

The Story of Occlusion

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Citation: McCoy G (2023) The Story of Occlusion. J Den Re Ora Heal: JDROH-102.

Received Date: March 30th, 2023; Accepted Date: April 06th, 2023; Published Date: April 10th, 2023

Abstract / introduction

The subject of Occlusion is presented and perceived to be an understanding of the masticatory system. This should entail knowledge of its' components, how they work together to perform a certain task, how to recognize dysfunction, and management if it occurs. Unfortunately, that understanding is elusive if not impossible. As it turns out, Occlusion is not a subject at all, but a misconstrued redefinition of a word that has created considerable confusion. Its' legacy is that it has been a major diversion from the understanding the true nature of the function/parafunction relationship of the masticatory system.

What happened to make this the most controversial, least understood subject in dentistry?

Occlusion Confusion

In medicine, the word *occlude* means to shut or obstruct the passage of something such as a thrombus occluding a coronary artery and *occlusion* would be the act of occluding. In dentistry, the word occlusion was originally defined as the maxillary and mandibular teeth being closed, but with the passage of time the definition was completely changed to become a synonym for the masticatory system. Fig.1

Occlusion 1898 (Dorland) [1]

The contact of the teeth of both jaws when closed.

Occlusion 1982 (Jablonski) [2]

The relationship between all the components of the masticatory system in normal function, dysfunction, and parafunction, including the morphological and functional features of contacting surfaces of opposing teeth and restorations, occlusal trauma and dysfunction, neuromuscular physiology, the temporomandibular joint, muscle function, swallowing and mastication psychophysiological status, and the diagnosis, prevention, and treatment of function disorders of the masticatory system.

Figure 1: Two different definitions

Why did this happen?

Mohl explains: "There had been a movement among dentists to modify the meaning of the word Occlusion. They felt that even though previous definitions were accurate, they were too narrow and did not truly define the field [3].

They thought that the word *Occlusion* should be construed as an understanding of the masticatory system itself---not just closure, and they had their chance with Jablonski.

Stanley Jablonski was a prolific writer but not being a dentist, he relied on glossaries and 31 consultants (13 of which were dentists) to produce his 887- page *Jablonski's Dictionary of Dentistry* [2]. His definition of Occlusion was from their input.

Did the change benefit dentistry?

In a word, no. The consultants may have had good intentions, but their input created a state of confusion that has lasted for decades. In semantics, broadening of a word to enhance its meaning is common, but this was not enhancement: this was a full change of the meaning.

The masticatory system is the gateway to the major digestive system. It's job: to mechanically break down food as it begins

its journey through the gastrointestinal tract from mouth to anus. It is the restorative dentist's responsibility to understand how the system normally functions and management during parafunction. Declaring that Occlusion was to reference this system did not offer any advantages to achieve these goals.

Previously, it was common to debate occlusion's role in the function of the system: now Occlusion had become the system. Dentists were confused: goals were not defined. There was no explanation as to what a good occlusion was, and how to achieve it: nor bad, and how to correct it. Subsequently, the ADA sponsored three workshops to clarify these issues so that an understanding of Occlusion could be introduced into a dental school curriculum.

The ADAs' first workshop (1952) was a nomenclature conference [4] whose official purpose was to interpret general concepts of occlusion in its broadest significance. There were 30 participants, and the dissention was high. At the conclusion of the conference, the only determinant was that occlusion was either functional (harmonious medium occlusion) or it was parafunctional (disharmonious peripheral occlusion).

The second workshop (1975) entitled Occlusal Education [5], was a serious attempt to investigate and survey the trends and goals of occlusal education in the US and Canada. In this workshop Solberg discussed the change: "Occlusion, *once limited to tooth contact, has now become identified with co-functioning areas of the entire stomatognathic system*". Not everyone agreed: Dr. Willy Krogh-Poulsen stated that the term Occlusion should be restricted to define only contact relations of the teeth.

In 1983, a new report entitled Special Guidelines n Occlusion [6], using the 1975 workshop as a reference, was developed by James Buckman and Jeffery Okeson. No new recommendations were forthcoming.

What are we to make of all of this? A restorative dentist's responsibility is to maintain the health and function of the masticatory system: how should it be done? Parker Mahan opines in the 1975 workshop: "Our goal is to recognize not only normal and abnormal masticatory system anatomy and function, but also dysfunction, its etiology, and management." So, if that is our goal, let's take Dr. Mahan's advice and review the system:

how should it work ideally, what is the role of the dentition in function, and how to manage parafunction?

Description of the System

The masticatory system consists of two u-shaped rows of teeth overlapping each other. The upper arch is fixed to the maxilla, and the opposing one to the mandible. Whereas the maxilla is fixed and part of the skull, the mandible is mobile and connected to the temporalis coronoid processes by masticatory muscles.

The mandible functions vertically with a slight elliptical stroke enabling the overlapping teeth to slice through food every time it approaches occlusion. After mastication, the mandible assumes a position of rest approximately 2 to 3 mm shy of occlusion.

Ideal Occlusion

What is an ideal occlusion (the design of the dentition in closure) that will allow the mandible to operate freely, therefore normally? A cross section of unworn molars in occlusion demonstrates a generous space between the teeth with the contact area confined to the crest of the mandibular buccal cusp which occludes with the maxillary central fossa [7] Fig. 2.

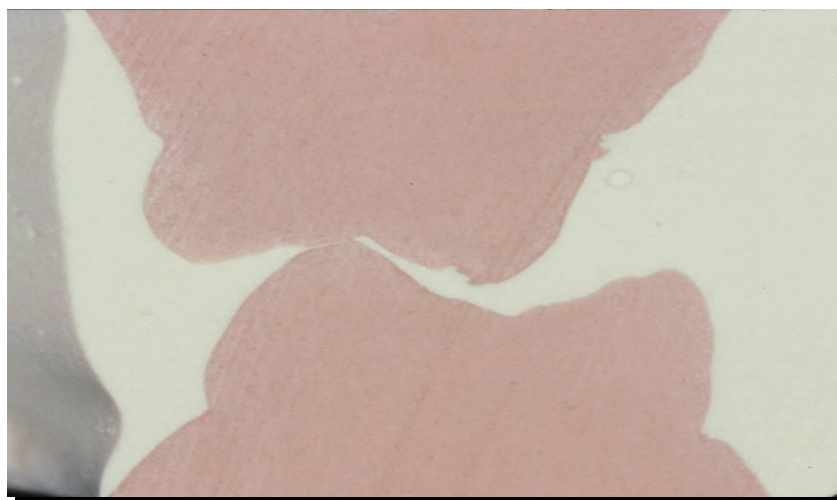


Figure 2. Cross section of unworn molars in occlusion

What were the intentions of our biological architects with such a design? There are two benefits of the limited contact. First, this position directs vertical loads down the axis of the tooth, allowing the divergent roots to distribute the forces to the alveolar bone. Secondly, it ensures minimal stress when clenching occurs.

G.V. Black once stated that if a masticating of 171 pounds were reduced to an area of 0.01 square inch on a cusp surface, the stress would increase to 17,000 pounds per square inch. However, this would only be correct if there were only two teeth. Since the remaining teeth would not allow the clenching force to increase, the status is limited to pounds per square inch: therefore, the less surface area in contact, the less stress [11].

In addition, the fact that there is generous space between the incline planes avoids collisions during mastication and allows unrestricted anterior-posterior repositioning of the mandible as

the body varies from a vertical position. The cusps are sharply designed to efficiently slice through food.

Natural Deviations and Important Clinical Consequences

Considering that not everyone has a natural class 1 jaw relationship, nor a straight dentition, what are we to learn from our biological architects? That when designing a restorative occlusal scheme in restorative dentistry, a theme of vertical loading is preferred, and incline plane contacts are not. What about worn, flattened teeth? Should they be reshaped (equilibrated)? It is not unusual for certain patients to wear their teeth flat over time: it seems to be a natural process for some and to alter their occlusal scheme might accelerate the process.

When *is* equilibration indicated? When patients are uncomfortable upon closure, it is usually because the strongest contacts are predominately on the incline planes resulting in off-loading of the dentition and sensitivity at the DEJ upon clenching. This last point is easily verified using occlusal

indicator wax. Upon confirmation of the undesired contacts, a decision will be made as to whether these contacts should be eliminated by equilibration or by orthodontia. The bottom line is that no matter the anatomical relationship of the upper and lower dentition upon closure, in the absence of parafunction: all is good. The key is comfort.

Understanding Parafunction in Restorative Dentistry

Restorative dentistry is the branch of dentistry that describes the restoration and replacement of teeth. While a dentist's primary concern would be the restorative project, there must be an appraisal of the masticatory system's general health: is it functioning "normally" or is it affected by parafunction which is abnormal or disordered function. Minor examples would include tongue thrusting, lip biting, and thumb sucking. That said, two major forms of parafunction deserve special attention: grinding (bruxism) and clenching (Dental Compression Syndrome) due to the dramatic consequences these powerful forces generate.

Bruxism

Although Paesani's definition of Bruxism includes *clenching* [8], it serves us better to examine the two separately and limit the term Bruxism to the original Greek expression *Brychein Odontas*, which means teeth grinding.

Upon clinical examination, the most common signs to suggest bruxism are tooth wear, fractures, tooth mobility, and pulp necrosis. While there are diverse opinions regarding the etiology of bruxism: stress, genetic and family environmental factors are prime suspects.

Management of Bruxism

There is no specific treatment for bruxism, hence its management focusses on protection by having patients wear guards/splints. Paesani opines: "*Splints can be said to be to bruxism what umbrellas are to rain. Both splints and umbrellas can offer protection, but the process cannot be prevented by them.*" [8]

Reacting to Bruxism

Initially, the dental profession tried to minimize damage from bruxism's grinding forces by distributing them to the cuspid, bicuspids, and the molars: it was termed *Group Function* [9]. Later, D'Amico suggested redirecting them to the cuspids to lower the force:¹⁰ then came anterior guidance [11]. So the question is: since the majority of bruxism occurs while sleeping, why didn't the profession just prescribe guards instead of trying to reduce and manage these destructive forces?

The idea of a proactive approach, using a guard to protect against bruxism, wasn't really apparent at that time. The first guards, *gumshields*, initially were prescribed for boxers in the late 1800's and then for football players in the 1940's, but not for bruxism. The term parafunction wasn't even introduced until 1983, so the connection just wasn't there.

Paralogism related to bruxism

One cannot leave a discussion of bruxism without discussing the validity of cuspid rise, anterior guidance, implant protected and mutually protected occlusion [12,13]. These are prime examples of paralogism.

A paralogism is a piece of illogical or fallacious reasoning—especially one which appears superficially logical. The idea that certain teeth were designed to protect other teeth from parafunction is just not accurate: teeth were designed to slice through food. If these ideas were valid, there would be no wear and no reason for a guard.

Dental Compression Syndrome (DCS)

Clenching is far more severe than grinding for several reasons: it occurs twice as frequent as grinding [8], it directs powerful vertical forces to the TMJ, and it works well within a patient's subconscious. Since most patients are not even aware, recognition of the visual signs is vitally important. DCS is distinguished as a syndrome because there are distinct signs associated with the disease. In addition to the enlargement of the mastication muscles, common signs might include multi-shaped examples of hard tissue fatigue caused by compressive forces, highly polished concavities appearing on occlusal surfaces, lines of Luder in metallic restorations, material fatigue in acrylic prostheses, exostosis, and alveolar bone loss [7,8]. Management cannot be successful without the patient's awareness and cooperation. While the etiology of Bruxism can be solely attributed to the CNS, it is much more diverse for DCS. Other factors that should be discussed are exercises such as stretching, rowing, lifting weights, or any sport where there is a bracing of the body. There are also psychological reasons such as anxiety, fear, aggression, anger, and pain in general, not to mention certain medications. The treatment for non-dental causes would be to eliminate the etiological factor if possible or have a serious conversation with the patient if the source seems to be unconscious behaviour control

Occlusion and the TMJ

Is occlusion an etiology of TMJ problems? A proper answer cannot be given if occlusion is seen as the combination of closure and function, but in this case the question wants to know if it's possible that the way teeth touch in closure could cause discomfort to the TMJ? It's possible: imagine a perfectly comfortable patient whose mandible is distracted upon closure because of an overly contoured gold crown. However, the question we should be asking is whether parafunction, specifically DCS, is creating havoc with the joint. Considering that clenching can generate hundreds of pounds of force, one must ask: what percentage of that force targets the condyles and menisci?

It is not unreasonable to compare TMJ discomfort to carpal tunnel syndrome: both are due to a combination of factors; primarily repetitive motion trauma: some are disabled, some are not. Accordingly, if a TMD patient is affected by DCS, initial management should be focused on reduction of the clenching.

Implantology

The longevity of implant restorations is easily compromised by hundreds of pounds of compressive forces from parafunction which may have contributed to the loss of the patient's natural teeth initially. Implantologists should consider that cuspid rise, anterior guidance, and implant protected occlusion offer not even a modicum of protection from DCS. Protection comes from a thorough understanding by the patient of all the etiological factors that initiate DCS and guard therapy if appropriate.

End of Story

The short-term success of any dental restoration depends upon the expertise of the dentist and the complexity of the restoration; however, the long-term success depends on excellent periodontal maintenance and the absence of parafunction/dysfunction.

The common theme throughout all the nomenclature conferences was that prevention of parafunction and its sequelae is achieved by a deep understanding of the ideal form/function relationship of the system, but this is limited thinking. The onset of parafunction is not limited to physical relationships of the dentition, but may include many other etiological factors such as mental stress, exercise, and certain medications.

While there are total reconstructions that take place, 99% of dental restorative work is the repair or replacement of a segment of the dentition, where the restorative dentist has two concerns: to comfortably blend the new work into the existing system, and to detect and manage parafunction if it occurs in the system itself. Bruxism is easily diagnosed and managed, however DCS is dangerous because of the powerful forces it inflicts upon the TMJ and the fact that it is silent: most patients just do not complain. Since it occurs during waking hours, management is the patients' responsibility, however detection, diagnosis, and education is ours.

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References

1. Dorland, W.A.N. Dorland's pocket medical dictionary, 1st ed, W.B. Saunders Co. 1898-19, Philadelphia
2. Jablonski, S. Jablonski's Dictionary of Dentistry, Krieger Publishing Company, Malabar, Florida, 1998
3. Mohl, N.D. A textbook of Occlusion, Quintessence Publishing Co., Inc. 1988, Chicago, Ill.pg16
4. JADA Volume 46, Issue 3, p324-335, March 1, 1953
5. Proceedings of the workshop on Occlusal Education. 1975, publication @ adea.org
6. Curricular Guidelines in Occlusion, Journal of Dental Education. Vol.47, No. 8, p 561-65, Aug. 1983
7. Br Dent J.2019 Sep;227227(6):512-517
8. Kroug-Poulsen, W.G. Proceedings of the Workshop on Occlusal Education, 1975, AADS, LSU, New Orleans, La.
9. Gray's Anatomy, 27th ed. Lea & Febiger, Philadelphia
10. McCoy, G. Dental Compression Syndrome, A New Look at an Old Disease, J. Oral Implantol. 1999,25: 35-49
11. Black, G.V. The Science of Dental Materials, E.W. Skinner, 3rd ed. 1946
12. Paesani, D.A. Bruxism Theory and Practice, Quintessence Publishing Co. Ltd. 2010, United Kingdom
13. Sidana,V. Bhasins,S. Makkar,M. Group Function Occlusion, Indian Journal of Oral Sciences, 3(3):124, 2012
14. Shah,S.B. Khan,S. Murtaza,S. Ahmad,A. Study of Tooth Wear in Canine Guidance Versus Group Function Occlusion, JKCD. December 2014, Vol.5, No.1
15. Broderson,S.P. Anterior Guidance—The Key to Successful Occlusal Treatment. J Prosthet Dent. 1978 Apr; 39(4):396-400
16. The Journal of Prosthetic Dentistry, Eighth Edition,2005, Mosby.