



REVIEW ON NOVELTIES IN ORTHODONTICS: MALOCCLUSION

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Abstract:

Background: Orthodontics is a crucial field in dentistry that aims to enhance both the aesthetic and functional aspects of dental health by moving teeth into ideal positions. Malocclusion, a common dental issue, can impact a patient's social interactions and psychological well-being. Various factors, including genetic and environmental influences, contribute to the development of malocclusion. The classification of malocclusion, based on the position of teeth, helps in determining treatment approaches.

Objective: This review aims to explore recent advancements in orthodontic treatments for malocclusion, analyze the etiology and classification of malocclusion, and assess patient satisfaction and outcomes following treatment with new orthodontic methods.

Conclusion: Recent advancements in orthodontics, such as 3D imaging technology, clear aligners, lingual braces, and accelerated orthodontic treatments, have significantly improved treatment outcomes and patient experiences. These innovations have provided more comfortable, convenient, and aesthetically pleasing options for addressing malocclusion, ultimately enhancing patients' quality of life. Embracing these new methods can lead to more personalized and effective orthodontic care, resulting in stable and long-lasting results for patients with malocclusion.

Keywords: Malocclusion, OHIP, OHRQoL, Orthodontic treatment, Quality of life

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DOI: 10.53555/ecb/2022.11.10.192

Introduction:

Orthodontics, a crucial field within dentistry, involves the use of various devices to facilitate the movement of teeth. Its primary goal is to enhance both the aesthetic appearance and functionality of teeth through mechanical interventions that reposition them more optimally. The determination of the most suitable dental alignment for each individual is influenced by factors such as facial harmony, facial symmetry, and aesthetic considerations [1].

Apart from addressing facial concerns, orthodontics also focuses on enhancing the alignment and interaction between the upper (maxillary) and lower (mandibular) teeth during functions like chewing. The way in which teeth come together and function in unison is known as occlusion, a concept that encompasses both biological and functional aspects. Consensus has been established over time regarding the characteristics that define an ideal or normal occlusion [2].

While malocclusion itself may not pose a direct threat to life, it can have negative effects on a patient's social interactions and psychological well-being. The Index of Orthodontic Treatment Need (IOTN), developed by Brook and Shaw in the UK, serves as a scoring system to assess the treatment requirements of individuals with varying degrees of malocclusion. This index has been widely utilized in research to evaluate the actual and perceived needs for orthodontic treatment [3].

Furthermore, numerous studies have explored the impact of orthodontic interventions on oral health-related quality of life (OHRQoL) in both treated individuals and untreated control groups. For instance, de Oliveira and Sheiham conducted a study on Brazilian adolescents and observed an improvement in the OHRQoL of those who had undergone orthodontic treatment [5]. In contrast, Taylor et al. did not find a significant link between orthodontic treatment for malocclusion and OHRQoL, despite improvements in the health, appearance, social well-being, and oral function of the patients [6]. Johal et al. investigated the effects of orthodontic treatment on OHRQoL in adults and noted a temporary negative impact during the initial three months of fixed orthodontic therapy, followed by an overall enhancement compared to pre-treatment levels [7].

Understanding how orthodontic interventions can influence quality of life is essential for informing patients about the potential health benefits and improvements associated with such treatments [4].

Objectives:

The main objectives of this review are:

1. To explore the latest advancements in orthodontic treatment for malocclusion.
2. To analyze the etiology and classification of malocclusion.
3. To assess patient satisfaction and outcomes following treatment with new orthodontic methods.

Etiology

The etiology of malocclusion is frequently multifactorial, with genetic and environmental influences playing a significant role. While the exact contribution of inherited factors to malocclusion remains incompletely understood, there is strong evidence supporting their involvement. Research has extensively explored the relationship between genetics and malocclusion, particularly in the case of Class III mandibular prognathism [8]. In this context, specific growth factors and genetic markers have been identified as key players in the heritability of mandibular prognathism, with historical examples such as the European royal Hapsburg family demonstrating the inheritance pattern of this condition over centuries. Referred to as the "Hapsburg Jaw," this familial trait was perpetuated through interbreeding, allowing the expression of genes associated with mandibular prognathism across multiple generations [8].

Moreover, inherited characteristics such as discrepancies in tooth and jaw size can contribute to malocclusion, leading to issues like crowding or spacing. Variations in the size and shape of the maxilla and mandible can also influence the development of malocclusion, with these traits being inherited either together or independently. Studies have indicated that when these characteristics are inherited independently, the likelihood of malocclusion due to disproportion increases. The prevalence of malocclusion has risen compared to earlier generations, partly due to increased outbreeding among diverse human populations, resulting in the inheritance of conflicting tooth and jaw characteristics [9].

Environmental factors also play a role in the development of malocclusion, particularly in children who engage in habitual thumb-sucking. This behavior can exert pressure on the roof of the mouth, leading to lingual displacement of the lower incisors and maxillary molars, as well as labial displacement of the upper incisors. Additionally, the downward positioning of the jaw can facilitate the eruption of posterior teeth, potentially causing a separation of the incisors [10].

Classification of Malocclusion:

Dr. Edward Hartley Angle, widely recognized as the "father of modern orthodontics," is credited with establishing a seminal classification system for malocclusion based on the relationship between the mesiobuccal cusp of the upper first molar and the buccal groove of the lower first molar. According to Angle's classification, there are three main classes of malocclusion. In Angle class I, known as neutroclusion, the mesiobuccal cusp of the maxillary first molar aligns with the buccal groove of the mandibular first molar. Class II malocclusion, or mesocclusion, is characterized by the mesiobuccal cusp of the maxillary first molar occluding mesially to the buccal groove of the mandibular first molar. On the other hand, class III malocclusion, or distocclusion, is identified by the mesiobuccal cusp of the maxillary first molar occluding distally to the buccal groove of the mandibular first molar [11].

Further subdivisions within class I malocclusion have been proposed by Dewey. In Dewey type 1, there may be crowding of the incisors, labial positioning of the canines, or a combination of both. Dewey type 2 is characterized by protrusion of the maxillary incisors, while type 3 involves edge-to-edge occlusion of the anterior teeth, crossbite, or a combination of these issues [12]. The Anderson classification expands on class I malocclusion, introducing types 4 and 5. Type 4 presents with a posterior crossbite, which can be unilateral or bilateral, while type 5 involves a class I molar relationship with mesioversion of the permanent first molar due to the extraction of a second deciduous molar or premolar. Approximately 32% of individuals with malocclusion exhibit class II malocclusion, where the mandible is retrognathic to the maxilla. Class II malocclusion is further divided into two categories. In Class II division 1, there is protrusion of the maxillary incisors, excessive overjet, and deep overbite, with a v-shaped maxillary arch and narrow canine region. Patients with this condition often have a shorter upper lip and difficulty in closing their anterior lip [13].

In Class II division 2 malocclusion, the maxillary central incisors are palatally inclined and may overlap the maxillary lateral incisors. This division is characterized by a deep overbite and a broad maxillary arch, with a normal upper lip seal and a deep mental groove. Unlike division 1, division 2 typically features a normal-sized mandible [14]. Class III malocclusion occurs when the mandible is positioned anterior to the maxilla, causing the mandibular teeth to protrude over the maxillary teeth. Class III malocclusion can be further categorized into three types based on the alignment

of teeth. In class 3 type 1, the arch shape is abnormal, while in class 3 type 2, the mandibular teeth are tilted lingually. Class 3 type 3 involves lingual tilting of the maxillary teeth [15].

Latest advancements in orthodontic treatment for malocclusion:

Recent advancements in orthodontic treatment for malocclusion have been marked by the integration of cutting-edge technologies. For instance, the shift from conventional two-dimensional X-rays to cone beam computed tomography (CBCT) has revolutionized the diagnostic process by providing detailed three-dimensional images of the teeth, jaws, and surrounding structures [16]. This advancement enables orthodontists to precisely identify the type and severity of malocclusion, thereby facilitating more accurate treatment planning and progress monitoring.

Moreover, the emergence of clear aligner therapy, exemplified by products like Invisalign, has garnered significant attention. These custom-made clear plastic aligners, which are nearly invisible and can be removed for eating and oral hygiene, offer a discreet and convenient alternative to traditional metal braces. Notably, they have gained popularity among patients, particularly adults, who may feel reluctant to opt for visible braces [17]. Similarly, lingual braces have surfaced as an inconspicuous treatment option, as they are affixed to the back surfaces of the teeth, rendering them virtually undetectable from the outside. This has alleviated the self-consciousness often associated with wearing traditional braces, providing patients with a more discreet orthodontic solution [17].

Advancements in orthodontic materials have also contributed significantly to enhancing the efficiency and comfort of malocclusion treatment. For instance, the utilization of nickel-titanium wires, which exert a more consistent force on the teeth and necessitate fewer adjustments compared to traditional stainless steel wires, has led to reduced treatment times and fewer orthodontist visits, thereby enhancing the overall patient experience. Additionally, the introduction of temporary anchorage devices (TADs), small titanium screws temporarily placed in the jawbone to provide additional anchorage for tooth movement, has revolutionized the treatment of complex malocclusions, enabling more predictable and efficient tooth movements, especially in cases where traditional methods may be insufficient [18]. Furthermore, the integration of digital technology into treatment planning and monitoring has been a pivotal development in orthodontics. Computer-aided design and computer-aided manufacturing (CAD/CAM) systems have empowered

orthodontists to craft custom treatment plans and fabricate appliances with unparalleled precision [19]. Intraoral scanners have also played a crucial role by capturing detailed 3D images of the teeth and soft tissues, eliminating the need for messy impressions and enhancing patient comfort and convenience.

Advancements in orthodontic research have deepened our understanding of the genetic and environmental factors contributing to malocclusion. This knowledge has enabled orthodontists to tailor treatment plans to each patient's unique needs, considering factors such as facial growth patterns, skeletal discrepancies, and soft tissue dynamics. By addressing the underlying causes of malocclusion, orthodontic treatment can now achieve more stable and enduring results [20].

Impact of new orthodontic methods in management of malocclusion:

Malocclusions, which refer to misalignments of the teeth, can significantly affect a patient's oral health, appearance, and overall well-being. While traditional orthodontic approaches like braces and retainers have long been the go-to solutions for correcting malocclusions, recent advancements in orthodontic technology and methodologies have paved the way for more effective treatments and enhanced patient experiences [21].

One of the notable breakthroughs in orthodontics is the introduction of clear aligner therapy, exemplified by products like Invisalign. Clear aligners are personalized, removable trays designed to gradually reposition the teeth to their correct alignment. Unlike conventional braces, clear aligners are almost imperceptible, making them a favored option among adult individuals who may feel self-conscious about wearing traditional braces. Moreover, clear aligners offer improved comfort and convenience as they can be easily taken out for eating, brushing, and flossing [22].

Another innovative orthodontic approach that has gained popularity in recent times is lingual braces. These braces closely resemble traditional braces but are affixed to the back of the teeth instead of the front. This positioning renders them virtually invisible to others, providing a discreet treatment alternative for patients seeking a more aesthetically pleasing option than traditional braces [23].

Furthermore, advancements in orthodontic technology have given rise to accelerated orthodontic treatments. Techniques like AcceleDent and Propel utilize high-frequency vibrations or micro-osteoperforations to stimulate bone restructuring and expedite tooth movement. These methods have proven to significantly shorten treatment durations, enabling patients to achieve

their desired outcomes in a more expedited manner [24].

The influence of these novel orthodontic approaches on malocclusion management has been profound. Patients now have access to a broader array of treatment choices that are more comfortable, convenient, and visually appealing than ever before. Clear aligners, lingual braces, and accelerated orthodontic treatments have democratized orthodontic care, making it more accessible to a wider demographic of patients, including adults who may have previously been reluctant to pursue treatment [25].

Conclusion:

In conclusion, orthodontics plays a crucial role in improving both the aesthetic appearance and functional aspects of a patient's dental health. The advancement of orthodontic treatments, such as the use of 3D imaging technology, clear aligners, lingual braces, and accelerated orthodontic techniques, has revolutionized the field, offering patients more comfortable, convenient, and aesthetically pleasing options for addressing malocclusion. These advancements have not only improved treatment outcomes but have also positively impacted patients' quality of life by providing more discreet and efficient orthodontic solutions. Embracing these new methods can lead to more personalized and effective orthodontic care tailored to each patient's unique needs, ultimately resulting in more stable and long-lasting results.

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