

# Evolution of occlusion and temporomandibular disorder in orthodontics: Past, present, and future



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Occlusion has been an important consideration in orthodontics since the beginning of the discipline. Early emphasis was placed on the alignment of the teeth, the stability of the intercuspal position, and the esthetic value of proper tooth positioning. These factors remain important to orthodontists, but orthopedic principles associated with masticatory functions must also be considered. Orthopedic stability in the masticatory structures should be a routine treatment goal to help reduce risk factors associated with developing temporomandibular disorders. (Am J Orthod Dentofacial Orthop 2015;147:S216-23)

The role of occlusion and its impact on functional disorders of the masticatory system continues to be a resounding issue in orthodontics. This interest is appropriate because orthodontists routinely and completely change a patient's occlusal conditions during therapy. Orthodontic therapy can be likened to a full-mouth reconstruction by a prosthodontist; however, this therapy is accomplished in the natural dentition. Adding to this issue is the fact that most of these changes occur in young, healthy adults, so this is unlike any other dental specialty. It would therefore behoove orthodontists to be cognizant of the effects of these changes, since they will influence masticatory functions for each patient's lifetime.

Over the years, the role of occlusion on temporomandibular disorder (TMD) has been extensively debated, leading to many opinions and much controversy. The purpose of this article is to review the history of occlusion and TMD as it relates to orthodontics. Occlusal treatment goals will be reviewed as they relate to joint function. As a nonorthodontist, I am pleased to have this opportunity to share some thoughts on this subject.

Perhaps an outside voice may have a different perspective on this subject.

This article is divided into 5 sections: (1) the history of occlusion and TMD in orthodontics, (2) the role of orthodontic therapy in TMD, (3) current functional treatment goals for orthodontic therapy, (4) future considerations of occlusion for the orthodontist, and (5) conclusions.

## HISTORY OF OCCLUSION AND TMD IN ORTHODONTICS

The history of orthodontics must begin with the work of Dr Edward Angle, considered the father of this specialty.<sup>1</sup> He founded the Angle School of Orthodontia in St Louis, Missouri, in 1900. Dr Angle introduced the term "malocclusion" to the dental profession as any abnormality in the dental configuration. He developed a classification of malocclusions that is still used today.<sup>2</sup> He generally divided the occlusion into 3 types: normal, or Angle Class I; a retrognathic jaw, or Angle Class II; and a prognathic jaw, or Angle Class III. These classifications were useful for communications between professionals and for research purposes.

At that time, interest in occlusion was primarily associated with esthetics. Sound occlusal stability with acceptable tooth angulations and centered midlines were needed to establish successful esthetics. Andrews<sup>3</sup> proposed 6 basic keys to establishing a sound Angle Class I occlusion; these became well-accepted orthodontic treatment guidelines for finalizing the dental occlusion. Although these guidelines were useful, they had no reference to the joint position. Instead, the orthodontic specialty focused more on various treatment

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philosophies, such as fixed vs removal appliances, functional appliances to affect growth, and extraction vs nonextraction treatment. At that time, most orthodontists were taking their patients' casts, occluding the teeth, and grinding the backs of the casts on a model trimmer. This was done so that the backs of the casts could be placed on a table, and the teeth could be brought together in the maximum intercuspal position. The orthodontist could then evaluate the occlusion, but there was no reference to the patient's joint positions. There was little concern for jaw function.

By the mid-1970s and early 1980s, some orthodontists began to consider the importance of developing a sound occlusal position at the same time that the condyles were in a stable joint position. This concept had been considered for years by prosthodontists, who realized that a stable joint position was essential for a successful prosthodontic reconstruction. At that time, Dr Ronald Roth began to write a series of articles in the orthodontic literature suggesting the importance of joint positions in orthodontic therapy.<sup>4-7</sup> According to Roth, orthodontic treatment goals can be divided into 5 categories: facial esthetics, dental esthetics, functional occlusion, periodontal health, and stability.<sup>8</sup> The uniqueness of Dr Roth's goals was the inclusion of function. One of his suggestions was to use a dental articulator to better evaluate the relationship of the occlusal position to the joint position. He insisted that orthodontists needed to use a dental articulator for treatment planning and managing orthodontic patients. This became a debated and controversial concept. At the time, orthodontists were not routinely using articulators, and they all thought that they were successful with their patients. Why add this technique to improve an already successful treatment?

History suggests to us that sometimes outside forces can alter professional directions. This was true in 1987, when a lawsuit was filed by a patient claiming that the orthodontist caused her to suffer with a TMD.<sup>9,10</sup> To the surprise of the scientific community, the patient won the lawsuit and received a sizable financial compensation. This successful lawsuit created much anxiety in the orthodontic community. Funds were then generated by orthodontic organizations for research needed to more completely understand the relationship, if any, between orthodontic therapy and TMD. The results of these studies will be discussed in the next section.

#### THE ROLE OF ORTHODONTIC THERAPY IN TMD

As interest in the relationship between TMD and orthodontic therapy grew, speculation also grew. There

were claims of orthodontic therapy's always causing TMD to claims of its never causing TMD. Similar claims were being made for certain types of orthodontic treatment: eg, that extraction of teeth always leads to TMD or never leads to TMD. The problem was that these concepts were based on clinical impressions and not on scientific evidence. The need for evidence was obvious, so the specialty began to study this relationship. By the mid-1990s, a series of studies became available that helped to answer this important question. It is not the purpose of this article to thoroughly review all these studies, but the data did not suggest that orthodontic therapy was a significant risk factor for the development of symptoms of TMD.<sup>11-17</sup> A review article has highlighted some of these studies.<sup>18</sup> As these studies were published, orthodontists became more comfortable with the concept that their treatments were not a significant etiologic factor associated with TMD. This perception lowered the general anxiety about the original lawsuit. However, the question that must be asked is how these studies should be interpreted. Certainly, most of these studies were well designed, leading readers to conclude that orthodontic therapy is not a risk factor for TMD. Therefore, one might say that orthodontic therapy is simply unrelated to TMD. Although most orthodontists would be comfortable accepting this concept, such a broad statement is most likely too simple. A second consideration is that all the long-term studies on the relationship between orthodontic therapy and TMD have been accomplished with well-controlled orthodontic therapies. Almost all the studies were performed in university graduate training programs, where orthodontic therapies are well supervised and controlled. Perhaps poorly completed orthodontic therapies do reveal risk factors for TMD. Another consideration in interpreting these results is that many patients receiving the orthodontic therapy were young, healthy, and adaptive. Providing orthodontic therapy in a developing masticatory system may help patients to adapt to the occlusal changes and joint positions, rendering them less likely to have functional problems in the future. This variable has not been well studied and certainly is a consideration when it comes to TMD. Still another consideration in interpreting the results of these studies is that although orthodontic therapy does change the patient's occlusion, the occlusion is only one of several factors that are associated with TMD. A thorough review of the literature shows that there are at least 5 major etiologic factors that can be associated with TMD: occlusion, trauma, emotional stress, deep pain input, and parafunction.<sup>19</sup> In addition to these variables is each patient's adaptability, which is still another factor that has yet to be well investigated.

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