

SEMINARS

A DISCUSSION OF BEGG'S ATTRITIONAL OCCLUSION MODEL AS CORRECT OCCLUSION

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INTRODUCTION

Since 1954, attritional occlusion, as described by P.R.Begg (1954, 1965) Begg and Kesling (1977) Kesling (1984, 1985), has been taught in conjunction with his orthodontic technique. Some of the concepts of this are examined in this paper with reference to literature and research currently available.

Begg (1954, 1965, 1977) as part of the foundation and rationale for his technique studied the occlusions of Australian Aborigines using skulls that predated western cultural influences. His premise was that in our society diet does not subject teeth to the same attrition as occurred during the earlier periods of our history. He asserted that with this lack of occlusal and interproximal attrition we are more prone to dental arch crowding.

This is typified by the statement (1977 p8) 'The authors have discarded the concept of textbook normal as a fallacy and therefore a hindrance to progress and orthodontics generally. We have adopted Stone Age man's attritional occlusion as the basis of orthodontics, because it is anatomically and functionally correct occlusion.'

Since that time other prominent Begg clinicians such as Kesling (1984) and the Kesling Rocke group (Barrer 1980) have continued to note attritional occlusion as important in the understanding of the Begg technique. Attritional occlusion is presented as a treatment goal with any overbite and overjet regarded as malocclusion, unlike Angle's textbook normal occlusion.

Some of the major points of Begg's study of the Australian Aboriginal occlusion are

1. Considerable interproximal attrition is necessary for the development of ideal occlusion.
2. Edge-to-edge incisor relationship is the correct occlusion for Man.
3. The Australian Aboriginal occlusion prior to European influence is a superior model to the traditional static occlusion model as typified by Angle.
4. Occlusal attrition is normal and lack of wear is abnormal.
5. Teeth display continuous eruption throughout life.
6. Attritional occlusion is associated with a shallow glenoid fossa and a flat condylar surface.
7. Mesial migration occurs bringing the whole dentition relatively forward.
8. There is a presumption that the environment was constant in both time and space for the dentition to be so well adapted to the environment.

1. Considerable interproximal attrition is necessary for the development of ideal occlusion.

Begg proposes this in the first two chapters of the text where he claims the lack of interproximal attrition is important in the development of anterior crowding (Begg 1977 p46-47) and for the common occurrence of third molar impactions (Begg 1977 p15-30,53, photo p17,18 and diagram p22. Begg (1977 p53) notes that although some malocclusions do exist in Stone age dentitions the occlusal attrition that occurs overcomes the functional deviations.

Malocclusions have been noted to exist in precontemporary cultures by authors such as Hellman (1920), Brash (1956), Dawes (1986) and in contemporary culture by Moorrees (1957).

Dawes (1986) also concluded that Begg's estimation of space loss due to interproximal attrition was overestimated, with one of the factors contributing to this being a morphological feature of the mandibular first permanent molar in the Australian Aboriginal dentition often having a concavity of the mesial surface which creates the appearance of a reduction in mesiodistal width (Figure 1).

Begg's (1977 chapters 3,4,5 and pp162-3) statements that teeth need to be extracted in the modern child even if there is no crowding to allow for the amount that interproximal attrition would reduce the dental arch in precontemporary Australian Aboriginal occlusion.

Dawes discusses Begg's figures of 1954 and conjectures that the sample is far too small (9 cases) and the variation in the size of teeth between individuals is too great for the findings to be significant. Had the sample of Begg's 154 unworn teeth been taken from Campbell (1925) 645 teeth sample the mean attrition would have been reduced from 10.54 millimeters to 7.24 millimeters. Dawes (1986 p248) also cites work by Murphy (1964) who calculated a rate of interproximal attritional in mature Australian aborigine dentitions as a reduction of 0.3 millimeters per year. Dawes therefore suggests the figure of 3.0mm per arch as the total mandibular arch loss in the dentition up to adolescence.

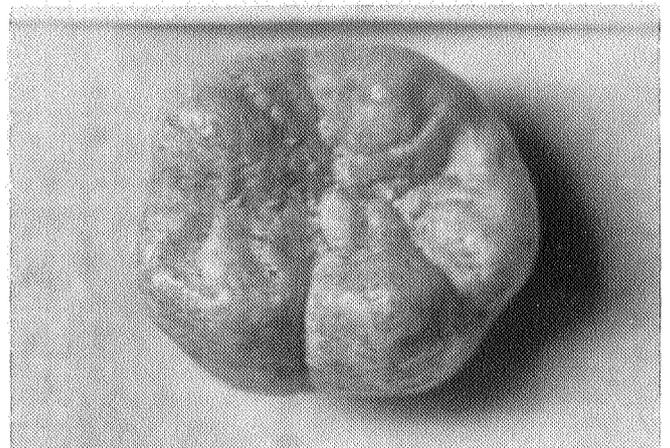


Figure 1. From 'Dawes 1986 Dental arch crowding in prehistoric man, and in indigenous groups of North America and Australia' An unerupted mandibular first molar which was dislodged from its crypt for examination, then replaced. This tooth exhibits a concavity of the mesial surface which may have been overlooked in the calculation of interproximal attrition. (Courtesy of B.E.Dawes)

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One of the examples which Begg (1977 figure 22 p21) used to demonstrate the effect of interproximal attrition was the low incidence of lower third molar impactions among Australian Aborigines.

Seward (1976 p169) noted that a feature of the Australian Aboriginal skulls that he observed was that even those with minimal interproximal attrition there was an average of six millimeters space distal to the maxillary third molar and only 2.5 millimeters more in worn dentitions. Seward (1989) noted that he believed mandibular third molar impaction was uncommon in both attritional and unworn groups.

2. and 3. The edge-to-edge incisal relationship and the Australian aboriginal as the model and the superiority of attritional occlusion to that of modern 'western' man.

Begg (1977 p19,20,63,64 etc.) considers anterior overbite and overjet as a malocclusion when compared to an edge-to-edge relationship. He noted (p74-75) that, in treatment, a goal of an attritional occlusion is a goal towards which we should aim. 'However, in order to obtain the best treatment results with the light wire technique, the lower teeth in Class I and Class II malocclusions are moved farther forwards in their occlusal relations with the upper teeth than the occlusal relations that are regarded as correct for civilised Man's non-attritional normal occlusion. The lower dental arch during growth and development is moved almost to Class III relationships, and the upper and lower incisors are brought end to end. The attritional occlusal relations of Stone Age man's teeth are simulated during orthodontic therapy to obtain the best treatment results. Of course, these attritional occlusal relationships do not remain after completion of appliance therapy, because civilised man's teeth do not have attrition.'

The use of the term 'Stone Age' man is perhaps more a colloquialism rather than a strictly definable scientific designation. Even so Australian Aborigines are a subgroup of precontemporary Man.

The comparison of the Australian Aborigine with other racial groups is inappropriate for as we know subjectively from observation of faces and more objectively from craniometry and cephalometry that racial variation exists and the morphometric characteristics for one race do not necessarily coincide with those for other races, for example, Scandinavians by Bjork (1947), Japanese by Moyers, Kuroda and Miura (1970), Chinese by Yen (1970) or North Americans Negroes by Altemus (1959). This appears to be interpreted similarly by Moyers and Enlow (1973 p95 see also p99) and specifically Australian Aborigines (McNulty and Morris 1970, Craven 1958, Campbell 1939). The observation that edge-to-edge occlusion is normal for Australian Aborigines should not make it a treatment goal for any other race.

Racial groupings, often display differing prevalences of malocclusions; for example, Moorrees (1957) found in the Aleutian dentitions a complete lack of class II and a higher incidence of Class III (thirteen percent). The edge-to-edge incisal relationship and universal occlusal attrition were features of the native Eskimoid dentition. Kinaan (1986) found racial variation in overbite and overjet when comparing the Iraqi to the British. Judging from the photographs Dawes presents in his thesis of Australian aborigines from his own and other studies (McNulty and Morris 1970) most of the skulls we are asked to regard as our normals would all be considered on the cephalometric Caucasian normals as bidental protrusions requiring at least four extractions (Begg 1977 p161) in discussing the need for extractions. I shall not consider the *normal* modern occlusal concepts but note that this concept is the exception for most of mankind and has no accommodation for adaptation over time.

Even with regard to edge-to-edge being normal for the Australian Aborigine, there is controversy with

Campbell (1925) describing it as 'universal almost without exception' and Begg (1954) who considered the pattern to be typical for Australian Aborigines living in their natural state. However, Barrett (1951-2) observed only *half* the mature adults and *one third* of the young adults with an edge-to-edge bite. Dawes (1989) noted difficulty in measuring overjet from skulls and found the gross occlusal wear permitted a range of mandibular movement of several millimeters. Dawes found 'it is common for the anterior arch segments to occlude in an edge-to-edge bite yet for a measurable overjet still to be present'. He questions some of the premises of attritional occlusion and the theory as proposed in Begg's papers (1954, 1965, 1977, p266). He cites Campbell (1938), in a study of an Australian Aboriginal group near Birdsville, who observed that only 15 of 26 individuals possessed an edge-to-edge bite. This edge-to-edge bite may well be an expression of a lack of overbite rather than the lack of overjet in contemporary man. When the broad occlusal surfaces of the worn anteriors are considered one may have both an overjet and an edge-to-edge bite.

4. Occlusal attrition should be considered the normal and lack of wear is to be considered abnormal

Begg (1965, 1977) hypothesised that attritional occlusion is in fact the normal and that what are regarded as normal occlusion in Modern Man, are abnormal.

In his observation of the Australian aborigine dentition Begg noted that an end-to-end relationship occurred frequently. He states (Begg 1977 p15) his belief that overbite and overjet are necessary for the guidance of the deciduous and permanent teeth into their correct positions and once they are in place they are abraded into a mature relationship. According to Begg the overbite and cusps are designed to be worn down as part of the development of a mature occlusion.

Luke and Lucas (1983) disagree and cite Weinstein (1963) in his experiments of tooth movement in response to onlays on the buccal surface of teeth, as evidence of the capability of soft tissue to direct the teeth into occlusion. 'Indeed, if teeth did not develop cusps there would be no need for the final minor adjustments of position which cusps are supposed to achieve!' The adaptability of the bony relationships develop despite wide variations in the relationship between the mandible and the maxillae (Solow 1980). This again suggests that the proper functional arrangement of teeth is that described as 'ideal occlusion' with cusps fitting precisely into fossae, grooves or embrasures of the opposing dentition.'

By contrast Dawes (1986) in his penultimate paragraph proposes

'...in a modern society that experiences an extended lifetime, there can be little to admire in a form of occlusion which lasts less than fifty years.'

5. Teeth display continuous occlusal movement throughout life

At present, the concepts of a dynamic and continual eruption of teeth is gaining renewed impetus from the work of Behrents (1985). Begg also emphasised the nature of occlusion as a dynamic rather than static phenomenon (Begg 1977 p7-9). I have not yet found an earlier reference that so clearly advocates the continual eruption of teeth throughout life. The diagrams in his text, however, indicate that the tooth moves occlusally as the attrition occurs and the epithelial attachment migrates apically. Ainamo and Talari (1975) considered the apical migration of the epithelial attachment. They measured the distance between the lower border of the mandible and the mucogingival junction and this distance was the same for patients aged 23 and 43 but the distance from lower to upper borders of the mucogingival junction increased. The

apical migration of the epithelial attachment did not occur without pathology. However, in the text (1977 p36) it is claimed the absence of periodontal disease in Australian Aboriginal Man due to the eruption and attrition of the teeth prevents the formation of periodontal defects and the interproximal attrition and the mesial drift reduces the possibility of the formation of triangular defects.

6. Attritional occlusion is associated with a shallow glenoid fossa and a flat head of the mandibular condyle

Begg (1977 p18-19) claims that the attrition in the deciduous and permanent dentition facilitates the development of a shallow glenoid fossa and flat head of mandibular condyle. This theme has also been developed by others such as McHorris (1979) by linking the development of the form of the glenoid fossa to cusp height and interincisal angle and overbite and overjet.

There are conflicting reports of correlations between the occlusion and temporomandibular joint anatomy. Richards (1984) found few correlations especially in the anterior region. Also Richards' literature review indicated that changes in eminence slope were usually associated with grossly pathological joints.

Diagrams of some proposed interrelationships of various areas of the masticatory system from Richards (1984) 'Form and function of the masticatory system'.

Richards (1988) in his discussion considered the relationship between tooth attrition and temporomandibular joint pathology was complicated by other factors and related that it was possible to have degenerative change without much attrition and also gross attrition with mild degeneration of the joint.

Seward (1976) examined the topic of tooth attrition and the temporomandibular joint and quotes work by Moffet in a study on Indians (1968) with 41 percent demonstrating primary osteoarthritic changes due to overuse. He notes Brown's (1965) findings: 'Similar gross changes are seen in a series of Australian aboriginal skulls. Such changes, which usually accompany marked tooth attrition, probably result from a response of the bone to pressure and represent a form of degenerative osteoarthritis.' In briefly discussing this with Seward (1989) he said that some of his findings, on 155 skulls of the Murray Black Collection at Melbourne University, were broader than the scope of the Angle Orthodontist article. To him there appeared to be a triumvirate of features, where marked tooth attrition was evident then there was an increased incidence of condylar head pathology and root resorption. The last feature, root resorption with attrition, is not common within the literature pertaining to precontemporary man and probably requires further research to clarify this hypothesis.

7. Mesial migration of teeth

Some credit Begg with introducing the concept of mesial migration of the dentition. Begg himself credits his first exposure to this concept was as a student of Dr Angle receiving lectures from Dr Spencer Atkinson (Begg 1977 p5). Campbell (1925 p69) also refers to a set of forces to counter the effects of interproximal attrition. Bjork (1969, 1983) also claims there is such an entity. In describing the development of the dentition Burdi and Moyers (1988 p118-9) quote Van Beek for describing mesial migration as occurring even prior to the eruption of teeth and is continuous throughout life as distinct from the anterior component of force which is a mesially directed force the product of axial inclination, cuspal incline, cant of the occlusal plane and muscle activity (Fig 6-22 and 6-23). The anterior component of force is countered by the lips and musculature.

Luke and Lukas (1983) contend that mesial drift of teeth is likely to be a protective mechanism to counter the effects of abrasion and attrition to which, to a greater

or lesser extent, all teeth are exposed. They contend that the literature related to the anatomy of the teeth and wear of teeth of other species indicate that our teeth are constructed for cuspal interdigitation and that the dentition retaining cusps is more efficient in comminuting food.

The emphasis that Begg placed on the dynamic nature of the occlusion and its continual change throughout life is a large philosophical break from the concept of static occlusion as the classical model. The popularisation of this has been important in our current understanding of occlusion.

One would expect that with mesial migration that the dentition would be placed progressively anteriorly yet Behrents (1986) found bimaxillary protrusion lessened with age. Other writers note a post treatment response of the lower incisors as 'uprighting' or even a lingual movement of the apices (Mollenhauer 1987).

The universal nature of mesial movement is also questioned by some authors in their observation of long term post retention cases. Joondeph and Reidell (1985) cite authors on the lingual movement of the mandibular incisors especially relative to pogonion growth. They also note the inconsistency and variability of response possible with post retention incisor movement.

8. There is a presumption that the environment was constant in both time and space for the dentition to be so well adapted to the environment.

There is no allowance given for such variables that most probably existed.

In presenting the occlusion of the Australian aboriginal without any criteria as to the age of the specimens or that they originated from a single region, environmental variation appears to have been ignored. Craven (1958) noted that previous authors have considered variable environment as a factor relevant for consideration to the Australian Aboriginal.

Seward (1976) also notes the lack of an explanation as to why some dentitions he studied had little wear and others had a great deal of wear and hypothesised environment may be a previously overlooked variable.

DISCUSSION

The Begg Attritional Occlusion model as the normal

Whilst researching and discussing the above concepts with some local colleagues, it was apparent that the concept is not absolute in its application. Rather it is a divergence from the inadequacies of the static concepts and crucial to treatment goals of overcorrection and allowances for mesial migration.

In proposing the use of a model of occlusion different to the classical model of Angle (1907) the new hypothesis must provide us with a model that aims to improve on the deficiencies of the former concept, at least in some areas. This requires a knowledge of the present system and the proposed system. The classical model is not within the scope of this essay but it should be noted that its rational basis is by no measure perfect. Brace's (1972) essay is illuminating in this regard.

The present writer finds it intriguing that Begg based his technique upon a racial grouping with possibly the greatest, by modern standards, average bidental protrusion (Craven 1928) with the qualification that this is not universally recognised as a malocclusion (Case et al. 1911 and Tweed et al. 1944) as the philosophical basis of what was a technique biased towards extraction for the resolution of malocclusion. It is also interesting that some of the cephalometric normals, such as lower incisor being forward of the A-Pog line (Williams 1970), were such that they were able to be used as a justification for extraction (Kesling 1984). Many of the examples of Australian Aboriginal dentition presented as normal occlusion would,

by some of the standards above, be deemed to require extractions (Kesling 1985).

The reduction of deep overbite (Begg 1965, 1977) is commonly regarded as a necessary phase during the Begg treatment and the appliance is considered by many to facilitate rapid bite opening in the first stage. The ability and perhaps the desirability of achieving this early in treatment does not necessitate that an edge-to-edge or minimal overbite must be a treatment goal for the completion of treatment.

There is a great deal to learn from Australian Aboriginal occlusion but it must be recognised that we are observing a different race, that the worn dentition is deemed by some as pathological that the commonly noted observation of edge-to-edge occlusion is not universal, and that the amount of interproximal attrition previously noted to occur is possibly overestimated.

With all the unknowns and variables present in the study of the Australian Aboriginal using their occlusion as a model may well be an uncertain basis upon which to base our treatment. However, a static model not incorporating the capability for change throughout life has obvious deficiencies, the attritional occlusion model addresses some of the deficiencies yet by no means provides a definitive explanation.

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