

## CHAPTER XII

### GENERAL VIEWS AND CONCLUSIONS

#### A. VITAL RELATIONSHIPS OF THE TEETH

**T**HE traditional indifference of physicians to the preservation of the teeth, and to the prevention or cure of dental diseases, has long been an anomaly of the practice of medicine. If normal teeth were merely inert masses of stone, like pieces of marble which they outwardly resemble, or if they were devoid of vital coordinations with the tissues that hold them in place, their neglect by medicine might not be difficult to understand. But they are living parts of an animate human body, perform various important functions, and, from infancy to senility, by becoming deficient or undergoing deterioration, may occasion distress, disability, or death. Normal teeth take their positions in the jaws, in the temporary set and then in the superseding permanent series, through long periods of intermittent discomfort and pain, as if Nature herself, by slow and insistent procedures of construction and alignment, were according them unusual attention and care, and giving to each tooth exceptional preparation for the performance of special duties.

That this figurative allusion is not misleading is shown by the variety and significance of the functions of the teeth. The broadest physiological aspects of the processes of dentition are not indicated by the normal outcome, but are more fully revealed by the consequences of abnormal production or disposition of individual teeth, or of groups or sets of teeth, which include such serious local derangements or general disorders as malformation of the skull, disfigurement of the face, disturbance of the senses, impairment of the influence of the nervous system, and maladjustment of various systemic balances. As initial mechanical factors in nutrition, the teeth are useful preliminary agents for its promotion in every part of the body. Mastication prepares solid masses of food for thorough mixture with saliva, for comfortable swallowing, and for ready digestion, and also facilitates ample production and timely delivery of digestive juices. Comeliness of countenance is enhanced or impaired by the processes that develop the dentition or by the condition of the teeth, and speech or song may be seriously modified by loss or imperfection of individual teeth or by irregularity in their positions and adjustments. The tissues in immediate contact with teeth may become disordered or be destroyed, and the affected teeth detached; and fatal diseases may arise in various parts of the body from infections originating in teeth or in the closely surrounding structures. Measured by the diversity and import of these vital relationships, it would seem to be obvious that a policy of health service, whether in private practice or in public administration, that does not include prevention of the developmental abnormalities of the teeth and jaws, or which ignores oral hygiene, or neglects dental maladies, and then indifferently extracts teeth

when they become deficient, cannot be expected to commend itself to enlightened public opinion. Fortunately this disregard in the medical profession is gradually being replaced by serious attention to oral conditions, especially among the physicians who are engaged in public health-service and among their associates, the public-health nurses and teachers acting in their behalf in the field of public-health information, who are giving an increasing amount of attention to the dissemination of knowledge of oral hygiene and to suitable extensions of dentistry. This desirable movement promises to attain its logical development among practitioners of medicine in general when medical schools give to their students suitable instruction in oral hygiene, and in the correlations between clinical medicine and clinical dentistry, and when dental service is accorded its proper place generally in hospitals and dispensaries.

#### B. PREVALENCE OF DENTAL AND ORAL DISORDERS

Dental defects and oral abnormalities never have been more prevalent among civilized peoples than they are to-day, and the consequent need for effectual oral health-service never was more urgent. Malformations of the jaws and ailments of the oral tissues are common. The boy or girl whose teeth are entirely free from caries is unusual; and the young man or woman without decayed teeth, or from whom teeth have not been extracted, or who has not had teeth filled, crowned, or replaced, is very hard to find. At middle age, disease of the tissues that surround the teeth is an accustomed experience; in old age, sound natural teeth are uncommon; and at all ages many persons suffer from infectious disorders that follow admission of germs through deficient dental tissues. The teeth are more frequently affected injuriously, more apt to become defective beyond the possibility of successful curative treatment, and more commonly eliminated by surgical intervention, than any other portions of the body.

The occurrence of dental derangements would be distressingly evident everywhere were it not for the achievements of dentistry in retarding the decay and disintegration of individual teeth or in disguising the effects of their loss. No other tissue or organ can be so effectually repaired or so satisfactorily restored by artificial means, both mechanically and functionally, as a tooth or the teeth collectively. Because the enamel is apparently lifeless and the adjacent dentin very nearly inanimate, these exterior portions of a tooth may be removed and artificially replaced without damage to the rest of its structure and without impairment of the vitality or utility of the tooth as restored. These conditions enable dentistry to achieve its distinctive successes in arresting disorganization of teeth, in artistically replacing defective or destroyed dental structure, and in preserving the remainders. Fully-formed teeth do not appear to produce anything that, passing from them, is useful in any other part of the system, and they do not alter their physiological qualities with age or acquire any vicarious responsibilities. Therefore, since the uses of

the teeth are essentially physical, and their masses and relationships comparatively stable, a variety of substitutes for lost teeth may be fitted comfortably and safely, and made not only functionally adequate but also esthetically superior. Such reconstructions now mask dental deficiencies in an increasing proportion of the population.

The most common of the important bodily defects among civilized peoples is dental caries, which, besides causing disintegration of the affected part of a tooth, may, if it proceeds far enough, also occasion serious or fatal systemic infection. Dentistry is remarkably proficient in delaying the progress of decay, when practitioners are visited early enough to enable them to intervene in time. But, despite the great importance of precluding the initiation of dental decay and the passage of microorganisms through the enamel, neither dentistry nor medicine has learned how to prevent the general incidence of caries, or to halt the advance lines of infection through a decayed tooth, or with certainty to destroy all of the organisms at the apex of an infected root, or to restore the health of the tissues about an apex where an infection has occurred. Dentistry and medicine are also unable to obviate the general occurrence of disease in the tissues that surround the roots of teeth and which, after their degeneration, permit bacteria to pass along the surface toward the apical region, and often cause loosening and loss of teeth. The great need for thorough research, to increase the knowledge of prevention and cure and to strengthen oral health-service in these important relationships, is indicated in Chapter IX and in the succeeding section.

### C. IMPORTANT DEFICIENCIES OF ORAL HEALTH-SERVICE

#### *a. Uncertainty regarding adequate treatment of dental infections*

Owing to the occurrence of contradictory phenomena, the proper treatment of a tooth having an infected pulp and apex presents a series of very perplexing problems. The practice of dentistry and the practice of medicine meet on this common ground, but with conflicting views and contrary procedures. It is believed by physicians generally, and by some dentists also, that a tooth thus affected in any degree is powerless to repel the invading germs, and cannot, by any therapeutic method, be reliably freed therefrom; that the organisms about the apex of a root of such a tooth cannot be destroyed by treatment applied through the root canal; that the unremoved bacteria will continue to be or will become a focus of secondary infection, or a cause of chronic poisoning from products of their activity or from those of the inflammation they induce, and thus may initiate serious or even fatal disease of other parts of the body; and that the only sure way to prevent the development of an impending systemic disturbance is to extract the affected tooth and by suitable supplementary measures to eliminate all of the threatening microorganisms. On the opposite side, it is believed by dentists generally, and by some physicians

also, that infections of a tooth and of the tissues about its roots, *when these tissues have not been destroyed beyond their powers of recuperation*— which it is impossible to predetermine— can usually be completely removed or isolated by suitable operative and therapeutic measures; that as a rule such a tooth, if properly treated, can be rendered non-septic for the rest of the body and restored to usefulness; that its retention after successful treatment does not constitute a menace to the patient's health; and that, under these conditions, if there is no present clinical or roentgenological evidence of injury, extraction of the affected tooth is neither necessary nor desirable to safeguard the welfare of the patient. From every humanitarian point of view it is to be hoped that the more conservative position is wholly correct, but unhappily this disagreement, on a "burning question" in dentistry, is based upon a number of premises on either side that have not been established conclusively by investigation and are rendered more or less dubious by inharmonious clinical evidence.

A few years ago, when oral infection as a cause of disease in distant parts of the body was first given an assured scientific foundation, physicians accepted it eagerly as a possible explanation of many baffling phenomena in their experience, and by free eradication of dental infections sought relief for many of their patients. Unfortunately a large number of physicians, who knew little about dentistry and regarded it disdainfully, themselves undertook to make the diagnosis of oral infection, and peremptorily overruled the judgment of experienced dentists. As a consequence of the confusion resulting from the mistakes of these physicians in their treatment of the dental conditions involved, and from the expressed indignation of many dentists whose experience and understanding had been repudiated, physicians have largely abandoned oral diagnosis. Meanwhile, organized dentistry has failed to conduct the broad, constructive, and judicial research that is necessary for a full solution of this serious practical problem, which, to be successful, requires due recognition of such facts as these:

(a) Dental caries (page 168) and periodontal disease (page 170) open passages for the introduction of bacteria, which commonly destroy the vitality of the pulps ("nerves") in the affected teeth.

(b) The pulp, after its loss of vitality from caries or for any reason— and often before— tends to acquire an infection, which soon extends into the tissue surrounding the apex of the root. This "periapical focus of infection" may or may not cause pain, but its presence can usually be determined.

(c) Diseases of the gums, which as a rule are complicated by infection, run a progressive course, along the root toward the apex.

(d) The infections noted in (b) and (c), which constitute by far the greater number in the mouth, are similar in their essential characteristics to primary infections that occur elsewhere in the body and have analogous secondary effects upon the system.

(e) Extra-oral infections similar to those in the mouth frequently occur in the alimen-

tary canal and in its related parts, such as the appendix and gall bladder; also in the middle ear, nasopharynx, paranasal sinuses, respiratory tract, tonsils, uro-genital passages, and other parts.

(f) Individuals suffering from certain common disorders, such as anemia, arthritis, endocarditis, iritis, malnutrition, myositis, nephritis, neuritis, etc., frequently, although not always, have one or more demonstrable causative or contributive "foci of infection," of which those about teeth are among the most common.

(g) In a large percentage of such maladies (f), complete removal of all existing foci of infection results in improvement or cure; but in many instances the ailments are due to other causes, or complicated by them, and therefore the removal of such foci may have little or no observable remedial effect.

(h) Experimental injection, into animals, of cultures of bacteria recovered from foci of infection in these cases (g) has resulted in the development of disturbances similar to those suffered by the corresponding patients, which some investigators have regarded as direct proof of a causal relationship between the primary foci of infection and the secondary diseases. But the validity of this evidence has been questioned by others, who have not been able to duplicate the results.

(i) It is a common observation that many individuals plainly harbor foci of infection, yet exhibit no other discoverable evidence of disease. This tolerance, although mystically ascribed to "immunity," has not been explained, nor has it been possible to determine, in any patient, when this resistance is about to be diminished or lost, or whether it will continue permanently unimpaired, and why.

(j) Convincing evidence that infection of the dental and periodontal tissues can commonly be eliminated, and that the treated tissues are not specially susceptible to reinfection, has not yet been presented; and it is not certain that infected teeth can usually be restored to a healthy condition and retained to the ultimate advantage of the patient.

Removal of the ignorance and uncertainty that encourage the differences of opinion noted above is a task that is worthy of the united efforts of able representatives of dentistry and of medicine. Thorough and complete basic enquiry in this field, through cordial coöperation of qualified investigators, with intent solely to ascertain the whole truth, is one of the most urgent needs of clinical dentistry and of oral medicine. Until the results of research establish the enduring foundations for the treatment of dental infections that will enable dentistry and medicine to agree on both facts and procedures, dentists and physicians cannot render scientific service in this important aspect of their duty, and dental teachers must remain uncertain regarding essential features of their instruction. In this situation, tragic in its possibilities for many individuals, the serious predicament of the laity should appeal strongly to persons who are able and inclined to endow research for the promotion of health service. Thorough study of this problem under favorable conditions, while humanity awaits the discovery of means to prevent dental infections, promises to

yield results of immediate importance for the relief of thousands in whom infected teeth are objects of present doubt or concern, or are possible causes of progressive or impending systemic disease.

The penetrating researches that are greatly needed in this field of urgent remedial practice, and which could be accomplished most successfully by sympathetic coöperation between workers in associated dental and medical schools in universities having adequate dispensary and hospital facilities, might advantageously be coördinated through enquiry along such avenues as these:<sup>1</sup>

(1) Histo-pathological study of all of the morphological changes that occur in oral tissues through the influence of infection.

(2) Analysis of the efficacy of the various current methods for the growth and detection of microörganisms in oral foci of infection.

(3) Development of such additional media and procedures as may be necessary for the cultivation and isolation of microörganisms that occur in the mouth but which cannot be identified by available methods.

(4) Detection, by the use of improved procedures, of the presence or absence of infection in various suspected regions of the mouth.

(5) Recovery of bacteria from secondary foci, to ascertain whether the organisms belong to the variety found in primary dental foci of the same individual.

(6) Animal experimentation, fully controlled, to discover whether bacteria from primary foci of dental disease are able to produce the same disorder in the subjects of the experiments; and, distinguishing such conditions from those attending actual dental focal infection, a complete reëxamination of the foundations of the theory of "elective localization" as related to oral infection.

(7) Establishment of the relationships between primary and secondary infections by statistical studies of the results obtained in the treatment of secondary disease through the elimination of primary foci, with special reference to oral infections.

(8) Studies, including an examination of hereditary relationships, to determine the nature of the "resistance" observed in many individuals, so that when tolerance to established primary oral infection can be explained, artificial protection may possibly be provided.

(9) Selection, by differential study, of the most reliable treatments of periapical infections to ensure the safe retention of the affected teeth, without disregard for the fact that the mere presence of bacteria that persist after treatment cannot be evidence that the organisms will *certainly* exercise injurious influence, although that *possibility* is implicit in the finding. It is particularly desirable to raise the study of this aspect of the problem to a plane that would put it beyond the reach of partisans of standing commitments, and of the patentees and producers of therapeutic articles now on the market.

<sup>1</sup> These problems of research, like those suggested on pages 167-175, are intended to serve as illustrations only, and do not present a complete program.

(10) Reconsideration of the criteria for justifiable extraction of a tooth, where there is periapical infection and destruction of a portion of the pericementum, with special reference to the capacity of the pericementum — on which the physiological stability of the tooth in the socket depends — to repair its losses and to protect the tooth after the most suitable treatment.

(11) Reinvestigation of the validity of roentgenographic procedures for the detection of oral infections and for the assurance of restoration of healthy conditions after treatment, including specifications of all of the sources and limits of error in the roentgenographic indications.

(12) Reëxamination of the findings on alterations in the character and composition of the blood in patients having focal infections, to determine the validity of current claims that certain changes afford reliable differential diagnostic criteria.

(13) Devisal of reliable tests for the detection of latent susceptibility or hypersensitiveness to dental focal infections.

(14) Determination of the effects of diseases, unhealthy environment, fatigue, malnutrition, abnormal mental states, unusual occupation, pregnancy, etc., on the resistance to secondary ailments that are sequelae of primary dental focal infections.

(15) Invention of simple and reliable ways to detect early signs of the conveyance of microorganisms in lymph and blood to remote parts ("metastatic infection"), and also to distinguish initial symptoms of the absorption of bacterial toxins or of the inflammatory products caused by the local action of microorganisms ("chronic intoxication").

Large financial resources, for the study of these and related problems, if made available through a term of years to an earnest, capable, and coöperative group of dentists, physicians, and trained investigators in the medical sciences, in a leading university, would be potentially one of the most useful benefactions that might be offered to afflicted humanity. Here, of all places on the borderline between dentistry and medicine, in diagnosis and treatment, the need for close coöperation between dentists and physicians is most obvious. To the intelligent layman there appears to be an inherent failure when a physician, without the guidance of expert dental opinion, orders extraction of infected teeth; or when a dentist, without dependence upon the judgment of a physician, retains an infected tooth in a patient showing symptoms of any of the diseases that sometimes result from dental focal infection. No other field in dentistry has been more completely overrun by the pretentious, the gullible, and the ignorant, and none is more in need of accurate and balanced research by experienced and clear-sighted students of pathological problems, who, conscientious and dependable, would state fearlessly the facts discovered in a comprehensive enquiry, under conditions of publication that would not shield influential advertisers of worthless or harmful therapeutic products.

*b. Failure in prevention of dental disorders*

No physical defects are so common in children as those of the teeth. The greatest concern of the dentist in private practice should be the oral health of the largest number of children he might be able to serve. Adequate oral health-service during early childhood may be expected to assure the largest measure of enduring dental health thereafter, yet dentists as a body, with many notable exceptions, have not realized their social and professional obligations to make preventive dentistry for children, by both advisory and operative means, the fundamental purpose of dental practice. Fortunately, however, while dentists awaken to their responsibilities in this regard, oral health-service for children is being gradually extended under public auspices. Although as yet there are comparatively few communities in which public dental work is being done for children, it seems certain, from current demonstrations of the great usefulness of this service, that every well-organized public agency for the supervision of the health of children will soon include "public-health dentistry" in its program. The usefulness of the dental hygienist in this field is indicated in Chapter IV; the urgency of oral health-service for children is considered on pages 79 and 84; and the need for operative intervention, in children's teeth, to prevent initiation or extension of decay, is mentioned on page 166 ("prophylactic odontotomy"). But appreciation of the immediate importance and value of direct corrective measures should not be permitted to disguise the causes of unfavorable biological variations in dentition nor to minimize concern about the earliest possible discovery of all of the conditions of normal dental development and of the causes of its perversion, so that true prevention may be ultimately achieved, if it is not inherently unattainable.

Heretofore the practice of dentistry, exclusive of cleansing and extraction, has consisted chiefly of realignment of teeth, arrest of processes of dental decay and repair of the damages, treatment of dental and periodontal infections, replacement of the main parts of lost teeth, and surgical operations on the jaws and oral tissues. All of these procedures are effectual for the maintenance of the dental functions, and each is an important phase of grateful service for the protection, comfort, and contentment of the patient. Although dentistry has been endeavoring, also, to devise ways and means to prevent dental and oral abnormalities, little has been accomplished beyond the improvement of time-honored methods of cleaning teeth; the application of corrective measures to remove infections and defects or to delay the development of disorders; and extension of the common knowledge that teeth and jaws cannot grow normally in embryo or in childhood, and the surrounding tissues cannot be kept healthy after maturity, on a diet that is insufficient to maintain normal general nutrition. The new information on these aspects of oral hygiene has increased dentistry's ability to postpone the occurrence or to retard the progress of various dental and oral deficiencies, but the goal of true prevention

has not been attained, for these maladies frequently occur in mouths that receive special hygienic and operative attention and in persons whose diet keeps them well nourished.

Over-emphasis on the ideas that "a clean tooth will not decay," and that "a proper diet will ensure perfect teeth" — two very important factors, but not the only essentials in the preventive control of dental and oral abnormalities — has been tending lately to develop illusory views on the nature of the main problems awaiting solution. When, at a given point, a tooth is inherently defective or is abnormally disposed in a manner or to an extent that favors special local action of the ubiquitous microorganisms, and the tooth at that place is thoroughly scrubbed several times a day with dentifrice and brush in the customary manner, requiring even for the most fastidious less than a total of five minutes for any one location, then, however thorough the cleansing operation may be, closure of the mouth and adjustment of the oral parts to their usual contacts ensure immediate return of myriads of active organisms to that surface. Under such conditions, thorough washing of that particular spot could hardly do more than intermittently retard a destructive process that would be bound to continue there to some extent during the remaining twenty-three hours and fifty-five minutes of the day. At a definite position, after microorganisms pass slightly beneath the plane of the enamel surface into the channels there open to their advance, cleansing of the tooth on that area, with brush and dentifrice or other devices in the usual way, cannot dislodge all of the most dangerously situated individual organisms, however smooth the surface over them might seem, or however clean and polished it might appear; and the process of decay would go on there with little or no interruption. There is no known hygienic way to destroy all of the microorganisms in the oral cavity at any time or to prevent the immediate return of myriads of them from the outside; and in any protecting harbors in the mouth, where such organisms grow rapidly in the presence of retained particles or solutions of food, they tend promptly to induce destructive fermentation. Therefore, brushing the teeth is analogous in its sanitary effect to that of bathing the body. These cleansing processes are very desirable for a variety of important hygienic reasons, but neither prevents the development of disorders caused by microorganisms that cannot thus be removed, or that readily regain access to favorable positions during the intervals between the cleansing operations.

To some it appears that ingestion of ample quantities of a balanced diet automatically brings about the production and maintenance of perfect teeth and thereby the prevention of oral abnormality. But there is no evidence to show that a perfect tooth will not decay under oral conditions that favor special bacterial attack upon it, or that ingestion of good food in proper kinds and in sufficient amounts throughout the whole of the period of growth ensures normal formation of anything. Supplies of food, when eaten, are merely subservient units of construction in coördinated processes of building and repair. It is a matter of common observation, to illustrate familiar anomalies, that of two children in a family subsisting on practically the same adequate diet, and eating enough

of each kind of food needed for normal development, one child may grow rapidly and have a large skeleton and excellent teeth, while the other may grow slowly and have a small frame and poor teeth. If good food in the requisite proportions were the only physiological desideratum, such differences among well-fed children would not occur. No one assumes that the way to erect a building is to dig a basement and then unload into it, helter-skelter, all of the stone, brick, mortar, steel, and other necessary materials, in the expectation that these things will put themselves in order. The building rises only when it is erected by workers laboring, more or less faithfully, under directions for the consummation of a plan. When at least the minimum amount of each kind of essential material is available, the building acquires a size, shape, and stability that are dependent upon the coördinating influences and upon the responses of the workers. In the search for the secrets of prevention of dental diseases the actual conditions pertaining to cleanliness and food—to methods of cleaning the teeth, and to dietetics from the dental standpoint—cannot be too fully elaborated or too sharply detailed. But, in the quest for additional knowledge in these very obvious phases of the problem, more profound relationships and more elusive facts should not lack the attention that their paramount importance suggests. Thus, physiological coördinations between glandular activities or nervous influences and dentition, which are involved in the development of the teeth and jaws and in the secretion of oral fluids, on variable plans in different individuals, constitute a field where, it seems certain, important discovery awaits research by intimate application of the medical sciences to the needs of dental practice. Here again it is accordingly probable that results of fundamental significance in the effort to prevent disease will be forthcoming as soon as effectual collaboration between able investigators in associated medical and dental schools can be effected.

#### D. MAIN REQUIREMENTS FOR THE IMPROVEMENT OF ORAL HEALTH-SERVICE

##### *a. Practice*

The keys to progress in dentistry are the practitioner who serves the patient directly, the teacher who instructs and trains the practitioner, and the investigator who extends the knowledge on which the teaching and most of the improvements in practice depend.

Lately the number of dentists has been growing more rapidly than the general population, but it is far from adequate and the distribution is very irregular (pages 83-87). The organized dental profession, and also the universities and dental schools, are doing practically nothing to promote more uniform distribution. The number of licensed practitioners from foreign countries is very small. Current elevations of educational requirements may decrease the number of graduates during the next few years. The early creation of loan funds for the assistance of dental students would favor continued increase

in the number of dentists until the supply fully met the demand. The American College of Dentists is developing a plan intended to promote the public welfare in this manner.

Dental practice has been very progressive in the technical procedures of repair, restoration, and replacement, but has been backward in the biological responsibilities of prevention and therapeutics, which cannot be fully met by dentistry until, based on an adequate system of education that will also support and stimulate the best teaching and research, it becomes the full service equivalent of an oral specialty of the practice of medicine. In attaining its remarkable mechanical and esthetic successes, dentistry developed aptitudes and interests which, by focusing concern primarily upon procedures of reparation, distracted attention from its greatest opportunities in health service. The average dental practitioner, having had a poor education in the integration of the medical sciences with clinical dentistry, finds it difficult to apply them in his practice, and to keep himself informed as to the main features of their growth and further correlation. Few dentists have had the type of education that develops capacity and inclination for the serious and continual study of scientific literature, which the progressive practice of a profession requires. As a consequence many use antiquated methods of practice, or they uncritically or casually adopt new procedures that appeal empirically, or have nothing to commend them beyond persuasive demonstrations by salesmen or plausible advertisements by manufacturers. In accordance with these evidences of lack of the true professional spirit or of the understanding that a liberal education begets, a large number of dental practitioners use various patented therapeutic products regarding the true nature and properties of which they know little or nothing, and to this extent practise superficially and unprofessionally. The *Journal of the American Dental Association*, which represents the organized dental profession in the United States, has been helping to maintain these conditions by publishing advertisements of such products.

In discussing the prevailing critical attitude of medicine toward dentistry, physicians whose judgment is accorded universal respect often justify their want of confidence in individual dentists, and in certain relationships of organized dentistry, by pointing out not only that dental practitioners freely use patented therapeutic products of doubtful value, but also permit manufacturers to finance many professional projects; make important meetings of practitioners adjuncts to commercial exhibits; encourage the continuance of a system of supply-house journalism that is so obviously mercenary that sometimes its issues cannot be distributed in the mails at the reduced postal rates accorded to professional literature; elect to positions of honor, in professional organizations, beneficiaries of the sale of patented therapeutic products, stockholders of proprietary dental schools, editors of "house organs," and other industrial emissaries; and in sundry ways seem to proclaim unabashed that they regard dentistry as a trade and a business rather than as a profession. So long as large numbers of dentists show such partialities or indifference to commercialism in their professional affairs, it will be impossible

for medicine and dentistry to attain that accord and coöperation which the highest development of oral health-service requires, and which must be based on the mutual respect of the main bodies of their practitioners. Fortunately, among dentists themselves strong discontent with mercenary domination of organized dentistry is growing apace; and the prospective elevation of dental education to a plane of equality with that of medicine, with its collateral tendencies to reduce the proportion of the professionally unfit, to heighten the self-respect of the practitioner, and to stimulate the growth of ideals of service, promises an early end of the commercial régime.

Although these deficiencies of dental practice retard its evolution, and despite the fact that dentistry has not yet attained marked success in prevention or in the application of the medical sciences, it is true, nevertheless, that for many years dentists have systematically encouraged their patients to submit to periodic precautionary examinations for the diagnosis and treatment of dental disorders in their incipiency, and for the application of direct measures of oral hygiene. The importance of this procedure for children, in whom most dental abnormalities and diseases may be arrested, cured, or corrected, cannot be overestimated. These efforts by the dental practitioner, to discover promptly the incidence of oral maladies and to prevent their extension in his patients individually, exemplifies an ideal of health service — to keep people well — which has not yet appealed strongly to the average practitioner of medicine, who, manifesting little concern about prevention of illness among his private patients, seldom gives them personal advisory health-service when they are not sick. This notable difference between the direct efforts of dentists and physicians, in which dentists have set a useful example by endeavoring to convert a passive aspect of health service into an active phase, suggests an opportunity for marked improvement of medical practice in harmony with the popular expectations that are being developed by progressive public education for the conservation of health, in which lay agencies and medicine, dentistry, and nursing are actively participating.

The frequency of the periodic examinations gives dentists exceptional opportunity to note early signs of many types of illness outside of the domain of dentistry, and by advisory health-service to help their sick patients promptly to obtain suitable medical attention. This situation, in which the dentist might more actively coöperate with physicians for the welfare of his patients, emphasizes the desirability of improvement in the instruction of dental students in the medical sciences and in the correlations between clinical dentistry and clinical medicine.

Dental practice relates inherently and intimately to the individual patient, and, with occasional exceptions, can be conducted entirely in the office of the dentist, requiring neither visits to the home of the patient, nor treatment in a hospital or dispensary. This condition accentuates the importance of the clinical practice in the infirmary of the dental school, where the conditions of the student's chair-side experience closely approximate those of his prospective private practice, which is rarely the case for the medical student

in the medical school or in the hospital. In a general way the efforts of public-health officers and various other agencies, lay and professional including dentistry, to prevent dental diseases, are analogous to similar activity for the control of communicable diseases, although thus far they have had little effect on the quality of dental practice. The psychological features of oral health-service, especially in the treatment of children, and also the social and economic relationships—and their sympathetic comprehension by the practitioner—have not been receiving the attention in dental schools they require, but a broader preparatory education will facilitate their more effective development.

### *b. Education*

The proper training of the practitioner is a matter of prime importance. That he should be an educated man, with a background of culture and refinement, is quite as essential for the dentist as for the physician. That his professional training should give him a true medical comprehension of his duties, as well as mechanical facility and esthetic felicity in the execution of his procedures, is equally obvious. In educational quality and influence, dental schools should equal medical schools, for their responsibilities are similar and their tasks are analogous. The dental graduate should be the peer of the medical graduate in all important personal attributes, and in professional capability. Dental faculties should show the need in medical schools for integrated instruction in the general principles of clinical dentistry and in its correlations with clinical medicine, and should also cooperate in teaching stomatology to medical students and in conducting effectual dental service in the hospitals and dispensaries. Proprietary dental schools are about to become extinct, and non-proprietary independent dental schools are no longer able to meet the most important educational obligations resting upon them. The early union of these schools with universities, or their discontinuance, is clearly foreshadowed.

Everywhere education is chiefly what the teacher makes it. The most important immediate need in all of the dental schools is a much larger proportion of able and inspiring whole-time teachers, who, devoting their lives to teaching as a profession, by their character and example would exalt the spirit of dentistry, by their conduct of the instruction would heighten the quality of oral health-service, by their research would steadily extend the boundaries of dental knowledge, and by their scholarship would give to dentistry and to dental education the intellectual distinction now lacking in each. All desirable early improvements in dental education would follow their advent. In order to strengthen dental education at the point of its greatest weakness, funds sufficient to enable the schools to pay adequate salaries must be provided, and suitable means must be devised for the selection and training of the most competent prospective teachers and investigators. Fellowships and special funds are needed to encourage and support advanced study and research by the most promising candidates for whole-time teaching positions.

*c. Research*

Most of the research in dentistry has been conducted under commercial influences, and relatively little has been attempted in dental schools or universities. Large sums have been expended on the invention and improvement of valuable dental goods, but practically no funds have been forthcoming for the promotion of research relating to the welfare of the teeth and mouth and to the health of the whole person as it is affected by oral conditions. Compared with the activity in original investigation in medical schools, research in dental schools is weak and uninspired. The secrets of the means for the prevention of dental and oral abnormalities may remain hidden indefinitely unless dental schools actively institute a search for them, and find the minds and obtain the resources with which to promote adequate investigation. Many of the universities have been indifferent to this situation because dental faculties, interested chiefly in private practice, have failed to show the urgency of biological research for the promotion of dentistry.

The spirit of enquiry should animate the teaching of dentistry, and should be exemplified in the service of the practitioner; but, as a rule, fundamental research can be conducted with success only by those who are fitted by nature and by training to advance it, and whose abilities have been matured under the guidance of competent teachers. Worthy motives, ardent desires, keen aspiration to serve, and ready imagination, are not sufficient resources for the conduct of an important investigation. Without logical plans, accurate methods, careful controls, balanced observations, patient repetitions, rigorous skepticism, intellectual integrity and independence, and judicial discrimination and decision, research becomes a make-believe of unwarranted inferences and unsupported speculations, however attractively or persuasively it may be dressed up. The prevailing uncritical acceptance of the pretensions of such research in dentistry will come to an end when dentists receive the kind of education that will fortify their minds against it, and that will enable them to form a reasonably sound judgment as to the quality of any published research on a dental subject.

**E. PUBLIC RESPONSIBILITY FOR FURTHER DEVELOPMENT OF DENTISTRY**

In some states and provinces in North America public resources are used to provide dental service and to promote the education of practitioners, but most communities leave to individuals or to institutions the opportunity and the obligation to advance dentistry, which heretofore has been promoted mainly with funds supplied by dentists themselves or taken from profits in commercial dental enterprises. The public, the main beneficiary, has given little attention to the possibilities of improved oral health-service, and does not seem to realize that the universities are greatly in need of permanent resources for the furtherance of dental research. It is essential that the development of dentistry be projected through far-reaching enquiry in the field of prevention, yet important progress will

be impossible without adequate financial support. The opportunities for disinterested public service through the furtherance of dentistry, for the betterment of the health of individuals and communities, are exceptional.

#### F. GENERAL CONCLUSIONS

The present enquiry, although not a technical study of dental practice but an effort to present essential facts and opinions that might be useful in improving the conditions of education and of licensure in dentistry, appears to have justified the foregoing views and also the following general conclusions:

Dentistry is an important division of health service relating directly to the teeth and closely adjacent oral tissues, and indirectly to other parts of the body, to the organism in general, and to the transmission and prevalence of some communicable diseases.<sup>1</sup>

Dentistry, in the quality and efficiency of its service to the patient, should be made the full equivalent of an oral specialty of the practice of medicine.

The unusual mechanical and esthetic demands upon dentistry have fully justified and continue to require its active development as a separately organized profession.

The long continued indifference of medicine to the development of dentistry, and to the treatment of the abnormalities and diseases of the teeth and oral tissues, suggests that if dentistry were called stomatology, and included in the practice of conventional medicine, the mechanical and esthetic factors of oral health-service would not attain their most desirable improvement and development.

The success with which dentists have brought dentistry to its present state of usefulness, appreciation, and opportunity, against persistent belittlement as "merely a mechanical art," and the strength of the evolution of its scope and function now plainly in progress, indicate unmistakably that the leadership of the dental profession is advancing dentistry toward its full possibilities in health service.

Dentistry can be effectually and economically developed to the full service equivalence of an oral specialty of the practice of medicine through extension and improvement, in universities, of that system of dental education which, though separate from medical education, is closely related to it and should be more intimately associated with medical schools, hospitals, and dispensaries.

This extension and improvement could be accomplished without requiring the prospective general practitioner of dentistry to become a doctor of medicine before beginning his dental training, and could best be brought about by pursuit of the following three main objectives: (a) the preliminary education and the instruction in the medical

<sup>1</sup> Throughout this Bulletin "health service" is used in its natural sense to signify any and all private and public means to maintain or to promote health, to prevent disease, to restore health by treatment and cure of sickness, and to alleviate the discomfort, distress, and disability of incurable ill-health. Public-health administration, education for the prevention of disease, medicine, dentistry, nursing, and pharmacy are important divisions of health service.

sciences should be practically the same in general scope and quality as for medicine; (b) the technical and clinical training, the applications of the medical sciences, and the correlations of clinical dentistry with clinical medicine should be sufficient to assure both ability to initiate safely a dependable modern general practice of dentistry and capacity to grow in proficiency; and (c) the most advanced phases of dental practice should be reserved for systematic graduate study.

These three objectives could be attained through the requirement of at least (a) two years of approved preparatory work in an accredited academic college, including several extra courses that would stimulate interest and develop ability in the prospective practice of dentistry, or reveal ineptitude, (b) and three years of intensive and well-integrated effort in an undergraduate dental curriculum for the training of general practitioners only, the years to be lengthened by beginning them with summer sessions, or otherwise, wherever the time equivalent of four professional years of conventional length is regarded as essential; followed by (c) optional supplementary full-year graduate curricula for advanced training, during one or more years, in all types of dental and oral specialization. The suggested lengthening of the dental years, which might be accomplished by their subdivision into "quarters" in the conventional manner, would prevent long interruptions in the dental training besides adding a year to the practitioner's career in practice. Loan funds could be used to aid students in need of financial assistance.

Such a reorganization, by its selective character in the preparatory education, by its establishment of broad health-service objectives, and by its placement of the oral specialties on a graduate basis, would raise dentistry to intellectual equality with medicine, and would give physicians and dentists analogous types of professional training. It would develop similar capabilities in medical comprehension, ensure mutual respect and understanding, and facilitate intimate coöperation in the promotion of the welfare of patients.

This general improvement in dental education would involve reconstruction of the dental curriculum, with special reference to important betterment of the teaching in all of its aspects; economy of time without impairment of the efficiency of the instruction in the medico-dental sciences, in dental technology, and in clinical dentistry; more useful application of the medical and technical sciences; and more advantageous correlation of clinical dentistry with clinical medicine.

The proposed regeneration of dental education would necessitate, in practically all of the dental schools, an increase in the number of well-trained, whole-time teachers, especially in the dental subjects; and also great improvement of the libraries, and active advancement of research.

The dental schools in this country and in Canada, lacking endowments and in most cases being obliged to keep the quality of their work to the level of their income from fees, will be unable to proceed with the suggested improvements unless, individually, they receive large gifts of funds for the purpose.

## G. ACKNOWLEDGMENTS

Assistance throughout the present study has been given whole-heartedly and abundantly by so many persons and organizations, that the writer, in acknowledging the Foundation's indebtedness and also in publicly expressing personal appreciation, is deeply embarrassed by his inability to indicate the very large participation of those who have coöperated.

In 1921, when the study was begun, at the request of a number of organizations in the field, there were wide and serious disagreements among the dental faculties in the United States regarding the proper conduct of dental education. Notwithstanding these unsettled conditions, however, the dean and faculty of each dental school in this country and in Canada gave generous aid from the beginning, fully four hundred dental teachers having actively coöperated. The deans particularly, by their unselfishness in permitting close examination of their records, in responding orally and by protracted correspondence to very many direct questions, in correcting the manuscripts and printer's proofs of the statistical statements affecting their schools, and by their cheerful willingness to accept the consequences of a judicial enquiry without reference to their partialities, have provided the solid basis of facts on which this Report is founded, and which constitute the substance of Part VI and the Appendix. The study has also been furthered by very helpful advice received from a large number of teachers in medical schools, experienced students of education, members of state boards of examiners, officers of hospitals, and members of boards of health, who responded cordially to all requests for counsel.

Equally gracious in their assistance have been many dental organizations and their officers, in Canada and in the United States, especially the Canadian Association of Dental Faculties, the Dominion Dental Council, the American Academy of Periodontology, the American Dental Association, the American College of Dentists, the National Association of Dental Examiners, the American Institute of Dental Teachers, the National Association of Dental Faculties, the Dental Faculties Association of American Universities, the American Association of Dental Schools, and the Dental Educational Council of America. Since 1921 it has been the writer's privilege to attend the meetings of most of these bodies and there to discuss, formally and informally, many matters of importance in the work.

Historical data have been drawn freely from many well-known books, those by Koch and by Taylor among them; also from various periodicals, special records such as the forty volumes of the *Proceedings of the National Association of Dental Faculties*, and numerous original sources of information including private correspondence with participants in significant events. In the compilation of the data in Chapter XI, on dental education in Canada, generous coöperation was received from Wallace Seccombe, D.D.S., Dean of the Dental School of the University of Toronto, and Secretary of the Canadian

Dental Faculties Association when in 1923 it was amalgamated in the American Association of Dental Schools. A page proof of the comment on statutes and legal restrictions in Chapters III and VI has received the critical examination of Mr. Leslie M. Childs, Attorney and Counselor at Law, of Greenfield, Indiana, author of *Law for the Dentist* and of other important publications on dental jurisprudence and in additional legal relationships. Chapter V was prepared with the help of Negro dentists, chief among whom was Stephen J. Lewis, D.D.S., Editor of the Dental Section of the *Journal of the National Medical Association*, who has carefully reviewed the chapter at various stages in its preparation. The assistance of Mr. W. M. Steuart, Director of the United States Census and of Mr. R. H. Coats, Dominion Statistician, is more directly acknowledged on page 245.

The general conclusion that dentistry is a division of health service which, although continued as a separately organized profession, should be made the service equivalent of an oral specialty of the practice of medicine, was included in the dental section of the Annual Report of the President of the Carnegie Foundation for 1923; and the general outlines of the Introduction and of Chapter XII of this Bulletin were published in the dental sections of the Annual Reports for 1924 and 1925, respectively.

Outstanding in its influence for the furtherance of the study has been the direct and unstinted cooperation of the Dental Educational Council of America, which actively encouraged united assistance by all in the United States whose interests were most directly affected. The writer, invited to attend continuously each of the Council's sessions since 1921 and privileged to hear all of the discussions (1922-25), has thus been accorded exceptional opportunity to see clearly many of the special conditions in dental education in America. During the academic year 1921-22, when each of the dental schools in the United States and in Canada was visited at least once, nearly all of the members of the Council, in many special committees of two to four members, accompanying the writer, gave freely of their time and attention to the observations at each school in both countries, and from their wide experience and detailed knowledge made weighty contributions to an understanding of the situation. Throughout the study, the devoted and able Secretary of the Council, Albert L. Midgley, D.M.D., Sc.D., of Providence, Rhode Island, a member of the Rhode Island State Board of Dental Examiners and Secretary of the American College of Dentists, not only aided in the inspection of schools, but also presented the Council's historical and current records for prolonged study, helped freely to assemble significant data, gave wise counsel on many matters of fact and procedure, read critically the entire manuscript and at least two printer's proofs of the whole Bulletin, and at every stage of the study gave himself unreservedly to its progress.