The Rationale for Management of Morphologic Variations and Nonphysiologic Occlusion in the Young Dentition

S. Ross Bryant, BSc, DDS, MSc, PhD, FRCD(C)
Assistant Professor
Department of Oral Health Sciences, University of British Columbia
Canada

What Do We Know?

Assessment

Nonphysiologic. Signs or symptoms of abnormal function.[1] *Nonphysiologic occlusion.* Lack of functional adaptation in masticatory system that is difficult to define based on abnormal form/morphologic deficit.[2]

- Signs or symptoms of occlusal instability or lack of adaptation in teeth, periodontium, joints, or muscles.[2]
- Typically involves missing, malformed, or otherwise deficient dental, osseous, or neuromuscular structures, and may involve a lack of patient satisfaction with function or esthetics.[2]

Malocclusion. A dental occlusion typified by variation from ideal form/morphology.[2,3]

- Not necessarily associated with lack of functional adaptation, but often impairs facial appearance.[3]
- Originally, Angle[4] classification—Class I, II, and III corresponding to anteroposterior position of first molar and alignment of teeth around the arch perimeter.
- Now, variation about 1 or more of the 3 planes of space—orbital (sagittal or anteroposterior variation), midsagittal (transverse or lateral variation), and Frankfurt (vertical variation).[5–7]

Etiology. Genetic/environmental factors mediated through dental, osseous, or neuromuscular sites.[3]

- Specific genetic and environmental agents cannot usually be identified.[5]
- Environmental factors, eg, mandibular trauma, parafunctional habits, early loss of primary teeth.[5]
- Genetic factors, eg, congentially missing teeth, jaw growth direction, specific genes not known.

Distribution

Normative data. Available for anteroposterior and vertical relationships from lateral cephalometric studies.[8]

- Also available for transverse relationships and tooth size prediction and comparison.[9,10]
- Appearance and physiologic occlusion are complex concepts not lending to normative study.

Malocclusion. Ideal occlusion is unusual; nonetheless, functional adaptation is the norm.

- Approximately 70% of North American youths have malocclusion.[11,12]
- Malocclusion Angle Class I (50% to 55%), Class II (15% to 20%), and Class III (less than 1%).[11,12]
- The most common type of malocclusion is malalignment (crowding) with Angle Class I.[5]

Missing teeth. Some children have missing or malformed dental, osseous, or neuromuscular structures.

- 2% to 10% of children have congenitally missing permanent teeth.[13,14]
- Usually, up to 2 teeth are congenitally missing; premolars more commonly missing than lateral incisors.[13]
- Oligodontia with 6 or more congenitally missing teeth occurs in fewer than 1 in 1,000 children.[15]
- Teeth missing because of trauma may be even less common in youth, but typically involve incisors.[16]

Impact

Psychosocial impact. Malocclusion is thought to manifest a negative psychosocial impact, mainly through perceptions of facial appearance as influenced by personal and societal values.[17,18]

- Variations in tooth position correlate well with facial attractiveness among American youths, and malaligned or protruding teeth can yield negative social status.[18]
- Similar handicap experiences have been found in other developed countries[19]; 7% of Welsh children are teased at least once a week about tooth appearance.[20]
- Psychosocial debilitation of malaligned teeth may be disproportionately worse than anticipated.[21]
- Impact of congenitally missing teeth may not be obvious; only 15% of afflicted children have esthetic complaints,[22] a finding that likely relates to the typical location and extent of deficit.

Functional impact. Severe malocclusion, although relatively uncommon, can compromise chewing function in the young dentition.[23]

- Negative functional impact of malalignment and other mild malocclusion has not been established.
- Depending on location and extent of the deficit, the functional impact of congenitally missing teeth may be

Table 1 Theories on Managing Abnormal Occlusal Function and Form

Study	Year	Subject
Prosthodontic theory		
McCollum[33]	1938	Gnathology, malarticulation, balanced occlusion
Schuyler[37]	1929	Balanced occlusion may not suffice for natural dentition
Beyron[38]	1954	Characteristics of functionally optimal occlusion
Mohl et al[2]	1988	Physiologic occlusion
Hobo and Takayama[32]	1997	Gnathologic occlusion
Orthodontic theory		
Angle[4]	1900	Malocclusion in A-P plane, alignment
Simon[6]	1922	Malocclusion in three planes
Ackerman and Proffit[7]	1969	Esthetics, alignment, symmetry, malocclusion in three planes
Roth[35]	1995	Gnathologic complete-mouth rehabilitation in enamel
Rinchuse[36]	1995	Esthetics, functional occlusion

minimal; 40% of children with congenitally missing teeth have no complaints.[24]
- More extensive childhood deficiencies in teeth and other oral structures, often associated with rare syndromes such as ectodermal dysplasia, variously yield both esthetic and functional problems.[14]

Future oral deterioration and disease. Malocclusion has been thought to increase the likelihood of future oral disease or deterioration; however, studies have not borne this out as a major problem.

- There is an elevated 1 in 3 risk that a child with a Class II malocclusion and protruding maxillary teeth will traumatize maxillary incisors enough to cause fracture or devitalization.[24]
- A severe Class II malocclusion with an impinging overbite, although relatively uncommon, may also predispose the maxillary incisors to lingual tissue trauma and attachment loss.[5]
- It has been hypothesized that malalignment of teeth predisposes to both caries and periodontal disease; however, evidence does not defend the supposition.[25,26]
- Risks of tooth wear and temporomandibular disorders (TMD) have also been attributed to malocclusion; however, scientific evidence questions any essential role that malocclusion has in the pathophysiology of either condition.[27–31]

Management

Treatment strategies. Abnormal occlusal form and function can be managed as needed with orthodontic, surgical, operative, and/or prosthodontic treatment.[2,5]

- In developed countries, childhood malocclusion is often treated orthodontically to improve dentofacial esthetics and the distribution of occlusal stress in the masticatory system, and occasionally to align teeth and edentulous segments in preparation for prosthodontic rehabilitation.[2,5]
- Prosthodontic treatment is often implemented as a form of salvage for the functional and esthetic compromises that can result from missing or damaged teeth and oral structures.[2]
- Morphologic criteria do not appear to satisfactorily identify when intervention is needed.
- The masticatory system normally demonstrates substantial adaptive capacity, particularly in youth.
- A major bioethical obligation in any treatment intervention is "above all do no harm."
- A potential biologic price is inherent in all treatment strategies.
- We lack long-term studies comparing treatment and no treatment for abnormal occlusion.
- Occlusal treatment should be minimized where occlusal stability/functional adaptation are evident.
- Functional adaptation following treatment is an inadequate justification for it.

Gnathologic approach. Highly adjustable articulators have been argued to better enable location of the condyles in a predetermined centric relation position in precise harmony with centric and eccentric occlusal contacts.[32]

- Based in early prosthodontic literature (Table 1),[33,34] this approach has recently been promoted such that orthodontics is about doing a "full mouth reconstruction in enamel."[35]
- Nearly ubiquitous "malarticulation," and the failure to adhere to gnathology, is said to lead to oral deterioration including tooth wear, TMD, pulpitis, periodontal disease, and orthodontic relapse.
- It does appear that the gnathologic approach can provide a physiologic endpoint; however, it does not appear to be necessary for achieving an esthetic and functional therapeutic occlusion.

Functionalist approach. Treatment involving occlusal changes—orthodontic, prosthodontic, or otherwise—should optimize function and appearance in keeping with a physiologic occlusion.[2,36]

- Based in early prosthodontic literature (Table 1),[37] this approach took on a practical tone with Beyron's proposals[38,39] for the optimal morphologic objectives of a therapeutic occlusion as follows: *(1)* acceptable interocclusal distance; *(2)* stable tooth-to-tooth contact with axially directed forces on posterior teeth; *(3)* bilateral centric contacts; *(4)* freedom in retrusive range with intercuspal

position at or anterior to retruded contact position; and *(5)* multidirectional freedom of occlusal contact.
- It does appear that Beyron's approach can provide variable scope for achieving an esthetic, functional, and physiologic therapeutic occlusion across disciplines; however, sound evidence to support this is lacking.

What Do We Not Know?

Theories abound, but evidence is short. The lack of evidence certainly pervades clear and unequivocal morphologic, functional, and psychosocial criteria for defining physiologic and nonphysiologic occlusions in the young dentition, especially in the context of biologic and psychosocial adaptation to variations in form and function.

In the absence of intervention, we do not know if the various proposed criteria of occlusion are either necessary or sufficient for the maintenance of a physiologic occlusion in the young dentition, and we do not know what variations in occlusal form and function can be adapted to in an individual and why. We do not know the relative importance of the various proposed features for therapeutic occlusal interventions in the young dentition in relation to their effect on long-term outcomes, including the relationship between the intervention and its biologic price.

What Research Strategies Are Needed?

Additional normative studies of the form, function, and disability related to young and aging dentitions in various human societies are required. Continued research is needed into the features and mechanisms underlying biologic and psychosocial coping and adaptation with variations in human occlusal form and function. Also required are additional efficacy and effectiveness studies (both randomized controlled trial and cohort studies including community-based cohort studies) of the biologic and psychosocial outcomes of various therapeutic occlusal interventions (including nonintervention strategies) used to manage variations in occlusal form and function in the young dentition in various human cultures and societies.

What Needs Highlighting in Educational Programs?

We need to continue to improve undergraduate and graduate programs in their mandate to promote evidence-based decision making for diagnosing and treating problems in the young masticatory system (or indeed any dentition), even when the evidence is not definitive. We need to maintain constant vigilance in maintaining at least an equal priority on the questions of why and when to intervene and when not to intervene, compared to the more popular and commercial question of how to intervene.

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Determinants of a Healthy Aging Dentition: Maximum Number of Bilateral Centric Stops and Optimum Vertical Dimension of Occlusion

Winfried Walther, Dr Med Dent, PhD
Vice Director
Academy for Postgraduate Dental Studies
Karlsruhe, Germany

Introduction

In 1969 Beyron stated that the determinants of a healthy aging dentition are a maximum number of bilateral centric stops and an optimum vertical dimension of occlusion.[1] This approach should be analyzed considering contemporary results of dental research.

What Do We Know?

Occlusal Philosophies and Knowledge About Occlusal Contacts

Teachers of occlusal philosophies emphasized the location, size, distribution, and number of occlusal contacts, starting from the concept that an ideal occlusion can be found. Clinical investigations have established knowledge about the means of recording occlusal stops and the variations in occlusal contacts.

Occlusal indicators vary, and their markings may not be reproducible. A gold standard for recording occlusal contacts has yet not been established.[2–5] Occlusal contacts change throughout the day and over longer intervals and depend on the pressure and physical state of the masticatory system.[3,6,7] The location of occlusal contacts found in clinical studies differs from theoretic considerations, ie, from the concept of tripodism.[8]

Number of Occlusal Contacts

In an elderly population, approximately five contacts on each side of the posterior region of the tooth arch are to be found. Short-span fixed appliances exhibit more occlusal contacts than do longer span prostheses.[9] In young adults, the number of occlusal contacts relates with masticatory muscle activity.[10]

Maximum Number of Bilateral Centric Stops

The concept of providing the patient with the maximum possible number of bilateral centric stops has been challenged by the concept of the shortened arch. There is evidence that the shortened dental arch consisting of anterior and premolar teeth can provide adequate functional rehabilitation.[11,12]

Occlusion and the Development of Situations Leading to Symptoms

Changes of the occlusal contact pattern toward a traumatizing contact may lead to periodontal alterations. The effect of trauma from occlusion has been evaluated in animal models. A traumatic occlusion leads to increased mobility and reversible alterations of the periodontal apparatus.[13] There is support for the assumption that a stable occlusion in the intercuspal position is an essential prerequisite for the maintenance of extended fixed partial dentures on periodontally compromised abutment teeth.[14]

In rare instances, patients complain about continuous discomfort after restorative dental treatment because of the lack of familiarity of their own bite (phantom bite syndrome). Treatment success is rarely, if ever, obtained.[15]

Optimum Vertical Dimension

The difference between vertical dimension of occlusion and rest position (clinical freeway space) has been stated to be of decisive value for diagnostic and restorative procedures. Postural jaw position varies within the same person and is influenced by body posture, speech, and emotional tension.[16] Measures of clinical freeway space depend on the method used.[17] Electromyographic monitoring of the jaw muscles has not been proven to allow diagnostic decisions.[18] The patient has a good chance of adapting to an increase in vertical dimension.[19]

What Do We Not Know?

The variability of the results described does not support the assumption that the clinical reality of teeth and jaw relations can be described using mechanistic models.

To develop the rules of an "optimal occlusion," the authors of occlusal philosophies interpreted anatomic findings. They