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Orthodontics in a Quantum World V: Bruxism

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Abstract: *Current thinking about bruxism is reviewed. An alternative hypothesis, based on cranial concepts and open system thinking, is suggested. Three examples of severe bruxing are presented. Their diagnosis and treatment illustrates how the cranial concept can be used to understand the etiology of bruxism. This also provides a logical, practical way to approach the management and long-term treatment of bruxing.*

Bruxism has been defined as "the complex, unconscious grinding or clenching of teeth, especially during sleep, or as a mechanism for releasing tension during periods of extreme stress in waking hours."[1] It has also been called "the most prevalent, complex and destructive of all (oral) disorders."[2] The amount of destruction of tooth material can be severe, even resulting in pulpal exposure.

Literature Review

There is extensive literature on bruxism, offering a wide spectrum of opinion.[3, 4, 5] As the definition implies, psychological factors have long been recognized as contributing to the build-up of stress, which is then released by bruxing. Okeson[6] gives an excellent account of this aspect, emphasizing how psychological stress can be cumulative, resulting in variations in the intensity and frequency of bruxing. From a physical aspect, Messing,[2] in an exhaustive review, summarizes many of the articles which consider bruxism as an attempt to remove interferences in the occlusal scheme. Although there is a strong association between bruxism and temporo-mandibular joint (TMJ) dysfunction, the one can be found without the other.[5] When initial treatment is given to control the symptoms of TMJ dysfunction bruxing may cease since the joints and musculature are balanced. This does not necessarily mean that a permanent solution for the bruxing has been achieved.

Zarb and Speck[7] take the view that "establishing an occlusion that will not cause bruxism is not as important as creating an occlusal scheme that will withstand bruxing forces." This view seems to have wide acceptance. A typical treatment plan might involve initial management of any pain or sensitivity arising from the bruxing, usually with a full coverage splint. It is anticipated that the splint will probably continue to be used at night, for an unspecified period. Where restoration of teeth is needed, the placement of a resin-type material is usually preferred, with the understanding that this will eventually wear down and require renewal. Counseling, relaxation techniques or biofeedback[6] may be recommended to help the patient manage psychological stresses during the day. Following the insertion of any restorations these resin-type materials are protected from the bruxing forces with a nocturnal splint. This also helps to prevent further deterioration of the teeth. The bruxing will usually continue, as evidenced by the grooves which develop on the splint.

Placement of a more permanent type of restoration such as a porcelain or gold crown, is much more demanding. The hope is that a position of physiological balance of the mandible regarding the TM joints and the masticatory muscles, has first been achieved. The principles and techniques used in neuromuscular dentistry[8] are an example of this approach. A restoration which upsets this balance can lead to a recurrence of the previously controlled bruxism. The persistence of bruxing is a strong contra-indication for the use of implants.

Working Hypothesis and Clinical Examples

In contrast to the confusing picture of bruxism which continues to dominate dental thinking, the new paradigm of oral physiology proposed in this series of articles[9,10,11,12] outlines a logical explanation for its etiology. This in turn gives a basis for the successful management of bruxing.

A working hypothesis was proposed in an earlier article.[9] This is as follows:

- The body is a non-linear, self-regulating system, far from equilibrium.
- As such, it chooses its response to an internal or external stimulus.
- To maintain optimum health, certain physiological mechanisms take precedence over others.

- The mouth is heavily involved in a number of these mechanisms, over and above its familiar functions of mastication, airway, and speech.

From this perspective, bruxism is a physiological response, even when it leads to pathology such as the destruction of teeth. There is an important distinction to be made between bruxism and clenching. Although they tend to be considered together, and to a minor extent do have a similar role, bruxing is a very effective way for the body to remove tooth material, whereas clenching does not do so.

Three examples of severe bruxism are now presented. These illustrate how a physiological explanation of this phenomenon can be developed. They also demonstrate how a successful long-term treatment plan can be made for the management of bruxing.

Figure 1a, Subject K.B. - The flaring of the ears reflects compression of the occiput and the lateral displacement of the squamous parts of the temporal bones.

Figure 1b, Subject K.B. - The occlusion is an Angle Class I with heavy attrition on the incisors and primary molars.

Subject K. B.

This six year old male, (Figure 1a, b) presented with a history of constant nocturnal bruxing since the age of three years. He had a history of a lengthy and difficult natural birth, although forceps were not used. One of the commonest cranial strains, occurring during the birth process, is the compression of the occiput, as the infant head squeezes past the pubic bone.[13,14] This compression may be unilateral or bilateral, as in this instance. Compression of the occiput can result in lateral flaring of the squamous parts of the temporal bones. This in turn causes the ears to be flared, as exemplified here.

During the day, he did not brux, but he had subconsciously worked out his own way of dealing with the restrictions present in the cranial movement by chewing on whatever was convenient. This included a hockey puck, a baseball mitt and the front of his T-shirts (Figure 2). His mother also reported that he constantly chewed off buttons. Other than his unusual dental habit, he was an active, intelligent individual, in excellent health,

Figure 2, Subject K.B. Objects used for chewing habit: baseball mitt; hockey puck; front of T-shirt.

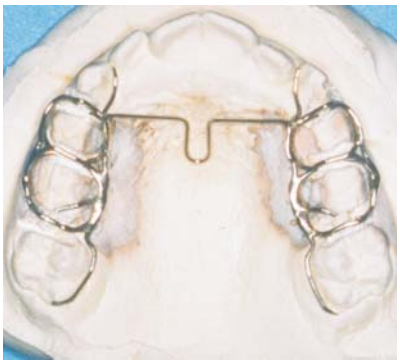

Figure 3, Subject K.B. Type of A.L.F. appliance Wire is Rocky Mountain Yellow Elgiloy for greater resilience.

and with no apparent evidence of psychological stress. He had an Angle Class 1 occlusion, with flattening of all the cusps of the primary molars. There was a lack of space for the permanent maxillary incisors.

A relevant point was that since the age of four years he had been playing in organized ice hockey. Helmets for this group are mandatory, but falls are *de rigueur* for four-year-old skaters. Such repeated falls can result in the spine cushioning the force like a shock absorber, transmitting it up to the C1 vertebra. The angulation of the occipital condyles against the facets of the C1 vertebra results in the inward jamming of these condyles. This can result in reduced mobility of the rhythmic flexion and extension of the cranium. Figure skaters and gymnasts are also prone to loss of cranial mobility due to this type of trauma.

Treatment for K.B. was begun with a referral to an osteopath for evaluation and probable treatment. The osteopath reported that there was severe restriction of the cranial rhythm in an age group where it is normally vigorous and easily palpated. After several cranial adjustments, there was increased mobility, but the bruxing continued. Orthodontic treatment was then begun and continued over a seven-month period. It consisted of an Advanced Lightwire Functional (ALF) appliance, similar to that shown in Figure 3. The wire used is Rocky Mountain Yellow Elgiloy, which has a higher degree of resilience than stainless steel. The appliance was only removed for adjustment at intervals of 6 weeks or so. It was secured in place by bonding composite on to the lateral aspects of the primary molars. Each adjustment was minor and care was taken to ensure

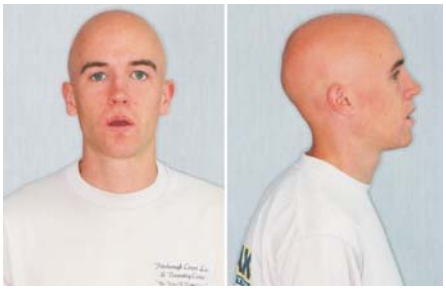

Figure 4a, b, Subject R.F. Twenty year old male. Patient has a hyperextension strain and Angle Class III malocclusion.

Figure 5a, b, c, Subject R.F. Pre-treatment occlusion. . Mandible is displaced anteriorly and to the left.

Figure 6, Subject F.K. Occlusion part way through the treatment. Center lines are now coincident.

Figure 7, Subject F.K. Pre-treatment lateral cephalograph. Note tendency to posterior open bite.

that the force used was within physiological limits. Applied Kinesiology (A.K.) was used throughout, to check for this.[11] The goal was orthopedic expansion of the maxillae. The bruxing ceased after three months, but the treatment was continued for four more months to ensure sufficient space for the eruption of the maxillary incisors. These did so without difficulty. An excellent Angle Class 1 occlusion developed, with no further orthodontic intervention being required. Ten years later, there has not been recurrence of his bruxing or his unusual chewing habit. His fondness for chewing stopped spontaneously with the increase in mobility of the maxillae introduced by the appliance.

Transient bruxing in children during the shedding of primary teeth is a common finding. The erupting

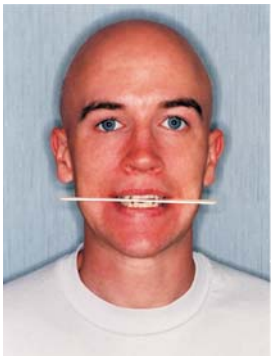

Figure 8, Subject, R.F. Full face view with tongue depressor between the teeth. Occular plane is horizontal, lateral occlusal plane shows slight tilt up to the right.

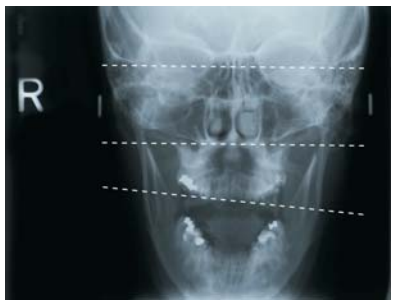

Figure 9, Subject, R.F. PA cephalograph shows ocular plane and floor of nares are horizontal. Only the plane of occlusion is up to the right.

permanent tooth pushes the primary tooth into the occlusal scheme and the bruxing helps loosen the tooth for exfoliation. This patient's bruxing was of a quite different order. The chewing habit during the day enhanced the effort to mobilize the cranium. If this patient had been left untreated, it is reasonable to conclude that there would have been considerable loss of permanent tooth material.

Subject R. F.

This 20 year old male, (Figure 4a, b) presented with a history of severe nocturnal bruxing. He had an Angle Class III malocclusion, (Figure 5a, b, c) reflecting an underlying hyperextension cranial strain.[15] The path of closure of the mandible (Figure 6) showed that this was centered until initial contact was achieved on the incisors. The mandible then deviated anteriorly and to the left to obtain maximum intercuspation. His lateral skull radiograph (Figure 7) shows that his posterior teeth did not occlude fully.

The placement of a tongue depressor between the teeth (Figure 8) showed that the lateral occlusal plane sloped up slightly to the right and that the mandible had centered itself. However the ocular plane was level. The pre-treatment PA radiograph (Figure 9) confirmed this and the fact that the floor of the nose was also level.

He had very little in the way of symptoms such as tooth sensitivity, headaches or TMJ dysfunction, but he did have greatly increased kyphosis and lordosis. This was related to Scheurmann's Disease. This is a non life-threatening developmental condition, appearing in adolescence, and which can cause spinal anomalies.[1] It also causes premature baldness. There was a history of

the patient having received severe trauma to the face at fifteen years of age. At that time, the right side of the frontal bone was fractured and the right maxilla was traumatized.

Dental intervention was directed primarily towards correction of the malocclusion. Previously, he had received extensive osteopathic adjustments but these were not successful in controlling the bruxing. A.L.F. appliances were used initially in both arches (Figure 10). This was to free up the premaxilla and maxilla, expand this arch anteriorly and to procline the incisors. In the mandible, the first bicuspids were extracted. The ALF appliance was used to retract the cuspids then retract the incisors. This appliance also had pads over the posterior teeth. The occlusal pads were adjusted to correct the slight tip of the lateral plane of occlusion. They also helped to allow correction of the reverse overjet. The appliances were then replaced with full fixed appliances and arch wires. Light Class III elastics were used while final alignment was achieved. The final occlusion, (Figure 11a, b, c,) shows the mandible as being centered. Five years later the occlusion has remained stable. Retention in the maxilla was with a Hawley appliance, but the patient admitted to not wearing this with any consistency. He opted not to have veneers placed on the maxillary central incisors.

The bruxing was controlled early in treatment, and has not recurred. The final facial photographs (Figure 12 a, b Figure 13a, b) show change suggestive of an improvement in the airway. The pre-treatment PA radiograph (Figure 9) did indicate possible blockage of the left nares prior to treatment and this may have been improved by the treatment.

In this type of malocclusion, mild faceting of the central incisors would be a normal finding. In this particular case, the bruxing had produced excessive wear. The patient apparently did not brux before the cranial and facial fractures sustained at fifteen years of age. It is reasonable to conclude that the injuries led to loss of cranial flexibility. The subsequent development of bruxing was a response to this. In addition, the displacement of the mandible resulting from the malocclusion introduced severe imbalance into the stomatognathic and postural systems. As has been discussed previously,[12] such a disturbance can affect the overall sense of balance, with subsequent postural adaptation. The bruxing, with resulting destruction of the incisors, could be seen as an effort to achieve physiological balance as well as to mobilize the cranium. In this case, there was both an antero-posterior and a lateral component to the bruxing.

Subject S. B.

This 25-year-old female (Figure 14a) presented with a history of numerous symptoms, including severe

Figure 10 - Subject R.F. Pads attached to the appliance over the posterior teeth in the mandible. This frees up the occlusion anteriorly for correction of the reverse overjet. It was also adjusted to help level the plane of occlusion.

Figure 11 - Subject, R.F. Post-treatment occlusion one year after active treatment. The tension in the maxilla was minimal. Mandible is centered. Bruxing is controlled. Patient opted not to have veneers on central incisors.

bruxing, since the age of 12 years. Her difficulties included postural deterioration and extensive back pain, with a marked worsening of symptoms over the last four years. Headaches were almost constant. She had recently developed visual problems, speech difficulties, and episodes of loss of balance. From a dental aspect, she had TMJ dysfunction, more evident on the right side with pain, reciprocal clicking, and restriction of mandibular movement. There was a history of repeated unsuccessful attempts to control the bruxing with splint therapy.

Her occlusion was a mild Angle Class III. There were veneers present on the six maxillary anterior teeth (Figure 15). These had been placed for cosmetic reasons following severe destruction of their incisal edges due to the bruxing. She subsequently developed an anterior open bite, with a forward tongue resting position. As a result, she was no longer able to manipulate the mandible in order to obtain any form of incisor contact.

There had also been severe attrition of the posterior dentition, with root canal therapy being required on three mandibular molars due to pulpal exposure (Figure 16).

Figure 12a, b - Subject R.F. Pre and post-treatment full faced views. Relaxation of oral musculature is apparent in the post-treatment view.

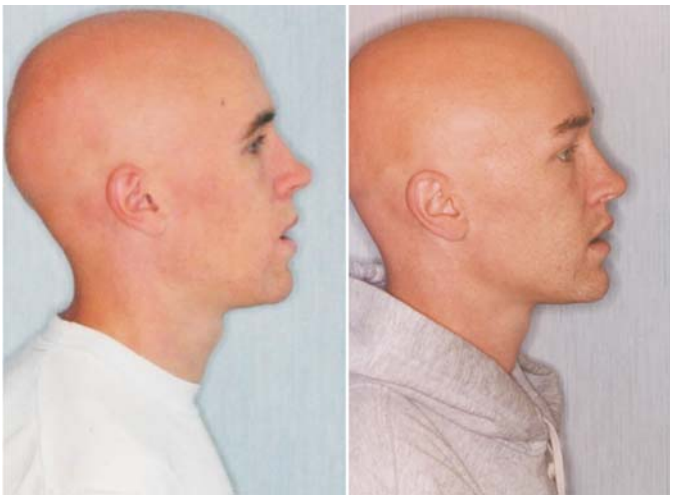

Figure 13a, b - Subject R. F. Pre and post-treatment profile views. Mid-face has come forward with use of Class III elastics.

Figure 14a - Subject S.B. Twenty-five year old female. Figure 14a shows pre-treatment view with tongue depressor in place. Occular and occlusal planes run up to the right. The right ear is lower than the left. These features are characteristic of a right torsion cranial strain. Figure 14b - Subject S.B. - Post-treatment view showing leveling of lateral occlusal plane. Her occular plane also appears to be more horizontal.

Figure 15 - Subject S.B. Pre-treatment view showing veneers on the six maxillary anterior teeth. These were placed for cosmetic reasons due to excessive wear on these teeth. Patient subsequently developed an anterior open bite.

There was over-eruption of both unopposed mandibular third molars. As a protective response, she postured the mandible forward at rest, bringing these teeth into occlusion with the maxillary second molars. This produced an open bite when a functionally generated bite registration was taken. The open bite extended from one maxillary second molar to the other, with the tongue resting between the teeth. To achieve maximum intercuspation of the teeth, she displaced the mandible distally, with subsequent compression of the TM joints. As the facial photograph shows (Figure 14a) she had a severe right torsion.[16] In this strain, the ocular and the lateral occlusal planes run up, more or less in parallel, to the right. The PA radiograph, (Figure 17) shows that the floor of the nares also runs up to the right. The key to a torsion is the rotation of the sphenoid bone on an a-p axis, with the right greater wing of the sphenoid carrying the orbit and the maxilla upwards. The occiput also rotates on an a-p axis, but counter to the sphenoid. The right ear is therefore lower than the left. The lateral cephalograph (Figure 18) shows double imaging of the lower borders of the horizontal rami of the mandible and of the posterior teeth. Together with clinical observations of the face, and the findings on the PA radiograph, these are indicators of the presence of a right torsion.

Treatment for a right torsion has been described in detail previously.[16] One important point is that there are significant differences between a left and a right torsion. They are not mirror images. The first phase of orthopaedic/orthodontic treatment must allow for this. It will be shown in the next article that while facial asymmetry is almost universal, it is not random. This has consequences, both in diagnosis and treatment.

Treatment extended over an 18-month period, due in part to the patient not being able to attend for some months. Extraction of the mandibular third molars was requested prior to the appliances being inserted. The primary objective of treatment was to level the occlusal plane and mobilize the maxillary right quadrant. As Figure 14b shows, this was achieved. The ocular plane was also levelled. ALF appliances were used throughout the treatment. The mandibular appliance had a unilateral

pad over the left posterior teeth. When this was first inserted, the patient experienced immediate relief. The effect of the pad was to start correction of the torsion which was the cause of her imbalance. This patient required close supervision and support, especially over the initial three months, during which she was seen on a weekly basis. The extensive list of symptoms and the severity of the facial and postural distortions made her very sensitive to intervention. The amount of correction of the cranio-facial structures, and the postural correction which followed from this, also made her fragile. Osteopathic support was given at intervals throughout treatment. The use of AK testing was invaluable in gauging each appliance adjustment, ensuring that it was within her physiological tolerance level. In this way she was kept comfortable, despite extensive change throughout the whole body as the torsion was corrected.

Once the occlusion had been levelled and her symptoms (including the bruxing) were controlled, reconstruction of the teeth was appropriate. Interestingly, towards the end of the orthodontic treatment, while the patient was out of the province and absent from the practice for several months, a dentist did place restorations on the left first and second mandibular molars. He was correct in starting with these teeth. The open bite had increased in this area due to the presence of the unilateral occlusal pad on the left of the mandibular appliance. This increase of the open bite had been anticipated, as the occlusal plane was being levelled. Unfortunately, the new restorations were only adjusted with the customary technique of articulating paper and the removal of high spots until the occlusion seemed acceptable to the patient. She experienced immediate recurrence of her difficulties, with a series of emergency visits to the dentist being needed until he had removed sufficient material for her to be returned to her comfort zone. The use of AK testing could have ensured at the time of the placing of the restorations that the patient's physiological tolerance was not exceeded by the procedure. Restorations (for a patient with such a formidable history) must be done cautiously. Temporary restorations should be kept in place for at least several months, while the body continues to adapt.

The important point is that a satisfactory permanent restoration of the dentition, even for a clinical challenge such as this, can be achieved once the primary etiology has been identified and treated appropriately. The additional clinical resource of AK testing, or some other form of assessing the body's response such as palpation of the cranium, is invaluable. The correction of the right torsion brought the body to a point where restoration of the teeth could be undertaken, after ensuring that the restorative dentist understood how to maintain the patient in comfort as he placed each restoration.

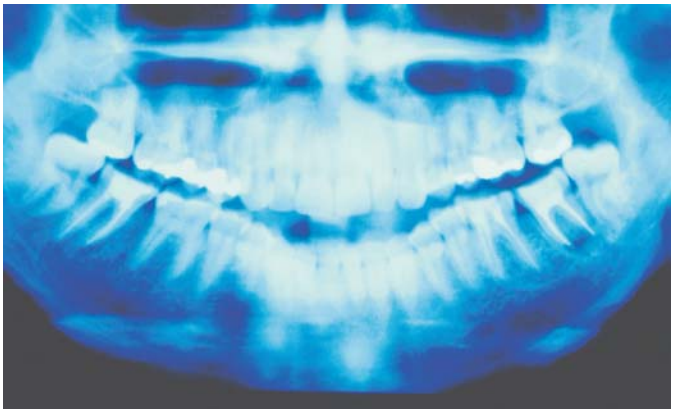

Figure 16 - Subject S.B. Panorex film. Root canal therapy has been required on three mandibular molars due to the severity of the bruxing. Patient postures the mandible forward so that the mandibular third molars occlude with maxillary second molars giving an open bite from one side to the other.

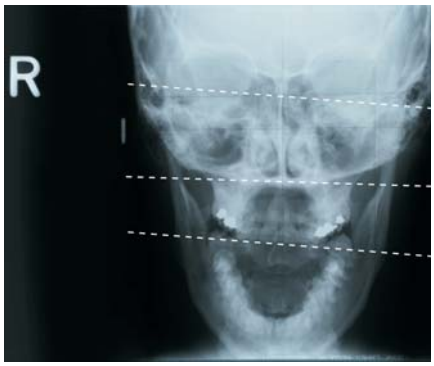

Figure 17 - Subject S.B. Pre-treatment PA cephalograph showing ocular plane, occlusal plane and floor of nares all running up to the right. This is typical of a right torsion strain.

Figure 18 - Subject S.B. Pre-treatment lateral cephalograph. This shows double imaging of the posterior teeth and of the lower borders of the horizontal rami of the mandible. This is commonly found with a torsion type strain.

It is relevant to speculate as to what might have been the outcome for this patient if the torsion had been recognized in early childhood, or even when her difficulties really began to build up at age ten to twelve years. Given how much easier it is to treat cranial strains in children, it could well have spared her many years of suffering. Unfortunately, current orthodontic diagnosis does not recognize the existence of torsion, or indeed of any cranial strain, let alone understand the treatment possibilities offered by the cranial concept. An appreciation of what is

involved in torsion such as this, and how craniofacial mobility can be harnessed, was central in achieving a successful outcome.

Discussion

Each of these three patients presented with severe, ongoing bruxism. By applying the criteria outlined at the beginning of this article, it is possible to understand what caused their bruxing. This gave a logical basis for the successful treatment of their condition. Subject K.B. had a cranial restriction, probably as a result of his lengthy birth process. This was aggravated by subsequent trauma. The need to mobilize the cranium prompted the nocturnal bruxing, but the restrictions were such that he also resorted to significant diurnal activity. Osteopathic adjustment plus minimal orthodontic intervention resulted in a release of the cranial/facial structures, with permanent cessation of the bruxing habit. It is reasonable to assume that left untreated, the severity of his bruxing would have led to excessive wear on his permanent dentition as it erupted.

Subject R.F. also had limited cranial mobility as a result of severe cranial and facial trauma at 15 years of age. He did not brux before the accident, although his malocclusion was fully developed. The underlying cranial strain, (hyperextension) had previously contributed to the Angle Class III malocclusion, with a reverse overjet, incisal interferences, and deviation of the mandible anteriorly and to the left. Such mandibular displacement can cause postural adaptation.[10] Therefore, in this case, there were two factors stimulating the need to brux. The first was to mobilize the cranium, the second was an attempt to gain a centered, balanced, position for the mandible. Orthodontic treatment was effective in addressing both problems. The bruxing was fully controlled, and has remained so four years later without the use of any appliance or splint.

Subject S.B. displayed massive cumulative effects of the underlying cranial strain i.e. a right torsion. Childhood photos showed that the torsion was already present at seven-years-of-age. It probably occurred as a consequence of cranial/facial distortion at birth. The worsening of her difficulties at around 12-years-of-age, when she had completed most of her adolescent growth spurt, was due to the loss of flexibility normally present in a growing individual. Early recognition and treatment of the cranial strain would almost certainly have been of benefit, besides being much simpler and easier to do. In this case, the torsion was the primary etiological factor. This individual, unlike the two previous patients, did have significant psychological stress. This was not surprising, given the accumulation of symptoms, and the failure over so many years, for successful treatment. In this case, the psychological stress was secondary to the physical imbalance and the lack of effective treatment, rather than being a major cause of the cranial strain. The emphasis in the dental literature on psychological stress stems in part from the failure to find satisfactory physical explanations for bruxism.

Subject S.B. also shows, in a severe form, another common response of the stomatognathic system to an imbalance. The initial reaction is for the patient to develop a localized tongue thrust. This gradually increases with time. The tongue both protects the teeth and supports the maxilla.[10] Eventually, the second molars are the only teeth in contact when a centric relation bite registration is taken and models are mounted on an articulator. Often only one side is touching. Typically, bruxing develops in an effort to level the maxilla by removing the interference. The rest of the teeth may already show evidence of bruxing even though they no longer contact the opposing arch. The second molars are subject to excessive wear with probable fracture of the enamel, or even root fracture. One seemingly obvious solution is to equilibrate the offending tooth or even in an extreme case, to extract it in an attempt to let the rest of the dentition come into contact. This does not explain why the tongue developed an interocclusal rest position in the first place. For Subject S.B., the tongue was her only means of introducing a semblance of balance and support into the severe imbalance caused by the torsion.

Another tempting solution involving the second molars, is to place a restoration, such as a gold crown, which can withstand the bruxing forces, as Zarb et al[7] suggest. This also does nothing to address the crux of the problem and could easily cause the bruxing to worsen. A more ambitious restorative scheme would be to place onlay type restorations to build up the occlusal surfaces of the teeth which are out of contact.[8] This increases the vertical dimension, which may be favorable but it has the effect of locking the patient into the cranial strain rather than helping to correct it.

A more physiological approach is to check whether a cranial strain and/or a postural problem is present and to treat that first. The need for combined dental and osteopathic treatment may be indicated. Even if only dental intervention is available, some form of orthodontic treatment to correct or minimize the strain pattern is appropriate, before restorations are attempted.

A common theme in the dental literature on bruxism is that the maxilla is immobile and that treatment such as equilibration must work around this immobility. An appreciation of cranial mobility and the oral consequences of the various cranial strains not only provides an explanation for bruxing, it enables a treatment plan to be devised using the fact that the maxilla is capable of

movement. Obviously, this does not resemble that of the mandible, but the maxilla can be altered significantly. **What is important is that the key to the problem of bruxing lies in the maxilla and by extension, in the supporting bones of the upper face and cranium, especially the sphenoid. To this we must add postural imbalance throughout the body and how it feeds into the overall system.**

It follows from this argument that particular attention should be made during the diagnostic process to identify if a cranial strain is present. The articles on the cranial strains, written in collaboration with Dr. Dennis Strokon,[15-23] discuss the characteristics of each strain and how these influence oral structures and behavior. For example, a torsion or a sidebend[21] strain can be superimposed on another strain. When this happens, if these particular strains are mild, it is easy to overlook them unless thorough records are taken.

Bruxism may indeed be resolved by equilibration only. However, before subjecting a patient to the removal of tooth material, a careful examination should be made to ensure that there is not a more serious, fundamental imbalance in the stomatognathic and postural systems. With an appreciation of cranial movement, and how cranial strains affect oral structures and behavior, a far more comprehensive approach to the etiology and treatment of bruxism is possible.

Conclusions

Bruxism is a physiological response to the presence of interference in the occlusal scheme. To support such a broad claim, it is necessary to recognize the existence of cranial movement as a normal part of a healthy cranial system. Craniofacial strains and postural factors are closely integrated with oral structures and behavior. The treatment of bruxism by equilibration only, may at times be appropriate but it is necessary to ensure that there is not an underlying cranial or postural imbalance which is the primary etiological factor. Where this is the case, treatment objectives should be directed to resolving this as much as possible as a first step in the management of bruxism. Successful placement of permanent restorations is achievable by recognizing the role of the cranial concept.

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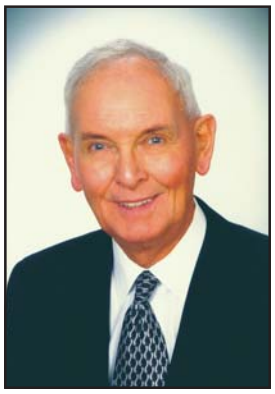

Dr. James is an Orthodontic Specialist in Barrie, Ontario, Canada. A major part of his practice was concerned with the management of temporomandibular joint and craniomandibular disorders. His interest in cranial movement has developed as a part of a more comprehensive examination of the problem of head and neck pain. He has now retired from active practice but continues to work as a consultant.