The analysis of the state of the art of complete denture prosthodontics cannot be adequately discussed by any one person, and even if attempted, the subject could not be explored in detail in the space usually allocated for one article. Nevertheless, I will do the best I can to make an honest appraisal of prosthodontics as I see it. Thus, in this article I will discuss, first, the technical accomplishments in complete denture prosthodontics, and, second, some of the philosophic, educational, and political situations and attitudes that are affecting prosthodontics.

PROGRESS IN PROSTHODONTICS

Since 1923 when I entered the College of Dentistry, The Ohio State University, as a student, my objective was to achieve excellence in everything I attempted to do. I wanted to be a dentist; I wanted to be a good dentist. At least, I wanted to follow my father’s advice—“If it is worth doing, do it the best you can.” This attitude caused me to be critical of everything I did. Later, my teacher in prosthodontics, Dr. Harvey Cottrell, gave me another lesson in the same direction. In the eight years I was associated with him in practice, I received two compliments from him, and these were earned, because I was trying very hard to improve my thinking, my knowledge, and my skill sufficiently to deserve his commendation.

Now, why do I tell you these things? Certainly not to impress you. Instead, I do it to point out the way in which improvement is developed. The critical point in my development and in the development and progress of prosthodontics was the recognition of the need to understand why things are done rather than to blindly follow techniques.

As a freshman dental student, I could not see the real value of studying gross anatomy when I was hoping to work in peoples’ mouths. My classmates and I thought of anatomy, histology, physiology, and biochemistry as hurdles that had to be cleared before we could get into the real job of learning dentistry. We thought these courses were there just to weed us out, so we did study hard—hard enough so that some of what we learned stayed with us. Later, the value of hard study became apparent. When we have the background of basic science, we have the tools for improving on the techniques. So, we were taught what was needed in spite of what we thought was needed.

Progress has been made in the art and science of prosthodontics because of the basic science background in dental curricula—especially since 1935 when the “Carnegie Foundation Curriculum Survey Committee Report” (Red Book) was published. This report tended to coordinate dental education in the United States by its recommendations regarding the place of basic sciences in dental education.

Along with the emphasis on basic sciences, there was continued emphasis upon technical and clinical exercises and clinical excellence. This brought to American dentistry a reputation for quality prosthodontics, and this reputation was acknowledged around the world.

PROSTHODONTIC TREATMENT TODAY

There can be no doubt that today’s prosthodontists have the best tools, instruments, and materials, and the technical know-how is better than ever. Let us look at a few items involved in complete denture service for edentulous patients.

Diagnosis

Diagnosis for complete denture service has two components. First, our basic science background has prepared us to recognize pathologic lesions and treat them as they should be treated in preparation for new dentures. This is an improvement over the situation in 1927 when I first began my practice. We recognize that the mouth must be healthy when impressions are made if the complete denture treatment is to be successful.

Second, we are able to recognize mechanical problems now which would not have been recognized in 1927. There are two reasons for this. Forty-seven years ago, very few dentists made “study” casts before making impressions. Now every prosthodontist and any wise dentist will make diagnostic casts before treatment is planned for edentulous patients. Failure to make diagnostic casts has led to failures in the treatment of...
many edentulous patients. Mounted diagnostic casts will reveal mechanical problems that might not be observed until it is too late to remedy these problems. Two examples of the value of diagnostic casts are (1) for detection of insufficient space between the residual ridges and (2) to demonstrate differences in size of the two ridges.

**Impression materials**

Impression making can be an orderly procedure, but it must be planned in relation to the individual anatomy of the patient. More than that, it must be planned in relation to the condition of the oral tissues it will rest upon and which will surround it. Therefore, complete denture impressions must be planned to respect the histologic structure of the basal seat tissues. Knowledge of the gross form is not enough. The type and thickness of the soft tissues covering the maxillary and mandibular bones are known by dentists, and they should vary impression procedures accordingly. The finished dentures reflect the differences between scientific and empirical impression procedures. To summarize this phase of the “state of the art,” the available impression materials and procedures are better now than even before, but unfortunately, many dentists do not make impressions as accurately as they know how. It is really too bad, because a failure to make impressions as accurately as possible may prove expensive when adjustments, relines, or remakes are required after the dentures are complete. Time for adjusting dentures is just as costly as time used in making them correctly so that they do not require these adjustments.

**Jaw relations**

Assuming that accurate casts and occlusion rims have been constructed from the impressions, the next consideration is that of jaw relations. Of course, these are the centric and vertical relations.

**Vertical relation.** There seems to be little disagreement about the importance of establishing the correct vertical relation at which the teeth should occlude. The problem is to find the most reliable method, and this problem remains after many years of study. It is much easier to say that there should be a certain interocclusal distance when the mandible is in its physiologic rest position than it is to establish that distance. In fact, it is difficult even to observe or measure the interocclusal distance, because such attempts in the mouth disturb the physiologic rest of the mandibular musculature. As soon as the patient tries to help, the musculature is no longer at rest.
A number of guides to the occlusal vertical relation are available. Included among these are the tactile sense of the patient as suggested by Lytle and observations of the relations of the anterior teeth during speech, especially during the production of the speech sounds S, CH, and J. When these speech sounds are made, the lower incisors should approach the upper incisors in an end-to-end relation, but they should not touch. This is a simple method of observation, but like all of the other guides, it is not infallible. Some patients have unusual speech habits and others have an uncanny ability to adapt to the trial bases temporarily. Later, they will regress to their former habits and jaw positions, so for these patients, the vertical dimension of the complete dentures based on speech sounds alone will be incorrect.

In the final analysis, clinical judgment is still the determining factor in the establishment of the vertical jaw relations of occlusion. But this “clinical judgment” can also be incorrect. I have seen situations in which a number of prosthodontists observed a patient, and some judged the occlusal vertical dimension to be too short while others felt that it was too great. The ultimate answer to the problem of vertical jaw relations is not yet apparent.

Centric relation. Centric relation is the most posterior relation of the mandible to the maxillae at the established vertical relation. This seems simple enough to understand and to record, but controversy continues. Centric relation is a relation of the mandibular bone to the two maxillary bones in the horizontal plane that exists under two simple conditions.

First, the mandible is as far back as it will go. This means that it is in a reference position to which it can be returned whenever necessary or desired. The controversy arises when someone asks critical questions: “Does the patient pull his own jaw back?” “Does the dentist push it back?” “How much force should be used to pull or push the jaw back?” “Since anesthesia and muscle relaxants have been shown to allow the mandible to be moved farther back by the dentist than is possible without these drugs, should this position be considered as the centric relation position designated in the definition?” “Are the condyles high or low in their fossae in centric relation?” “Is the posterior terminal hinge axis position the same as centric relation?” “Is the same as the Gothic arch (needlepoint) tracing of mandibular position?”

Unfortunately, most of these questions are based upon or related to techniques for recording centric relation. The questioners miss the point of the concept which is to record the relationship of the jaws under physiologic conditions. There is no point in having the mandible forced into any other position than the one in which the patient might place it under normal conditions. Certainly, the positions of the condyles in centric relation are purely academic, because they are not visible. However, location is essential for the adjustment of some articulators, so their locations may be related to techniques rather than to concepts.

The second condition specified in the definition is that the vertical jaw relation be established before the centric relation is recorded. This condition recognizes that the horizontal relation of the mandible to the maxillae changes with any change in the vertical relation. This is true, because the opening axis of the mandible is located above the level of the body of the mandible. So the body of the mandible carrying the dental arch will move forward when the vertical distance between the jaws is reduced, even though the condyles stay in their most posterior positions.

To summarize the situation regarding centric relation, we can say that there is much disagreement about what it is, how it should be recorded, and how it should be used in prosthodontics. Some prosthodontists visualize centric relation as a point on a needlepoint tracing, and some refer to it as an area rather than a point. Others think of it in the mouth as it concerns the teeth. This is true of periodontists who have coined the term “centric relation occlusion.” This is unfortunate, because this concept makes understanding difficult.

The simplest system is to consider jaw relations apart from tooth occlusions and then adjust the occlusion to be in harmony with the jaw relationship. The centric jaw relationship should have its bone-to-bone specifications, and the tooth occlusion should have its own specifications. The correlation of these two components then becomes the simple, practical consideration of dentists.

Tooth forms and occlusion

The interest in posterior tooth forms and occlusion seems to follow a cycle. Back in 1927 when Sears proposed his channel teeth, he stimulated many others to design mechanical tooth forms. The chief characteristic of most of these modified teeth was a lack of cuspal inclines. The objective of their design was the elimination of lateral forces on dentures. This is achieved to some extent when the teeth are rubbed together in side-to-side or forward-and-backward motion, but where food is to be sheared, the side-to-side motion is necessary with flat or monoplane teeth. This means that lateral forces are reduced between periods of eating, but during mastication, the undesirable lateral motions are necessary.

It should be noted also that any mandibular position in front of or lateral to centric relation places heavier occlusal loads on the anterior part of the occlusion than on the posterior part of the occlusal scheme.

Cusp teeth do provide the opportunity for patients to put undesirable lateral forces on their dentures during parafunctional activities, such as bruxism and clenching. In mastication, however, a more nearly vertical chewing stroke can be used with less lateral occlusal force than is necessary for shearing food with monoplane teeth. In
addition, cusp teeth provide an easy opportunity for the development of bilateral (cross-arch) balanced occlusion which is difficult, but not impossible, to achieve with cuspless teeth.

The current trend in teeth, however, is a near return to the Sears channel teeth of 30 years ago. The Sears teeth had a mesiodistal channel (the equivalent of buccal and lingual cusps) extending from the bicuspids to the last molars above. The lower teeth were narrow with a sharp ridge extending from the bicuspids to the molars. This ridge on the lower teeth occluded with the channel in the upper teeth. They cut food well, but it took patients a long time to eat when using them because of the small occlusal table.

The newest suggestion by Pound and Murrell is almost a complete reversal of this system. Thirty-degree cusp teeth are used in the upper denture, and 20 degree teeth are used in the lower denture. The lower teeth are modified by grinding to make broad saucer-like fossae into which the upper lingual cusps fit. Then the upper buccal cusps are taken out of contact so the resultant occlusion is a series of point contacts of upper lingual cusps against the lower teeth. The sides of the lower fossae are, in fact, shallow cusps which permit the balancing of the occlusion. One manufacturer markets teeth of this basic design.

It is apparent that much more can be done in the area of tooth forms for dentures.

Articulators

The trend in articulators is being influenced primarily by prosthodontists working in the fields of fixed restorations and full mouth rehabilitation. They have suggested and devised instruments that are much more complicated than those traditionally used by dentists providing removable prosthodontic service. There are a number of very fine and fully adjustable articulators, but most of these are not easily adapted for use for complete denture patients. The reason for this lack of practical application for complete denture patients is the soft-tissue foundation upon which the recording bases must rest. As long as the recording bases that support the recording instruments can move in relation to the underlying bone, the highly sensitive articulators cannot be accurately adjusted.

It appears, therefore, that for the present at least the simpler types of articulators are appropriate for complete denture construction.

The major change in articulator design for making complete dentures is that of the condylar guidance mechanism from the mandibular element to the maxillary member of the articulator. This Arcon design has definite advantages over the former “condylar” type of instrument. It must be recognized, however, that the person operating either of these instruments is more important than the instrument. If dentists under-

stand the articulators and their deficiencies, they can compensate for their inherent inadequacies.

Esthetics and phonetics

It is in developing esthetics and phonetics that prosthodontists have their greatest opportunity for superior results. When we realize that the teeth and base materials available today are the best in the dental history, we owe it to our patients to use them in the most effective, artistic manner.

Within the last 25 years, prosthodontists have broken away from the mechanical and arbitrary methods of tooth selection and placement. No longer do prosthodontists put square teeth in square faces, tapered teeth in tapered faces, and ovoid teeth in ovoid faces without thorough individual consideration of the harmony of the teeth in the face. The objective is to make the patient’s dentures appear to be natural teeth. The available teeth and base materials make this objective possible, and most prosthodontists make the attempt.

The recognition that artificial teeth will look best if positioned exactly as the natural teeth had been makes the difference. Formerly, all teeth were placed “over the ridge.” This was done for mechanical reasons when leverage was the big concern.

Now, however, teeth are being successfully placed in the “neutral zone” which is, in fact, the zone previously occupied by the natural teeth. Leverage is not ignored, but a lack of favorable leverage is counterbalanced by the controlling action of the cheeks, lips, and tongue that confine the dentures. Thus, the same forces that helped to position the natural teeth in the dental arches can help to maintain the artificial teeth in their places.

Obviously, this requires clinical judgment and a sincere interest in doing more than filling a mouth. Prosthodontists are more than ever before interested and concerned in this aspect of practice.

Today’s prosthodontists have the materials, the equipment, and the know-how to rehabilitate edentulous people so that they regain the self-confidence and dignity that they had before loss of their teeth.

THE ONE BIG PROBLEM IN PROSTHODONTIC TREATMENT

One problem is more serious than any other in the clinical treatment of edentulous patients—continuing resorption of residual ridges. It leads to the need for repeated replacement and refitting of dentures and periodic occlusal reshaping of teeth on dentures.

This problem has not been solved even though certain impression procedures and materials are supposed to avoid the destruction of the residual ridges.

Some jaw relation recording techniques are supposed to avoid destructive occlusal forces. Some tooth forms
and occlusal schemes are supposed to place only favorable forces on the ridges and thus prevent their destruction. Some denture base materials are supposed to provide the resiliency that will protect the residual ridges. Some denture techniques are supposed to provide the necessary “magic” that will avoid residual ridge shrinkage. Some diets are supposed to supply the necessary nutrition that will stop the shrinkage.

However, we might as well face it. We do not know how to prevent changes in the basal seats for dentures. This is the major problem in prosthodontics, and in spite of much research and many well-intentioned claims, the problem still exists.

The chances are that the greatest source of need for prosthodontic service is from people who have worn at least one set of complete dentures. With the useful life of dentures averaging about seven years, the recurring need for replacement dentures is apparent.

Accompanying this inevitable bone loss is a deterioration in the foundation for dentures. The technical problems of construction become more difficult, and at the same time, the physiologic problems become more complex. Consequently, with the increase in life expectancy, there is a corresponding increase in the need for expert prosthodontic care. The complete denture problems faced by dentists in general practice and, in turn, by prosthodontists will become progressively more difficult to solve.

**FORCES AFFECTING THE FUTURE OF PROSTHODONTICS**

There are many disturbing forces affecting the future of prosthodontics. They will affect the quality of prosthodontic care. These forces are powerful, and some say they are irresistible, but I choose to believe that right will prevail if we work hard enough to achieve it.

There are pressures from government, from the public, from illegal practitioners, from economics, and from dental educators. I will point out the direction of some of these pressures and briefly explore what is behind them.

**Pressures from government**

Every day we read or hear of some new plan for the government to take care of the health needs of all of the people in this country. Since 1939, there have been step-by-step proposals which were obviously made to influence voters. These plans are good bait, because no one really enjoys spending money for hospital care or physicians’ or dentists’ fees; they would rather spend their money for new golf clubs or a new television set or for some pleasant activity. Consequently, when someone says “the government” will pay the health bill, the public is happy to hear this. Of course, the only way the government can pay the bill is to tax the people who receive the service. Those of you who are past 65 years of age and have Medicare insurance know what I mean. Somebody has to pay the bill.

How does this affect prosthodontics? Very simply! If prosthodontic care is supplied under some forced health program, the government (or some designated dental care organization or insurance company) will be insistent upon keeping costs down. Now, keeping costs down is a fine idea except that it leads to a poor quality of service. It also encourages dentists to accept only the “easy” denture patients. When the fee allotted for denture construction reaches a low comparable to that under England’s National Health Service, many dentists will choose not to make dentures, or they will take shortcuts that will not produce quality dentures. The mystery to me is that some dentists in this country insist that dentistry be included in any national health program.

The disaster will be that prosthodontics will become progressively less attractive to dentists and dental students so that patients will have to rely increasingly upon illegal practitioners of dentistry. And, because these practitioners lack education and training, the quality of prosthodontic care will deteriorate with accompanying increased damage to the mouths and health of edentulous patients.

Of course, this trend will eventually lead to a greater need for, and use of, prosthodontists. The specialty should prosper in proportion to the decline in quality of prosthodontic service provided by general dentists.

**Pressures from consumer groups**

Consumer groups (the public) really have not yet exerted much pressure on the dental profession. However, one day they will if there are enough politicians and well-meaning but unwise dentists who keep talking about “free” dentistry for everyone.

Unfortunately, some politicians, some consumer groups, some dental educators, some dentists, and all illegal practitioners think only of putting many dentures in the mouths of many people in the shortest period of time and at the least expense without consideration for patient appearance.

However, recently, the governor of one state appointed a parent of a handicapped child to the Medical Advisory Board for the Bureau of Services for Crippled Children in the Department of Welfare. This lay person replaced a prosthodontist on the Board. There is doubt that this person qualifies as an expert in fixed and removable and maxillofacial prosthodontics. This is an example of misguided government and consumer activity.

**Pressures from illegal practitioners**

The recent situation in Canada concerning dental mechanics and illegal practitioners should be a lesson to us. I am sorry to report that similar activity is occurring.
now in the United States. Bills introduced into some legislatures would license laboratory technicians as “dental mechanics” under the State Board of Dental Examiners much the same way as has been done in Canada.

Certainly, this is a threat to quality prosthodontic service throughout this country. The public will suffer if these bills become laws, and the public will not know that they have been cheated by the bait of low price. They will not know that they could have received better service than that provided by untrained and uneducated people.

Pressure of economics

The pressure of economics is affecting prosthodontics in two ways.

First, many dentists are seeking simplified methods that take a minimum of time to make dentures. Some of them develop and use shortcut methods that cannot take full advantage of the basic sciences they learned in dental schools. Consequently, they tend to provide the kind of prosthodontic service that “dental mechanics” provide. This is too bad, because the results of their inadequate efforts encourage laboratory technicians to think they can do better. In fact, the dentists can do it better if they take the time.

Anatomy was the first of the biologic basic sciences to be related to prosthodontic services. Later, histology and physiology were recognized as having an essential role in the treatment of edentulous patients. The emphasis on these basic sciences and their application to prosthodontics lifted complete denture service from the early mechanical art to the applied clinical science it is today. It is a shame if economic need forces a regression to a mechanical art.

Another effect of economic pressure is the urge to expand the duties of auxiliaries in the discipline of prosthodontics. Since procedures in complete dentures can be done over, they are reversible. This means that unscrupulous dentists can take advantage of their patients in some states. This is too bad, because patients deserve better than second-class prosthodontic care. When an assistant makes a preliminary impression or an impression for a diagnostic cast, the dentist is denied the information that he could obtain by observing the patient while making the impression himself.

The solution here seems to be to train the auxiliaries to perform more of the operations done apart from the patient than they now do. These operations could logically include cast pouring, making occlusion rims, cast mounting, and many other operations done by dentists. However, the dentist could and should continue to do all of the mouth operations.

The real danger is that, if auxiliaries are doing mouth operations in dental offices, politicians will conclude that non-dentists can do the job. The effect would be that training centers would be set up to teach non-dentists to make dentures for the public. This is precisely what has been proposed in some states.

Prosthodontics in undergraduate dental education

Some trends in current undergraduate dental education are most disturbing. These are predominantly in reductions of time allocated to teaching and learning prosthodontics in dental curricula.

The trend to cut the prosthodontic teaching time is not new. It was first pointed out by Dr. I. Lester Furnas in 1940 at a meeting of the National Society of Denture Prosthetists. He showed how other aspects of dentistry were being segmented into major categories and departments and that each of these new divisions looked at the laboratory time used in teaching prosthodontics as time they felt they needed. This chipping away at prosthodontics has continued, and now we find courses in community dentistry, sociology, psychology, and human relations taking the lifeblood of prosthodontics.

Now you might ask, “What is the lifeblood of prosthodontics?” It consists of experience, skill, and clinical judgment based on sound fundamental, basic science principles. Again, the addition of basic sciences to the dental curriculum brought dentistry up to the status of an honored profession. The question now is, “Will the profession continue to grow in stature or will it decline in favor of expediency?”

Since prosthodontics has been the “kicking post” in dental education, its practice is in danger of being relegated to persons less qualified than dentists. This is happening now in Canada and in Europe. It is being proposed here with current efforts to expand the duties of dental auxiliaries.

Dr. Bernard Levin⁴ in reporting to the American Prosthodontic Society said, in part, “...in Denmark...laboratory technicians are allowed by law to treat patients directly and can therefore make both partial and complete dentures for the public. There are no controls on the educational requirements for these lay people, who provide about 80 per cent of all the dentures in Denmark. The full-time teachers...in Copenhagen were mainly engaged in research. The requirement for graduation was the fabrication of one set of dentures...and it is rare to exceed this requirement. Clinical procedures were supervised by junior teachers and recent graduates who could barely make a set of dentures themselves.” He continues, “I cannot help but wonder if this is fair for the people of Denmark, 38 per cent of whom are completely edentulous.”

Later in his report Dr. Levin said, “...laboratory work (i.e., casting, carving wax patterns, setting teeth, etc.) is practically being eliminated from the curriculum for future dentists, with more and more responsibility placed on technicians. In discussing this with older teachers, we were concerned that soon most younger
dentists will be completely helpless when given inferior products by technicians because of their own inability, through lack of training and experience, to criticize properly and to correct the work themselves, if necessary.”

You may say that this cannot happen here, but it is happening here. I have heard it stated that prosthodontic time has been reduced 35 per cent in our school (The Ohio State University, College of Dentistry). The obvious next step is for the politicians to observe that dentists do not and apparently cannot do prosthodontic treatment and that the law must be changed. Dentistry must look to its own standards, especially in prosthodontics, if prosthodontic specialists do not retain the total responsibility for supplying dentures for the public. It will be up to the prosthodontic organizations to lead the fight to save the public from inferior prosthodontic service.

AMERICAN BOARD OF PROSTHODONTICS

The American Board of Prosthodontics which was founded in 1947 has provided a significant stimulus for improving the quality and standards of specialty prosthodontic service. The Board conducts the most rigorous two-phase examination of any of the American specialty boards. This has caused the candidates to concentrate on their preparation for examination to the point that they are better dentists for the experience, even if they do not pass the tests.

The Board has been hampered to some extent by regulations imposed upon it by the ADA Council on Dental Education. For example, the Council has forced the Board to be a three-phase board. It must examine candidates in removable prosthodontics, fixed prosthodontics, and maxillofacial prosthetics, and yet, the Board is not allowed to distinguish between the subsections in the annual certificate. This accomplishes the Council on Dental Education’s aim of holding down the number of specialty boards, but it does not help patients to find the kind of prosthodontist they need.

The value or service of boards to patients is more important and more easily justifiable than the value of specialty boards to prosthodontists. When this is generally recognized, the situation will improve.

FEDERATION OF PROSTHODONTIC ORGANIZATIONS

The Federation of Prosthodontic Organizations (FPO) is the only organization that has enough muscle to influence the thinking of the American Dental Association, and its various councils. Likewise, the FPO, representing the individual constituent member organizations, can present a powerful force for the good of prosthodontics in education and in legislation when the constituent societies provide the background and stimulus for action. The Federation is frequently called upon for representation in many conferences being conducted by government, dental, and educational bodies.

CONCLUSION

I have touched upon many items of concern to prosthodontists in this review, and I am certain that I have not placed sufficient emphasis on each one of these considerations. But if I have stimulated you to think about and act upon the many implications in each phase of this discussion, I will be happy.

REFERENCES


0022-3913/30.00
Copyright © 2004 by The Editorial Council of The Journal of Prosthetic Dentistry

doi:10.1016/j.prosdent.2004.05.017