

## The Impact of Dental Malocclusion on Oral Health and Quality of Life: A Review of Orthodontic and Surgical Treatment Approaches

María Fernández\*, José García, and Francisco González

Department of Medicine and Dentistry, University of Santiago de Compostela, Spain

### Abstract

Dental malocclusion, characterized by misalignment between dental arches, poses oral health risks and affects quality of life. Prevalent globally, it stems from genetic factors, abnormal development, habits, or trauma. Left untreated, it can lead to decay, gum disease, jaw joint issues, and social impacts. Orthodontic interventions like braces or clear aligners are common, while severe cases may require surgery. Technological advances enhance treatment precision, and interdisciplinary collaboration improves outcomes. Early detection and intervention are crucial for optimal oral health and well-being, necessitating further research into innovative treatment strategies.

**Keywords:** Dental malocclusion; Orthodontic treatment; Surgical intervention; Oral health; Quality of life

### Introduction

Dental malocclusion is a prevalent condition that affects individuals of all ages and demographics worldwide. It is characterized by misalignment or incorrect relation between the teeth of the upper and lower dental arches, leading to functional and aesthetic concerns. Malocclusion can manifest in various forms, including overcrowding, spacing, overbites, underbites, and crossbites, each with its own set of challenges and implications for oral health. The etiology of dental malocclusion is multifactorial, involving a combination of genetic predisposition, abnormal dental development, environmental factors, and behavioral habits. While some cases of malocclusion may be inherited, others may result from factors such as oral habits like thumb sucking or pacifier use during childhood, prolonged bottle feeding, or trauma to the teeth or jaws. Additionally, certain medical conditions or syndromes can predispose individuals to malocclusion [1].

Untreated dental malocclusion can have detrimental effects on oral health and overall well-being. Misaligned teeth are more difficult to clean, increasing the risk of tooth decay, gum disease, and other oral infections. Malocclusion can also interfere with proper chewing and speech, leading to functional limitations and discomfort. Furthermore, severe cases of malocclusion may contribute to temporomandibular joint disorders, causing pain and dysfunction in the jaw joint. In addition to its physical consequences, dental malocclusion can have psychosocial implications for affected individuals. Aesthetic concerns related to misaligned teeth may impact self-esteem and confidence, affecting social interactions and quality of life. Therefore, addressing malocclusion goes beyond functional improvements and encompasses the broader goal of enhancing the overall oral health and psychological well-being of patients.

### Prevalence of dental malocclusion

Dental malocclusion is a common condition affecting individuals worldwide, with prevalence rates varying among different populations and age groups. Epidemiological studies have reported that a significant portion of the global population exhibits some degree of malocclusion, ranging from mild to severe manifestations. The prevalence of malocclusion tends to be higher in certain demographic groups, such as children and adolescents, due to ongoing dental development and growth. Studies have shown that malocclusion affects approximately 60-75% of children and adolescents, making it one of

the most prevalent oral health concerns in this age group. Furthermore, the prevalence of malocclusion may vary depending on geographic location, socioeconomic status, and cultural factors. For example, urban populations may have higher rates of malocclusion compared to rural areas, possibly due to differences in access to dental care and lifestyle factors [2].

Various classification systems, such as the Angle classification, have been used to categorize different types of malocclusion based on the relationship between the dental arches and the positioning of individual teeth. These classification systems help clinicians assess the severity and type of malocclusion, guiding treatment planning and intervention strategies. Understanding the prevalence of dental malocclusion is essential for public health planning and resource allocation, as well as for developing targeted interventions to address this widespread oral health issue. By identifying populations at higher risk and implementing preventive measures early in life, it is possible to reduce the burden of malocclusion and its associated complications on individuals and healthcare systems alike [3].

### Etiology and risk factors

Dental malocclusion has a multifactorial etiology, influenced by a combination of genetic, developmental, environmental, and behavioral factors. Understanding the underlying causes and risk factors is crucial for identifying individuals at risk and developing effective prevention and treatment strategies. Genetic factors play a significant role in the development of malocclusion, with studies indicating a strong familial predisposition. Certain craniofacial characteristics, such as the size and shape of the jaws, as well as the position and angulation of teeth, are heritable traits that can contribute to malocclusion. Additionally, genetic syndromes and chromosomal abnormalities may increase the

**\*Corresponding author:** María Fernández, Department of Medicine and Dentistry, University of Santiago de Compostela, Spain, E-mail: maria.ferna@dez.es

**Received:** 08-Feb-2024, Manuscript No. johh-24-132339; **Editor assigned:** 10-Feb-2024, Pre QC-No. johh-24-132339 (PQ); **Reviewed:** 24-Feb-2024, QC No: johh-24-132339; **Revised:** 29-Feb-2024, Manuscript No. johh-24-132339 (R); **Published:** 05-March-2024, DOI: 10.4172/2332-0702.1000414

**Citation:** Fernández M, García J, González F (2024) The Impact of Dental Malocclusion on Oral Health and Quality of Life: A Review of Orthodontic and Surgical Treatment Approaches J Oral Hyg Health 12: 414.

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likelihood of malocclusion, further emphasizing the genetic component of this condition.

Abnormal dental development during childhood and adolescence can also contribute to malocclusion. Factors such as delayed eruption, premature loss of primary teeth, or abnormal growth patterns of the jaws can disrupt the normal alignment of teeth and lead to malocclusion. Furthermore, oral habits such as thumb sucking, pacifier use, tongue thrusting, or prolonged bottle feeding can exert forces on the developing dentition, causing misalignment of teeth and malocclusion. Environmental factors, including socioeconomic status, access to dental care, and cultural practices, can influence the prevalence and severity of malocclusion. Poor nutrition, prenatal exposure to certain substances, and maternal health during pregnancy may also impact dental development and increase the risk of malocclusion in children [4].

Behavioral habits, such as mouth breathing, tongue posture, and parafunctional habits like bruxism (teeth grinding) or nail biting, can contribute to malocclusion by affecting the positioning and alignment of teeth over time. Additionally, traumatic injuries to the face or jaws can disrupt the normal occlusion and lead to malocclusion. Overall, dental malocclusion is a complex condition influenced by a combination of genetic predisposition, developmental factors, environmental influences, and behavioral habits. By addressing these underlying etiological factors and modifying risk factors early in life, it is possible to reduce the incidence and severity of malocclusion and improve oral health outcomes for individuals.

### Impact on oral health

Dental malocclusion can have significant implications for oral health, affecting various aspects of dental function, hygiene, and overall well-being. The misalignment or incorrect relation between the teeth of the upper and lower dental arches can lead to a range of oral health problems, including:

**Difficulty in cleaning:** Malocclusion often results in irregular tooth alignment, overcrowding, or spacing, making it challenging to effectively clean all tooth surfaces. This can lead to the accumulation of plaque and bacteria, increasing the risk of dental caries (tooth decay) and periodontal (gum) disease [5].

**Increased risk of tooth decay:** Misaligned teeth may create tight spaces or overlapping areas where food particles and bacteria can become trapped, promoting the formation of dental plaque and tartar. Over time, this can lead to the development of cavities and dental caries, particularly in areas that are difficult to access with regular brushing and flossing.

**Gum disease:** Malocclusion can contribute to gum disease (gingivitis and periodontitis) by creating pockets or spaces between the teeth and gums where bacteria can accumulate. Untreated gum disease can lead to inflammation, bleeding gums, receding gums, and ultimately, tooth loss if left untreated. Severe malocclusion or improper bite alignment can exert excessive pressure on the temporomandibular joint (TMJ), leading to pain, stiffness, clicking or popping noises, and dysfunction of the jaw joint. Temporomandibular joint disorders (TMD) can cause discomfort during chewing, speaking, and jaw movement, impacting overall quality of life. Malocclusion can result in occlusal trauma, where uneven or excessive forces are applied to certain teeth during biting and chewing. This can lead to tooth wear, enamel fractures, tooth mobility, and even tooth loss over time.

**Speech and chewing difficulties:** Depending on the type and severity of malocclusion, individuals may experience difficulties with speech articulation and chewing efficiency. Misaligned teeth or jaw discrepancies can affect the proper alignment of the lips, tongue, and oral structures, leading to speech impediments and inefficient mastication. Overall, addressing dental malocclusion is essential for maintaining optimal oral health and preventing associated complications. Early detection, comprehensive evaluation, and appropriate treatment interventions can help mitigate the impact of malocclusion on oral health and improve overall dental function and well-being [6].

### Orthodontic treatment modalities

Orthodontic treatment plays a central role in addressing dental malocclusion and achieving optimal dental alignment and occlusion. Various treatment modalities are available to correct malocclusion, ranging from traditional braces to newer alternatives such as clear aligners. The choice of treatment modality depends on factors such as the type and severity of malocclusion, patient preferences, and treatment goals.

**Traditional braces:** Traditional braces consist of metal brackets bonded to the front surface of the teeth, connected by archwires and secured with elastic bands. Braces apply controlled forces to gradually move teeth into the desired position over time. They are effective for correcting a wide range of malocclusion types, including overcrowding, spacing, overbites, underbites, and crossbites [7]. Modern braces are more comfortable and aesthetically pleasing than their predecessors, with smaller and sleeker brackets and a variety of colored elastic bands to choose from. Clear aligners, such as Invisalign, offer a discreet and removable alternative to traditional braces for correcting mild to moderate malocclusion. These custom-made, transparent plastic trays are worn over the teeth and gradually shift them into alignment through a series of incremental adjustments. Clear aligners are virtually invisible, making them a popular choice among adults and teenagers who prefer a more discreet orthodontic treatment option. They are also removable, allowing for easier oral hygiene maintenance and the ability to eat and drink without restrictions [8].

**Functional appliances:** Functional appliances are specialized orthodontic devices used to correct skeletal discrepancies and improve jaw relationships in growing patients. These appliances apply forces to the jaws to stimulate growth and modify facial development, helping to address issues such as Class II or Class III malocclusion. Examples of functional appliances include headgear, Forsus appliances, and Herbst appliances, which are typically worn for a specified period to achieve desired skeletal changes and improve bite alignment.

**Orthodontic surgery:** In cases of severe malocclusion or skeletal discrepancies that cannot be corrected with orthodontic appliances alone, orthognathic surgery may be necessary. Orthognathic surgery involves surgical repositioning of the upper and/or lower jaws to achieve proper alignment and occlusion. It is often performed in conjunction with orthodontic treatment to optimize functional and aesthetic outcomes. Orthognathic surgery may be recommended for conditions such as severe overbites, underbites, facial asymmetry, and open bites that cannot be adequately addressed with orthodontic appliances alone. Overall, orthodontic treatment modalities offer effective options for correcting dental malocclusion and achieving optimal dental function and aesthetics. By working closely with orthodontic specialists, patients can select the most appropriate treatment approach based on their individual needs and preferences, ultimately achieving a healthy and harmonious smile (Table 1).

**Table 1:** The common types of malocclusion, along with their descriptions and characteristic features, which can aid in diagnosis and treatment planning for affected individuals.

Malocclusion Type	Description	Characteristics
Class I Malocclusion	The dental arches are in normal occlusion, but individual teeth may be misaligned.	- Normal relationship between the first molars (mesiobuccal cusp of maxillary first molar aligns with the buccal groove of the mandibular first molar)   - Crowding or spacing of teeth   - Mild overjet or overbite
Class II Malocclusion	The upper dental arch protrudes relative to the lower arch, creating an overbite.	- Maxillary incisors protrude anteriorly relative to the mandibular incisors   - Deep overbite   - Retrognathic mandible
Class III Malocclusion	The lower dental arch protrudes relative to the upper arch, creating an underbite.	- Mandibular incisors protrude anteriorly relative to the maxillary incisors   - Anterior crossbite   - Prognathic mandible
Open Bite	The upper and lower teeth do not occlude properly, leaving a space between them when the jaws are closed.	- Lack of vertical overlap between the upper and lower incisors   - Anterior open bite affecting anterior teeth   - Posterior open bite affecting posterior teeth
Crossbite	The teeth do not meet in their ideal position, with some upper teeth positioned inside the lower teeth (anterior crossbite) or vice versa (posterior crossbite).	- Anterior crossbite: Maxillary incisors are positioned lingual to mandibular incisors   - Posterior crossbite: Buccal cusps of maxillary teeth occlude lingual to mandibular teeth
Overjet	The horizontal overlap of the upper front teeth over the lower front teeth is excessive.	- Increased horizontal projection of maxillary incisors beyond mandibular incisors   - Lip incompetence   - Risk of traumatic injury to maxillary incisors
Underbite	The lower front teeth protrude beyond the upper front teeth when the jaws are closed.	- Lack of vertical overlap between maxillary and mandibular incisors   - Decreased chin prominence   - Increased risk of occlusal trauma and temporomandibular joint disorders
Crowding	There is insufficient space in the dental arches to accommodate all teeth, leading to overlapping or rotated teeth.	- Teeth are crowded or rotated within the dental arch   - Narrow arch width   - Difficulty in oral hygiene maintenance
Spacing	There are gaps or spaces between teeth, often due to smaller tooth size or missing teeth.	- Excessive spacing between teeth   - Diastemas (gaps) between teeth   - Aesthetic concerns or speech difficulties

Surgical intervention for severe malocclusion

In cases of severe malocclusion or skeletal discrepancies that cannot be adequately corrected with orthodontic appliances alone, surgical intervention may be necessary to achieve optimal functional and aesthetic outcomes. Orthognathic surgery, also known as corrective jaw surgery, is a specialized surgical procedure performed by oral and maxillofacial surgeons in collaboration with orthodontists to realign the upper and/or lower jaws and improve overall facial harmony and occlusal function.

Orthognathic surgery is indicated for a variety of severe malocclusion conditions, including:

**Class II Malocclusion:** Orthognathic surgery may be recommended for individuals with a retruded or recessed mandible (lower jaw) relative to the maxilla (upper jaw), resulting in a deep overbite or overjet. Surgical repositioning of the mandible can correct the skeletal discrepancy and achieve proper occlusion and facial balance.

**Class III Malocclusion:** Patients with a protruded mandible or deficient maxilla may benefit from orthognathic surgery to reposition the jaws and achieve a balanced facial profile. Surgery may involve advancing the maxilla, retracting the mandible, or a combination of both to correct the underbite and achieve ideal occlusion.

**Vertical Maxillary Excess:** Excessive vertical growth of the maxilla can lead to a gummy smile, deep overbite, or open bite. Orthognathic surgery can address vertical maxillary excess by repositioning the maxilla upward or downward to improve dental and skeletal harmony. Patients with facial asymmetry resulting from unequal growth of the jaws or craniofacial deformities may require orthognathic surgery to correct asymmetrical skeletal relationships and achieve facial symmetry. Orthognathic surgery is typically performed in conjunction with pre-surgical orthodontic treatment to align the teeth and prepare the jaws for surgery. The surgical procedure involves precise repositioning of the maxilla, mandible, or both, using specialized surgical techniques such as osteotomies (bone cuts), bone grafting, and fixation with plates and screws. Post-surgical orthodontic treatment is then used to fine-

tune the occlusion and ensure optimal alignment of the teeth and jaws [9].

- Benefits of orthognathic surgery for severe malocclusion include:
- Correction of functional problems such as difficulty chewing, speaking, and breathing.
  - Improvement of facial aesthetics and harmony.
  - Enhancement of occlusal stability and long-term oral health.
  - Resolution of temporomandibular joint (TMJ) disorders associated with malocclusion.
  - Enhanced self-confidence and quality of life for patients.

Orthognathic surgery is a valuable treatment option for individuals with severe malocclusion who have not achieved satisfactory results with orthodontic treatment alone. By addressing underlying skeletal discrepancies, orthognathic surgery can help patients achieve improved facial balance, occlusal function, and overall well-being.

Advances in orthodontic technology

Recent years have witnessed significant advancements in orthodontic technology, revolutionizing the diagnosis, treatment planning, and delivery of orthodontic care. These technological innovations have enhanced treatment precision, efficiency, and patient comfort, leading to improved outcomes and patient satisfaction. One notable advancement is the widespread adoption of digital orthodontics, which utilizes advanced imaging and computer-aided design (CAD) technology to create digital models of the teeth and jaws. Digital impressions, obtained using intraoral scanners, offer a more comfortable and efficient alternative to traditional impression materials, eliminating the need for messy impressions and improving patient experience. Digital models allow for more accurate diagnosis and treatment planning, as well as seamless communication between orthodontists and other members of the dental team.

Furthermore, 3D printing technology has revolutionized the

fabrication of orthodontic appliances, such as clear aligners, retainers, and orthodontic brackets. 3D-printed appliances offer greater customization and precision, allowing for optimal fit and performance. Additionally, advances in material science have led to the development of new biocompatible materials with enhanced strength, durability, and esthetics, further improving the quality and longevity of orthodontic appliances. Another significant advancement is the integration of computer-aided simulation and virtual treatment planning software into orthodontic practice. These software tools allow orthodontists to visualize and simulate treatment outcomes, predict tooth movement, and customize treatment plans for individual patients. By incorporating digital treatment planning into clinical practice, orthodontists can optimize treatment efficiency, minimize treatment duration, and achieve more predictable results.

In addition to technological innovations in appliance fabrication and treatment planning, advances in orthodontic biomechanics and orthodontic mechanics have led to the development of new treatment techniques and protocols. For example, self-ligating brackets, temporary anchorage devices (TADs), and customized archwires allow for more efficient and controlled tooth movement, reducing treatment time and improving patient comfort. Advances in orthodontic technology have transformed the field of orthodontics, enabling orthodontists to provide more personalized, efficient, and comfortable treatment options for patients. By harnessing the power of digital technology and biomechanics, orthodontists can achieve superior treatment outcomes while enhancing the patient experience [10].

### Interdisciplinary management approaches

Interdisciplinary collaboration between orthodontists and other dental specialists plays a crucial role in the comprehensive management of complex malocclusion cases and achieving optimal treatment outcomes. By working together as a cohesive team, dental professionals can leverage their respective expertise and skills to address the multifaceted aspects of malocclusion and deliver integrated care tailored to the individual needs of each patient. One common interdisciplinary approach involves collaboration between orthodontists and oral surgeons in the treatment of severe skeletal discrepancies and dentofacial deformities. Orthognathic surgery, combined with orthodontic treatment, allows for precise correction of skeletal discrepancies, optimizing facial aesthetics, occlusal function, and TMJ health. Close coordination between orthodontists and oral surgeons is essential for treatment planning, surgical execution, and post-operative orthodontic management to achieve stable and predictable outcomes.

Additionally, interdisciplinary collaboration may involve consultation and coordination with other dental specialists, such as periodontists, prosthodontists, and endodontists, to address specific dental issues or comorbidities that may impact orthodontic treatment. For example, periodontal therapy may be necessary to address gum disease or periodontal defects before initiating orthodontic treatment, while endodontic treatment may be required for teeth with pulp pathology or periapical lesions.

Furthermore, interdisciplinary management approaches may extend beyond the dental specialty to include collaboration with medical professionals, such as otolaryngologists, speech therapists, or pediatricians, when addressing systemic conditions or functional concerns that may impact orthodontic treatment outcomes. For example, collaboration with speech therapists may be beneficial for patients with speech or swallowing difficulties associated with

malocclusion, while coordination with pediatricians may be necessary for the management of systemic conditions that affect dental development or growth. Interdisciplinary management approaches enhance the comprehensiveness and effectiveness of orthodontic treatment by addressing the diverse needs of patients and optimizing treatment outcomes. By fostering collaborative relationships between dental specialists and other healthcare professionals, orthodontists can provide holistic care that integrates the principles of dentofacial esthetics, function, and overall health.

### Results and Discussion

The results of this study provide valuable insights into the prevalence, etiology, consequences, and treatment of dental malocclusion. Our findings underscore the significant impact of malocclusion on oral health, quality of life, and overall well-being, highlighting the importance of early detection and intervention to mitigate its adverse effects. The prevalence of dental malocclusion varies among different populations and age groups, with studies indicating a high prevalence among children and adolescents. Genetic factors, abnormal dental development, environmental influences, and behavioral habits contribute to the development of malocclusion, emphasizing the multifactorial nature of this condition. Untreated malocclusion can lead to various oral health problems, including tooth decay, gum disease, temporomandibular joint disorders, and difficulties with chewing and speech. Furthermore, malocclusion can have psychosocial implications, affecting self-esteem, social interactions, and quality of life.

Orthodontic treatment modalities, including traditional braces, clear aligners, and functional appliances, offer effective options for correcting malocclusion and improving dental function and aesthetics. Surgical intervention may be necessary in severe cases of malocclusion to realign the jaws and achieve optimal occlusion. Advances in orthodontic technology, such as digital orthodontics, 3D printing, and computer-aided simulation, have revolutionized treatment planning and delivery, enhancing precision, efficiency, and patient comfort. Interdisciplinary management approaches involving collaboration between orthodontists, oral surgeons, and other dental specialists are essential for addressing complex malocclusion cases and achieving optimal treatment outcomes. By leveraging the expertise of multiple disciplines, dental professionals can provide comprehensive care that integrates orthodontic principles with other aspects of oral health and overall well-being.

### Conclusion

In conclusion, this study highlights the importance of recognizing and addressing dental malocclusion as a significant oral health concern. By raising awareness, promoting early intervention, and adopting interdisciplinary management approaches, we can improve outcomes for individuals affected by malocclusion and enhance their oral health and quality of life. Further research is warranted to explore emerging treatment modalities and refine existing approaches for the management of malocclusion.

### Acknowledgment

None

### Conflict of Interest

None



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