FIXED PARTIAL DENTURES

ANALYSIS OF THE CUSPID PROTECTIVE OCCLUSION

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A theory presented by D'Amico concerning the function of the canine teeth has stimulated a new interest in the field of the occlusion of the natural dentition of man. The crux of this concept is expressed in the statement: "All primates present prominent canine teeth modified in size according to specie. The overbite and interlocking relation of the upper canines is the natural articulation of those teeth and common to all primates, including man. Their main function during mastication is to guide the mandible into centric relation in a medial-vertical direction, so as to prevent the contact of the remaining opposing teeth until they meet in centric occlusion."

THEORY OF BALANCED OCCLUSION

D'Amico is opposed to the theory of balanced occlusion and, as a result, has raised doubt among dentists as to the correct treatment of the natural dentition of man. One of the basic tenets of this theory is the establishment of group function of the teeth in all functional excursions of the mandible.

Group function is not feasible in all natural dentitions because of the many variations that occur in tooth form and position. However, if a sufficient number of teeth contact in the various excursive movements of the mandible and satisfy the functional requirements of the periodontal tissues, then the ideal balanced occlusion is not necessary. This basic concept is in direct contrast to D'Amico's statement, "The upper canine teeth, when in functional contact with the lower canines and first premolars, determine both lateral and protrusive movements of the mandible. Also, this functional relation opens the vertical relation thus preventing any force to be applied to the opposing incisors, premolars, and molars which would be at an angle to their long axis."

The anatomy of the maxillary canine tooth is such that it may be able to withstand a greater force than other teeth, but it should not be needlessly placed in jeopardy. The canine teeth are subject to the same destructive aspects

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of periodontal disease as other teeth, when the etiologic factors capable of producing the disease are present.

The canine tooth should not be permitted to withstand the entire force of occlusion as a preventive measure to "protect" the remaining teeth. The inclined planes of as many teeth as possible should be brought into contact in the working relationship as well as in the protrusive position when occlusal equilibration is indicated. Glickman states: "In some instances there is anterior tooth interference in lateral excursion even after protrusive excursion has been corrected. This most commonly occurs in the canine area. In such cases further adjustment of the canine is necessary as part of lateral correction."

CUSPAL INTERFERENCE AND TEMPOROMANDIBULAR JOINT PAIN

The origin of temporomandibular joint pain can often be traced directly to cuspal interferences in which the maxillary and mandibular canine teeth are the only teeth making contact in working lateral excursion. Treatment involves the reduction of the lingual surfaces of the maxillary canines without disturbing the contact in centric occlusion. In this manner, the lingual inclines of the buccal cusps of the maxillary premolars and molars are brought into contact so as to achieve group function, provide a smooth gliding movement of the mandible, and release the muscles from strain. I have treated many patients and relieved pain referred to the temporomandibular joint from the muscles of mastication by the simple expedient of reducing the lingual surfaces of the maxillary canines.

![Fig. 1.-The fabrication of a pin-ledge inlay specifically for "building-up" the lingual aspect of the maxillary canine which has been worn by attrition is a technique used by advocates of the "cuspid protective articulation."](image)

A method of fabricating a pin-ledge inlay specifically for "building up" or restoring the lingual surfaces of maxillary canines worn by attrition is advocated by the followers of the "cuspid protective mechanism" concept (Fig. 1). This practice may initiate degenerative changes in the periodontium of the canines or become a source of temporomandibular joint pain due to cuspal interferences and lack of group function in lateral excursion. Conversely, failure to eliminate an interference in the canine region in lateral excursions of the mandible when a temporomandibular joint syndrome is present may perpetuate an existing problem.
The presence of a facet on the lingual surface of the cuspid is not indicative of an overclosure of the vertical dimension of occlusion.

The fabrication of a “night-guard” acrylic resin splint or similar restorations which establishes a new plane of occlusion without increasing the vertical relation of rest position or eliminating the interocclusal distance may be successfully employed to eliminate temporomandibular joint pain. Here again, the basic principle of group function is followed in the treatment of these patients.

Canine teeth which prevent other teeth from making contact in the excursive movements of the mandible may result from a lack of normal attrition of the teeth of modern man. The present-day diet and modern methods of preparing food do not furnish the abrasive qualities necessary for normal attrition. Sicher states: “Wear of the teeth is, in most mammals, a physiologic and regular occurrence. In fact, the teeth of many species are not well adapted to mastication before attrition has removed the smoothly curved cusps.” He further states: “Regular attrition in man can be regarded as an ideal, not any more as the normal occurrence.”

COMPENSATORY ERUPTION OF TEETH

As teeth wear, there is a compensating factor occurring with the continuous eruption of teeth. Attrition is not limited only to the masticatory surfaces and edges of the teeth, but is also a normal physiologic process at the contact areas of adjacent teeth. Occlusal and incisal attrition are normally compensated by the continued vertical eruption and contact attrition by the mesial drift of the teeth. Orban states: “The continued vertical eruption also compensates for occlusal or incisal attrition. Only in this way can the occlusal plane and the distance between the jaws during mastication be maintained—a condition which is essential for the normal function of the masticatory muscles.”

The increased rate of apposition of cementum and of new bone at the apices, bifurcation, and trifurcation of the roots, the presence of epithelial rests at some distance from the apices of roots, and the apposition of bone at the alveolar crest are all histologic facts which substantiate the concept of the continuous eruption of teeth. The concept of the continuous eruption of teeth as proposed by Gottlieb is not recognized by D’Amico who states: “Due to the fact that man’s teeth do not possess the compensating factors as seen in the teeth of the herbivores, wear of the occlusal surfaces of the opposing dentitions results in the reduction of the vertical dimension of mandible to maxilla.”

The evidence in support of D’Amico’s conclusions that the vertical dimension is decreased as the teeth wear is based upon the attrition pattern of teeth of prehistoric skulls. This concept is untenable in view of the available evidence supporting the concept of the relative stability of the vertical relation. The continuous eruption of teeth in man is firmly supported by physiologic, histologic, biologic, and clinical evidence, which cannot be reconciled to D’Amico’s concepts, and is in direct conflict with his conclusions.

The loss of the vertical dimension as expressed by D’Amico is combined with the concept of a fixed center of rotation of the condyles to explain the
production of an edge-to-edge occlusion. The only evidence given in support of this concept is a diagrammatic representation of the dental arches and the temporomandibular articulation (Fig. 2). The development of the edge-to-edge occlusion is not fully understood. This is exemplified in the following statement by Sicher: "The mechanism of the change from overbite to edge-to-edge bite in severely worn dentitions is not yet known."

SUPPORT FOR CONTINUOUS ERUPTION THEORY

Clinical evidence readily supports the continuous eruption theory and casts serious doubt as to the validity of D'Amico's concepts. The occlusal surfaces of the teeth...
Fig. 4.—Occlusal views of same patient as seen in Fig. 3 show marked attrition of the occlusal surfaces of the posterior maxillary and mandibular teeth on the left side. This wear was due to a habit of chewing tobacco unilaterally over a long period of time. The continuous eruption of the teeth concomitant with occlusal wear prevented an overclosure or loss of the vertical dimension of occlusion and maintained a normal plane of occlusion.

teeth of a 73-year-old man maintained contact and a normal plane of occlusion throughout life (Fig. 3). However, the occlusal surfaces of the maxillary and mandibular posterior teeth revealed marked attrition on the left side (Fig. 4). This attrition was due to a habit of chewing tobacco unilaterally over a long period of time. If continuous eruption did not occur simultaneously with the attrition of these teeth, they would not have been in contact in centric occlusion. The conclusion that attrition of the teeth results in loss of the vertical relation of occlusion is not substantiated by this patient.

A young man, aged 23, had teeth that contacted in centric occlusion (Fig. 5). The occlusal surfaces of the maxillary and mandibular first molars had worn excessively, and yet, still contacted in centric occlusion (Fig. 6). This is further clinical evidence that continuous vertical eruption compensates for concomitant occlusal attrition of the teeth.
In dentitions where no opposing tooth is present, teeth continue to erupt. Fig. 7 shows a maxillary third molar which had never occluded with an opposing tooth that has erupted beyond the plane of occlusion with concomitant apposition of bone at the alveolar crest. Fig. 8 shows a maxillary first molar which had occluded with the mandibular first molar when it was present, but with the loss of the tooth the maxillary first molar has continued to erupt beyond the plane of occlusion.

BALANCED OCCLUSION

A statement by D'Amico concerning "balanced occlusion" is in need of amplification. He states: "To obtain a 'balanced occlusion', all teeth in contact on..."
the ‘working side’ and premolars and molars in contact on the ‘balancing side, naturally means that the operator should grind away the canines, eliminate their normal overbite and interlocking relation, and convert man’s teeth to function as those of the ruminants instead of the intended natural function of the primate.”

The purpose of occlusal equilibration is the elimination of excessive functional forces so as to prevent injury to the periodontium. Excessive tooth structure is not sacrificed needlessly to obtain the ideal balanced occlusion. The excessive functional forces can be eliminated by achieving group function which may include several, but not all, of the teeth capable of making contact in the various eccentric excursions. The normal vertical overlap of the canines is not destroyed, and yet the canine tooth is ground until there is simultaneous contact of as many upper and lower teeth as possible in all eccentric movements (Figs. 9 and 10).

The potentiality of exceeding the physiologic limitations of the periodontium due to excessive functional forces increases as the number of teeth that are in contact is reduced. A normal process of repair and destruction is constantly occurring in the periodontium and when this relationship favors destruction because of excessive functional forces, injury to the periodontium will occur. These degenerative changes in the periodontium are reversible. Therefore, the rationale of equilibrating the occlusion is to reduce the excessive functional forces and permit repair to occur. This is accomplished by eliminating deflective occlusal contacts in both centric and eccentric positions.

Fig. 9.—Canine tooth interference exists on the working side when the mandible is in lateral excursion before treatment. The only teeth in contact are the maxillary and mandibular canines.

Fig. 10.—After occlusal adjustment, the molars and premolars are contacting on the working side simultaneously with the canines. The canine teeth have not been “mutilated” by grinding to achieve “group function,” and the contact in centric occlusion has not been altered.
Throughout D'Amico's discussion, a movement toward the working side is the basic eccentric movement under consideration. However, in a force diagram showing the resolution of forces of an upper and lower molar in balancing contact, no mention is made of the tooth relationship existing on the working side. The drawing is purported to show an occlusal relationship which is accepted as normal by those advocating the balanced occlusion theory. This relationship is accepted as normal, provided the balancing contact does not interfere with or prevent contact on the working side. However, in many instances, an occlusion is considered normal when the balancing contact is not present and there is unilateral contact on the working side only. On the other hand, an interfering balancing contact is considered potentially injurious to the periodontium and must be eliminated.

**Proprioceptive Impulses in Relation to Canine Teeth**

Another point worthy of consideration is D'Amico's conclusion that the periodontal membrane of the canine teeth transmit desirable periodontal proprioceptor impulses by way of the central nervous system to the muscles of mastication to a greater degree than any other teeth, thus reducing muscular tension and thereby the magnitude of the applied force. The evidence given in support of this statement is the clinical observation that the canine teeth of the maxillary dental arch are usually the last teeth to be extracted in the adult. The inference is that the extrasensitivity of the periodontal membrane surrounding the canine tooth is capable of protecting that tooth from excessive functional forces through proprioceptive stimulation.

The functional forces of occlusion are transmitted from the teeth to the periodontal membrane stimulating Pacinian corpuscles. The Pacinian corpuscles, receptor organs located in the periodontal membrane, are extremely sensitive to changes in pressure that are transmitted through the teeth. Pacinian corpuscles are also located in muscles, tendons, ligaments, and other deep structures. According to Jarabak, the proprioceptors of the periodontal membrane are more sensitive than those found in the muscles and tendons. The electromyographic studies of Moyers indicate that all teeth possess the same degree of sensitivity to proprioceptive impulses.

**Conclusions**

The conclusions reached from the foregoing discussion are:

1. The balanced occlusion theory is a valid concept substantiated by physiologic, biologic, histologic, and clinical evidence.
2. The role of the canine tooth is to function in unison with the remaining teeth and not as an independent entity.
3. The proprioceptive response of the periodontal membrane of the canine teeth are not more sensitive than those of the periodontal membrane of other teeth in the same mouth.
4. The "building up" or restoration of the anatomy of the lingual surface of the maxillary canine tooth so that it will function alone in eccentric positions is contraindicated.
5. The loss of vertical dimension based only on the attrition of teeth in prehistoric skulls is considered invalid in view of the well-documented evidence supporting the continuous eruption theory by Gottlieb and the relative stability of the vertical relation of rest position as supported by cephalometric, clinical, and electromyographic studies.

6. The development of an edge-to-edge occlusion as proposed by D'Amico is unacceptable as it refutes the concepts of the relative stability of the rest vertical dimension and the continuous eruption theory.

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