection has not yet occurred, with all its potentialities for sickness and death, chronicity supervenes; the periapical bone is gradually absorbed and replaced by granulation tissue (granuloma). This may, in some measure, be regarded as a means of defense, but a potential focus of infection none the less. On the other hand distant organs of the body may have long since been infected, or their efficiency impaired, by bacteria floating through the blood or lymph, or by their toxins absorbed through these fluids. Driven by pain or discomfort, the patient may seek the dentist at this stage, and the tooth is extracted. But what of the secondary foci that, perhaps, have been established during the months or years through which he has been exposed to infection?

By far the greatest number of diseases of the investing tissues of the teeth are due to neglect in one form or another and are therefore preventable. Mutilation of the masticating machine by extraction of teeth and failure to replace them early may bring about overloading of those that remain, or, more frequently, a perversion of function, with consequent trauma, due to an unbalancing of the reciprocal relationship of each tooth to its neighbor, or its antagonist. This results in lowered tissue resistance and predisposes to infection. Lack of oral hygiene is perhaps the most fruitful source of peridental disease. Primitive people, in whom metabolic conditions are usually at their best, may enjoy good

oral health with little or no attention, but, exposed as we are to the vitiating influences of indoor life and dietary abuses, artificial means must be used to rid teeth of concretions of foreign matter with their bacterial growth. These produce disease in several ways: by pressure upon the soft tissues obstructing the circulation, by mechanical damage to the surface epithelium, by providing food and shelter for pathogenic organisms which first attack the gums and membranes of the teeth, and finally, by continuity of tissue, the bone of the alveolar process is invaded. This form of peridental disease is extremely chronic and may go on for decades, without notice, until the work of destruction is complete. Frequently a tooth, the third molar in particular, in the course of its eruption, becomes obstructed by the tooth anterior to it, due to a lack of development in the maxillary bones. This is known as an impacted tooth. Impacted teeth may be the seat of serious disturbances of the nervous system, as a result of pressure, and may be overlooked in a clinical examination, because, in most cases, they are completely covered by bone and soft tissue. Sometimes they are partially erupted, having a pocket around the covered portion of the crown, which forms an ideal focus for the propagation of pathogenic micro-organisms. Occasionally, they become the seat of a fulminating infection in the floor of the mouth known in surgery as Ludwig's Angina, the mortality from which is exceedingly high. The gum flap which overlies the partially erupted third molar is frequently subjected to traumatic injury from a tooth in the opposite arch. This not only invites painful inflammations and trismus, but, occasionally, leads to a malignant neoplasm, sarcoma in the young and carcinoma in those of mature years. For these reasons it has been suggested that more attention be given to the early diagnosis and removal of impacted third molars as a prophylactic measure. They may be removed with comparative ease before the roots are fully formed; later, the operation is attended with great difficulty. Occasionally, a set of sound teeth, well cared for, and functionally normal, may suddenly develop widespread disease of the investing membrane with atrophy of the supporting bony process. This sometimes occurs in pregnancy, and in grave systematic diseases.

Having discussed some of the common types of dento-alveolar infections, let us consider more specifically their effect upon the health of the people.

The acute dento-alveolar abscess is one of the most striking expressions of dental disease. The alveolar periosteum is early involved and may be stripped from the bone by inflammatory exudates over a considerable

area. The cortex of the bone is thus exposed to infection and necrosis, which is a not uncommon complication. In the lower jaw the floor of the mouth may be involved in a cellulitis with a fatal termination. Occasionally, an abscessed tooth is the seat of an osteomyelitis of the entire lower jaw. An acutely infected upper bicuspid or molar tooth may pour its exudates into the maxillary sinus. A very large percentage of maxillary sinusites are brought about in this way. Thromboses of the cavernus sinus, usually fatal, resulting from acute abscesses in upper anterior teeth have been reported. When the acute symptoms of an alveolar abscess have subsided, a chronic focus is established. A tooth may, however, become chronically abscessed without passing through the acute stage. The patient may thus be unaware of the danger.

When a focus of infection has been established at the apex of a tooth, let us say, it may become encapsulated so that the infecting organisms do not migrate, but they may elaborate toxins, which are absorbed by the body fluids, and produce a general lowered resistance and ill health. Sometimes the organisms are directly dissipated into the circulation and find lodgment in some organ favorable for their growth. A secondary focus is thus set up in the organ, which becomes diseased. With the removal of the primary focus, the disease in the secondary focus may or may not disappear. Patients who suffer from metastatic infection from diseased teeth usually exhibit an exacerbation of symptoms upon the extraction of these teeth. It is considered that, in this way, the bodily defenses are stimulated to overcome the infection.

As a complement to the quotations from Hunter, which you heard in the introductory part of this essay, and, to close the brief discussion of the relationship of dental infections to systemic diseases, permit me to quote from the work of Dr. Russell L. Hayden in this field, which is the result of six years of patient labor, in which clinical work was checked by laboratory experimentation in all the cases he reported.

"In summary, it may be stated that there are few tissues in the human body in which bacteria from a dental focus may not localize. Clinically, only a small number are commonly found affected. The incidence of involvement, as observed in clinical work, checks closely with the incidence of lesions as found in the experimental animal after intravenous inoculation with organisms recovered from dental foci. The lesions most frequently seen in patients due to focal infection are those of the locomotor system. The kidney, heart, stomach, duodenum and eye are often affected. Less commonly, other organs such as the nervous system and blood building tissues may be involved. Rarely, very unusual lesions, such as onychia or thyroid disease, may result from dental infection."

A presentation of this kind, coming as it does, at the end of a series on preventive medicine and public health, would not be complete without a word on *prevention.* The majority of our people harbor some dental focus of infection; some will attain their allotted three score years and ten without any apparent harm; some will be more or less handicapped, experiencing minor disability from time to time; while others will become permanently cripples, or their span of life may be shortened. The best prevention of focal infection is, of course, to prohibit the development of foci of infection, or to run them down and destroy them. But neither of these two alternatives is as simple as it sounds. Let us consider the second.

The elimination of dental foci should bring into play broad vision and sympathetic understanding on the part of both the dentist and the physician, each giving due consideration to the problems of the other. All the available facts bearing on the case, both local and systemic, should be assembled for mutual study. It should be remembered that, although the teeth are the most frequent source of focal infection, the tonsils, sinuses, gall bladder, and prostate follow in frequency, in the order named. Since the teeth are so easily accessible for examination, they are the first to come under suspicion. Not infrequently, patients suffering from some obscure systemic disease become the victims of unnecessary dental operations, on "doctors' orders," after a superficial physical examination, and find themselves twice crippled. Yea, the last state of the man becomes worse than the first. But let it be granted that all other sources of focal infection are excluded, and the evidence points to the teeth without the shadow of a doubt. Even here, problems of the most perplexing nature may arise. Are the organic changes in the body beyond repair? Is the patient old and decrepit? Will he be able to adjust himself mentally and physically to the anatomical alterations incident to the operations involved, or to the dental appliances for their correction?

This brings us to the conclusion of the whole matter. Man was undoubtedly intended by nature to keep his teeth throughout the normal span of life, but we have gone astray from the simple laws of nature through ignorance, greed and commercialism; we are now reaping our reward of disease and malnutrition, as is manifest in universal dental disease.

When Captain Cook first visited the Hawaiian Islands he found a prolific and healthy people with fine physique and magnificent teeth. With the impact of western civilization and the introduction of foreign refined foods, the natives of these islands abandoned their simple way

of living and have dwindled to a degenerate minority. Now their infants are afflicted with a "malignant" form of dental decay, which literally dissolves the teeth of the babies as soon as they erupt; and this in spite of the fact that the babies were breast fed and received the classical supplements thought necessary for the building of healthy teeth and bone. As soon as the mothers and babies were put on the simple fare of their ancestors, consisting of sweet potato and taro, all went well and the infant mortality rate dropped from 160.7 in 1929 to 25.4 in 1932. The inhabitants of the lonely island of Tristan de Cunha, in the mid-Atlantic between Africa and South America, subsist on fish, milk, potatoes, and other vegetables grown on the spot, and they are relatively immune to dental decay. The Eskimo lives on an animal diet exclusively; he also is immune, but as soon as he moves to the white man's settlement that immunity is lost.

These and other instances seem to point to the fact that man was intended by nature to gain his subsistence from his native soil and climate, and, that the factor of environment must be given greater consideration in our future dietary studies.

The health of the teeth is closely bound up with the health of the body. Teeth are living organs, deriving their nourishment from the same source as the other organs of the body. The foundations for dentition are laid during the sixth week of fetal life. By birth the crown of the first permanent molar, perhaps the most important tooth from the standpoint of development, has begun to calcify. At three years after birth, the deciduous teeth are completely erupted and the second dentition is well advanced in its calcification. It is evident, therefore, that preventive dentistry, in its widest sense, is not only a problem of the dental profession as now organized, but in its fundamental implications. a greater share of responsibility falls on the shoulders of the obstetrician, the pediatrician and family doctor than is generally realized. Give the child a good start; dentistry will do its part. The foundation for the next great step in dental progress, in the line of preventive dentistry, should be laid by the physicians. Will they do it?