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The Canine Teeth---
Normal Functional Relation of the Natural Teeth of Man (continued)

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The Edge-To-Edge Bite: Resolution Of Its Development

The very changes that Hector Jones has seen in his study of the primitive Australian aboriginal and present living descendants, I likewise have seen in my study of the pre-white and present California Indian. He has seen the change in the functional relation of their teeth, i.e., the extensive attrition and edge-to-edge bite of the "primitive" to the overbite of upper incisors and overlapping and interlocking upper canines as seen in those living today in an environment of Western European culture.

Practically all writers agree that the attrition of the dentition of primitives is due to mastication of a coarse, abrasive omnivorous diet. Most seem to agree that the canines in man appear to be casualties of evolution. I believe that the attrition and edge-to-edge bite of incisors and canines are the result or effect of extraordinary or excessive usage of the teeth. It is the result of function in the attempt made by primitives to adapt themselves to an extremely coarse, abrasive diet. The canines in the primitive have been casualties of function rather than casualties of evolution.

To increase the leverage of the mandible in order to cut and crush hard foods more readily, the primitive instinctively learned to exercise the internal pterygoid so as to move the mandible medially while the temporal and masseter muscles moved it vertically. This produces a glancing shearing action of the buccal cusps, increasing their efficiency in function. However, as the lingual cusps of the upper teeth glide laterally on the transverse ridges of the buccal cusps of the lowers, the abrasive nature of the food hastens the wear of those cusps. This action rapidly eliminates cuspal interference thus permitting wider horizontal latitude in mandibular movements.

Attrition of the occlusal surfaces progresses quite rapidly. Actually, it starts at the time of weaning in infancy in the deciduous dentition. 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. Figure 23 A illustrates the progressive reduction of the vertical dimension as attrition of the opposing natural teeth progresses. The upper central incisors, line E K, overlap the lower central incisors, line I N. They slope downward and forward. The lower central incisors slope forward and upward. Point F represents the axis or the center of rotation in the vertical movement of the mandible. Point N represents the anterior-inferior point of the mandible (symphysis). The upper central incisors are fixed to the maxilla so that the distance of line E K to the axis is constant and fixed. However, the lower central incisors, line I N, are fixed to the mandible and move in a constant arc described by the vertical rotation of the mandible at its axis.

It will be noted in the diagram that the radius F N is much greater than the radius F E as shown by the arc D as compared to point E. If we reduce the length of the

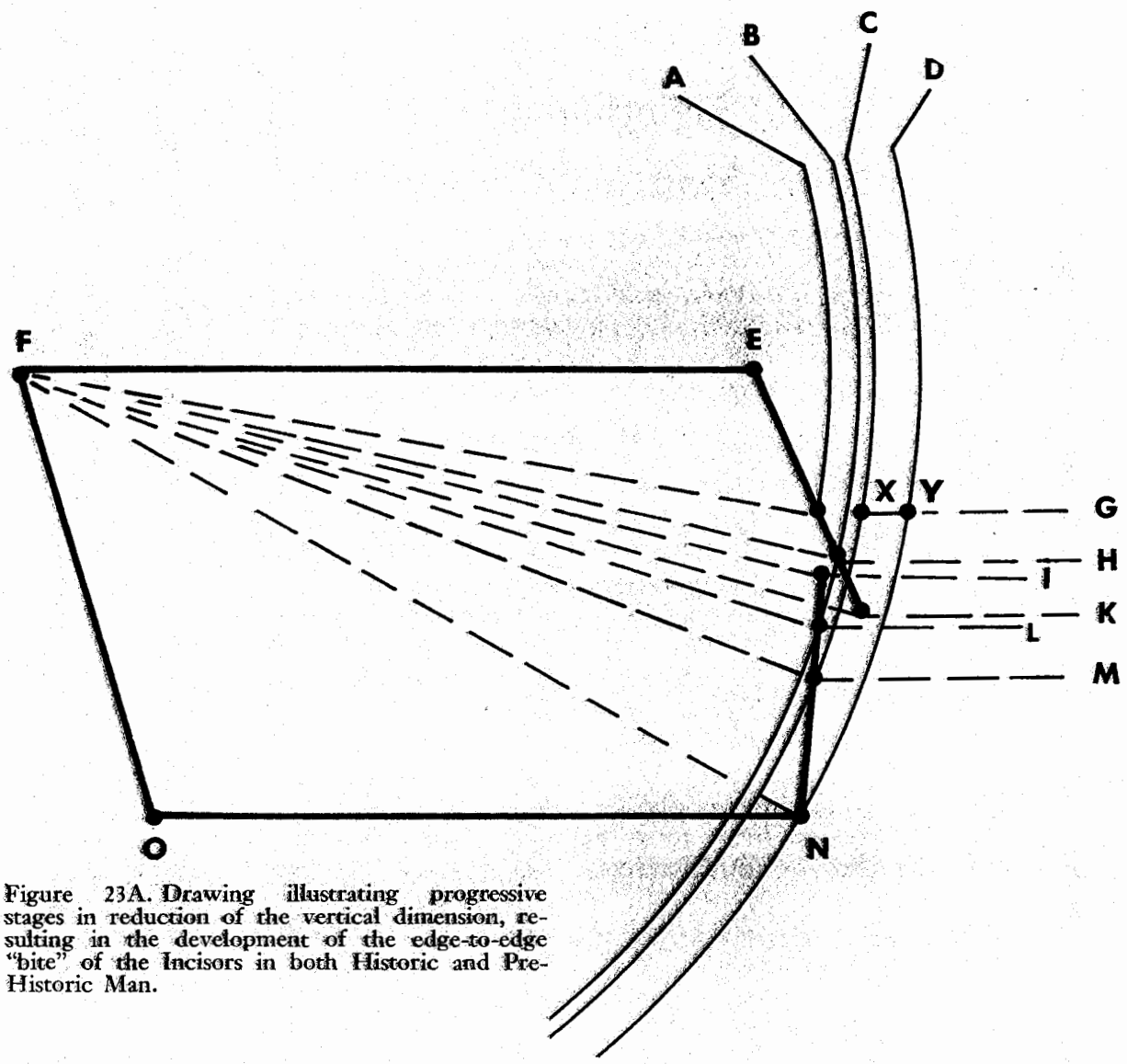

Figure 23A. Drawing illustrating progressive stages in reduction of the vertical dimension, resulting in the development of the edge-to-edge "bite" of the Incisors in both Historic and Pre-Historic Man.

upper incisor from point K to point H, and the length of the lower incisor from point I to point L, upon closure of the mandible, point L will describe the arc B and will contact line EK at point H thus producing the edge-to-edge bite of the incisors.

Further reduction of the distance E K to point G and I N to point M would show the lower incisor as being anterior to the upper incisor. As the mandible rotates upward, point M will follow the arc C and intersect point G at point X. Thus the difference in the length of the radius F G to that of F M would be equal to the distance G X, as point G would describe the arc A while point M would describe arc C. Arc D would be the path of the symphysis if it could continue its upward rotational movement at its axis F.

In the premolar and molar areas we have an entirely different relation. Here we see the opposing teeth in a vertical relation to each other, and closer to the center of rotation or axis. Although the radii of the lower molars and premolars would be slightly greater than that of their opponents, the difference is so slight that as the vertical dimension is reduced the inter-cuspal relation would appear to be unaltered. The cusps of the lower premolars and molars would certainly be slightly anterior of the original inter-cuspal relation before attrition sets in, but hardly enough to be noted by the naked eye.

The foregoing clearly demonstrates the writer's contention that there is no shifting or change of position of the condyle in the glenoid fossa as the vertical dimension is opened or closed. The center of rotation is constant. Likewise, there is no forward

shift of the anterior teeth during the development of the edge-to-edge bite either in primitive man or man as we know him today.

The design of the diagram depicts the relation of the incisors as seen in the paleolithic type. Both upper and lower incisors slope forward and showing a lack of development of the chin as seen in Neanderthal, Tabün and other specimens in that category. In the neolithic type, (modern man) we see a well developed chin with the lower incisors either in a more vertical position or sloping slightly lingualy. The difference in the dimension of the radii from the center of rotation to the upper incisors as compared to that of the lower incisors would be far greater than that seen in the paleolithic type.

The presence or absence of a diastema in man has been as fascinating to the writer as has been the development of the edge-to-edge bite in the primitive. It is the personal opinion of the writer that the prescence of the diastema in the ape is due to the articulation of the cusp of the lower canine tooth in the embrasure between the upper lateral incisor and canine tooth. The cusp of the lower canine is pronounced and serves as a wedge thus causing a separation between the upper lateral incisor and canine. In primitive man attrition and the edge-to-edge bite of the anteriors has eliminated this wedge-like relation of the lower canine tooth. It is quite likely also that the development of the Musculature of the upper lip was sufficient to develop enough tension to force the upper incisors lingually, thus bringing the upper lateral incisors in contact with the canines.

This is strictly a personal opinion of the writer. However it can not be too far from the truth if we observe and study the dentition seen in the "man apes" of the Pliocene-Pleistocene era, Plesianthropus-Transvaalensis.* The morphology of the teeth is that of an ape and the canines closely resemble those of the chimpanzee. The extent of attrition in the upper and lower dentition, showing a reversed plane of occlusion definitely indicates an edge-to-edge bite of the anterior teeth. The wedging and leverage of the lower canine teeth had been eliminated, thus permitting the upper lateral incisors to make contact with their adjacent canine teeth.

To the writer, the edge-to-edge bite and lack of diastema seen in Australopithecinae indicates only the result of function. It would not necessarily indicate human relationship. The following is Hooton's opinion: "There is, in point of fact, a rather serious disagreement as to the human or infra-human status of the erect presumably featherless, biped Australopithecinae of South Africa, who almost certainly had feet modified away from the prehensile type for support in two-legged locomation, who probably used sticks and stones with their emancipated fore-limbs, who satisfied the minimal and some further dental requirements for human status and yet seem to have had such small brains that their hats would have slipped down over the ears of a chimpanzee. If these Australopithecinae were men, we shall have to enlarge the zoological scope of anthropology." (16)

The presence of a diastema in man today is not uncommon. Some times it appears unilaterally, however in the majority of cases it is present bilaterally. In each instance, a study of the articulation of the lower canine teeth will give us the answer of why it is present. One of the many cases the writer has in mind is illustrated in figures 64 and 65.

The rapid loss of tooth structure by abrasive action, the resulting loss of the vertical relation and development of the edge-to-edge bite of the incisors were the prime factors which simplified the mechanics of mastication for the primitive. The elimination of cuspal interference of the premolars and molars, and the elimination of cuspid and incisor guidance reduced the lever action of the opposing teeth to a minimum when they came into functional contact or articulation. We could look upon this change of functional relation as being a desirable re-action to action, because the resulting direction of the opposing applied forces would be almost parallel to one another and in line with the long axis of the teeth. This favorable condition existed only during the period that the flat incisal and occlusal surfaces remained horizontal and at right angle to the long axis of the teeth.

However, the loss of tooth structure

not see how the biological factors controlling the growth, development and function of the teeth of the three mammals cited by Sicher are related to those of man. The teeth of the sloth functioned in the manner of those of the herbivor, attrition of the softer dentine allowed the harder layer of dentine to remain sharp for shearing while constant eruption of the tooth compensated for the attrition and loss of tooth structure. Constant eruption of the incisors of the rat also is a compensating factor to offset the rapid attrition of the enamel of the incisal edges.

As to the human teeth, Sicher states that "even in such teeth as the human teeth, growth, though limited in rate, never stops. The continuous growth of the cementum, and its accentuated increment around the root ends, is a well known fact. And as in the case of the rat incisor, dental growth is indivisibly linked with eruption, the latter being the visible effect of the former. Furthermore, one must not overlook the fact that attrition in man is at the same time occlusal and proximal wear. As a matter of fact the latter is much more regular than the former. And it is again by minute movements, the well known mesial drift, that proximal wear is compensated, that, in other words, the teeth keep their ranks tightly closed despite the shortening of their mesiodistal diameter. This movement also is the effect of differential growth, thus also dependent on the continuous apposition of cementum. Continuous vertical eruption and mesial drift entail, however, also growth changes of the alveolar bone."

The growth changes of the alveolar bone seen by Sicher are the presence of osteoblasts on the distal wall and the presence of osteoclasts on the mesial wall. He also notes a constant build-up of cementum around the root. The presence of the osteoblasts would indicate an acceleration in the regeneration or replacement of overaged (fatigued) bone cells. Osteoclasts seen in the mesial wall of the alveolar process would indicate an arrest in growth of the bone tissue, thus permitting the mesial drift of the tooth. Sicher also states that the vertical eruption of the tooth toward the wider cervical parts of its socket permits the build up of cementum around the root thus avoiding encroachment upon the periodontal membrane and alveolar wall. According to Sicher, the foregoing biological changes are the factors which compensate for the loss of tooth structure both occlusal and proximal.

The loss of tooth structure whether lost as a result of attrition or caries is permanent. Enamel and dentine are tissues which do not possess regenerative powers. Compensation from this biologic standpoint is completely negative. Compensation for the loss of tooth structure by continuous eruption of the teeth as seen in the ruminants and rodents, is also absent in man. If such a biologic phenomenon did exist in man, the edge-to-edge bite relation of the incisor teeth of primitive man could have never been developed. For instance, looking at illustration 23 A, if the upper incisor erupted continuously to compensate for the loss of tooth structure in the incisal area, then the incisal edge would remain constant at point K and the line E K representing the length of the incisor would also remain constant. This also would hold true for point I representing the incisal edge of the lower incisor. The distance or radius from the incisal edge of the upper incisor from point K to the axis or vertical rotation center at point F would likewise remain constant. This would also apply to the radius of the lower incisor from point I to the axis at point F.

The published article by Sicher was not accompanied by illustrations of either the maxillary or mandibular segments. However, the text would indicate to the writer that he was describing the changes which he saw in the mandibular teeth and their associated parts. If this assumption is true, then the anatomy of the body and alveolar process of mandible of modern man would be identical to that of the Heidelberg "jaw." Constant bone growth of the alveolar process, plus constant growth of the cementum plus constant eruption of the teeth, plus the mesial drift would certainly have prevented the development of the chin as seen in modern man. The development of the chin in man has been at the expense of the alveolar process. The body of the mandible and the distance from the posterior angle of the ramus to the symphisis have re-