

DIFFERENT BITE CLASSES AND THEIR INFLUENCE ON BODY POSTURE: A REVIEW

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Abstract

This review explores the relationship between dental occlusion, particularly malocclusion, and its impact on body posture, emphasizing the musculoskeletal effects of different occlusal bite classifications. Class I, II, and III malocclusions affect head, neck, and spine alignment, which can lead to musculoskeletal disorders, chronic pain, and postural imbalances. Class II (overbite) results in anterior head posture, increasing strain on the cervical spine, while Class III (underbite) causes posterior head posture, leading to compensatory stress in the spine and lower back. Research highlights the biomechanical effects of malocclusion on the temporomandibular joint (TMJ) and spine, contributing to conditions like kyphosis, lordosis, and gait abnormalities. A comprehensive search of relevant literature was conducted using databases such as PubMed and Google Scholar. This review identified a need for interdisciplinary treatment approaches combining dental, orthopedic, and physical therapy interventions to address both dental alignment and musculoskeletal health. Orthodontic treatments, such as braces and jaw surgery, help realign the jaw, reducing postural strain, while physical therapy can alleviate muscle tension and improve overall body alignment. These insights highlight the importance of integrating dental and postural treatment strategies for improved patient outcomes.

1. Introduction

The body's posture is shaped by numerous factors, from musculoskeletal health to neurological control, but one often overlooked element is the alignment of the teeth. Occlusion, or the manner in which the upper and lower teeth come together, plays a vital role in head and neck posture. Misalignments in the bite, referred to as malocclusions, have far-reaching consequences on body posture, potentially leading to chronic pain and musculoskeletal disorders (1–3).

Dental occlusion can be categorized into different classes of bites, each of which has distinct characteristics and postural implications. This review focuses on the three primary classes of occlusion—Class I, Class II, and Class III, represented in Figure 1—and

how these bite types affect body posture. Understanding these relationships will help in developing comprehensive treatment plans that address both dental and orthopedic issues, improving overall patient well-being (4,5).

Class I Occlusion: Normal Bite

Class I occlusion, often referred to as a "normal" or "ideal" bite, is characterized by a harmonious relationship between the upper and lower teeth. In this alignment, the upper teeth slightly overlap the lower teeth, and the molars fit together in a balanced, functional position.

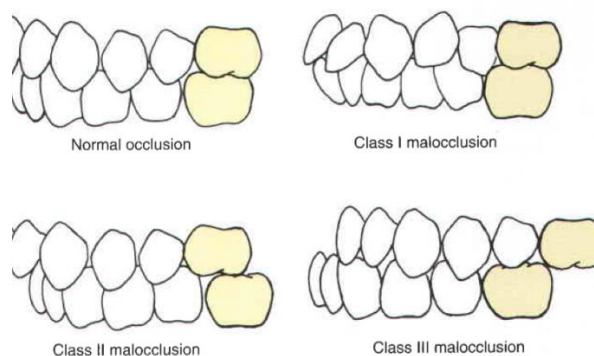


Figure 1. The different types of malocclusions and the contact of molar surfaces

A Class I occlusion generally allows for proper function and efficient distribution of forces during chewing and speaking, resulting in minimal strain on the TMJ and musculoskeletal system. However, even slight deviations from ideal alignment within Class I can lead to postural changes that cause stress on the head, neck, and spine (6).

Class II Occlusion: Overbite

Class II malocclusion, commonly known as an overbite, occurs when the upper teeth significantly overlap the lower teeth. This misalignment is often the result of a retruded lower jaw (mandibular retrognathism) or a protruding upper jaw (maxillary prognathism). This class of bite can range from mild to severe and has significant effects on body posture (5,7).

Patients with Class II occlusion often experience anterior head posture, where the head is positioned forward in an attempt to compensate for the misaligned bite. This shift in head position can lead to neck strain, rounded shoulders, and upper back pain, as the body tries to maintain balance and stabilize the head (8–10).

Class III Occlusion: Underbite

Class III malocclusion, or underbite, is characterized by the lower teeth protruding in front of the upper teeth. This occurs due to mandibular prognathism (forward positioning of the lower jaw) or maxillary retrognathism (underdevelopment of the upper jaw). Like Class II malocclusion, Class III occlusion affects head and neck posture, but in the opposite direction (7,11,12)

Individuals with a Class III bite often adopt a posterior head posture to compensate for their occlusal imbalance, which can lead to musculoskeletal strain in the neck, shoulders, and lower back. The body's effort to counterbalance the forward-positioned jaw can result in a variety of orthopedic issues over time (13).

2. Materials and Methods

A comprehensive search was conducted across several databases, including PubMed/Medline, Google Scholar, Scopus, and the Cochrane Library. The search aimed to gather peer-reviewed publications, clinical studies, and reviews that explored the relationship between occlusal bite classes and body posture. Keywords such as *malocclusion*, *bite classification*, *Class I, II, III malocclusion*, *posture*, *musculoskeletal system*, and *temporomandibular joint dysfunction* were used in various combinations. Boolean operators (AND, OR) helped refine the search, leading to the identification of relevant articles.

To ensure the selection of high-quality, relevant studies, specific inclusion and exclusion criteria were established. Included studies were peer-reviewed articles published in English between 1990 and 2023,

focusing on clinical research related to the impact of bite classification (Class I, II, III) on body posture. Studies from fields such as dentistry, orthodontics, orthopedics, and physical therapy that covered both adult and pediatric populations were prioritized. Excluded studies included non-peer-reviewed sources, conference abstracts, unpublished theses, and articles focused solely on the aesthetic or cosmetic aspects of malocclusion without addressing postural or functional outcomes.

Two independent reviewers extracted key information from the selected articles, focusing on study objectives, sample characteristics, methods for assessing posture, and outcomes related to musculoskeletal changes. Special attention was given to quantitative and qualitative data showing the biomechanical effects of malocclusion on posture. The findings were synthesized into a cohesive narrative, emphasizing common trends and identifying gaps in the literature. Data were further examined for insights on interdisciplinary treatment approaches, combining dental and orthopedic interventions.

3. Results and Discussions

Posture and Head Position

The alignment of the head and neck is one of the most significant areas affected by malocclusion. In individuals with Class II malocclusion, the forward shift of the head (anterior head posture) places excess strain on the cervical spine, increasing the risk of neck and upper back pain. This anterior positioning can lead to hyperlordosis (excessive inward curvature of the lower back) as the body compensates to maintain balance (14,15).

Conversely, Class III malocclusion often causes a backward (posterior) head posture. This results in the cervical spine being in a more extended position, which can lead to muscle fatigue, joint compression, and lower back pain. As the body adapts to this new head position, it affects the alignment of the thoracic and lumbar spine (16–18).

The Role of the Temporomandibular Joint

The TMJ connects the lower jaw to the skull and plays a crucial role in jaw movement and posture. Malocclusion can lead to TMJ dysfunction (TMD) represented in Figure 2, which manifests in symptoms such as jaw pain, clicking or popping sounds, headaches, and neck pain. Misaligned bites place uneven stress on the TMJ, which can further exacerbate postural imbalances (19–21).

In Class II malocclusions, the retruded lower jaw places excess strain on the TMJ and surrounding muscles, contributing to a forward head posture. This can lead to chronic tension in the neck and shoulders, as well as headaches. In Class III malocclusions, the protruding lower jaw shifts the TMJ out of its optimal position, causing discomfort and compensatory postural changes that can affect the entire body (18).

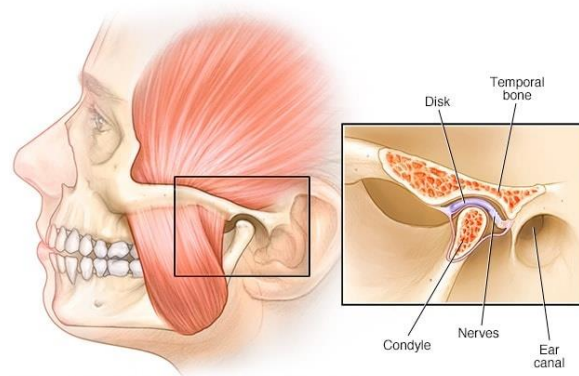


Figure 2. The temporomandibular joint and its impact on surrounding structures

The cervical spine, which supports the head and connects it to the thoracic spine, is particularly vulnerable to the effects of malocclusion. In cases of both Class II and Class III malocclusion, the altered head position places uneven pressure on the cervical vertebrae, leading to misalignment, muscle strain, and joint dysfunction. Research has shown that malocclusion can contribute to cervical spine disorders such as cervicgia (neck pain), limited range of motion, and even degenerative changes over time. The relationship between the jaw and the cervical spine is a critical factor in understanding how different bite classes affect overall body posture (22).

While the head and cervical spine bear the most immediate effects of bite misalignment, the thoracic and lumbar spine also play a role in compensating for changes in posture. Class II malocclusions, with their characteristic forward head posture, often result in kyphosis, an exaggerated outward curvature of the thoracic spine. This hunched position places additional strain on the lower back, leading to lower back pain and a compromised lumbar spine (23,24).

In Class III malocclusion, the backward head posture can contribute to flattening of the thoracic spine and hyperextension of the lumbar spine. These compensatory mechanisms place excess stress on the lower back, increasing the risk of lumbar spine disorders such as lordosis and disc degeneration (7).

Muscle Tension and Fatigue

One of the most immediate consequences of malocclusion on posture is increased muscle tension, particularly in the muscles of the head, neck, and shoulders. In Class II malocclusions, the forward head

posture places continuous strain on the sternocleidomastoid and trapezius muscles, leading to chronic muscle tension and fatigue. Over time, this can contribute to muscle imbalances, with some muscles becoming overactive and others underactive (18,21).

In Class III malocclusions, the backward head posture exerts similar strain on the posterior neck muscles, leading to tension in the suboccipital muscles, which can cause headaches and discomfort. The muscles of the upper back and lower spine are also affected, as they work to maintain balance in response to changes in head position, these are illustrated in Figure 3 (25–27).

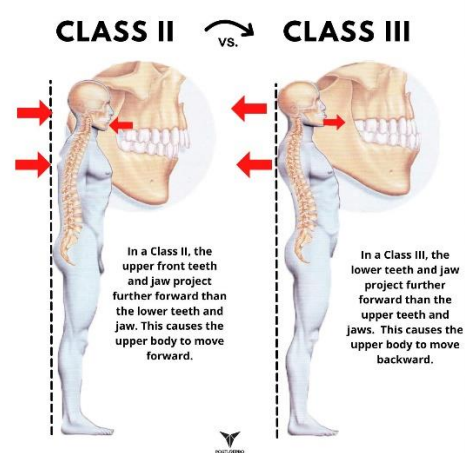


Figure 3. Class II and III malocclusions and their impact on skeletal balance

Effects on Balance and Gait

The human body relies heavily on a stable head position to maintain balance, coordination, and overall body alignment. The position of the head is crucial as it affects the body's center of gravity, which in turn influences how forces are distributed throughout the musculoskeletal system. Malocclusion, particularly in severe cases of Class II (overbite) and Class III (underbite),

can significantly disrupt this delicate balance. These types of malocclusion cause postural compensations that affect not only the head and neck but also the alignment of the spine, shoulders, pelvis, and lower extremities. Over time, these compensations can lead to musculoskeletal discomfort, increased wear and tear on the joints, and gait abnormalities, impacting overall stability and mobility (16,28).

Class II Malocclusion and Its Impact on Posture and Gait

Class II malocclusion is characterized by a prominent overbite, where the upper teeth significantly overlap the lower teeth. This malocclusion is typically associated with a retruded lower jaw, causing the mandible to be positioned farther back than ideal. As a result, individuals with Class II malocclusion often develop anterior head posture (AHP), a condition where the head is positioned forward in relation to the body's center of mass. Research shows that AHP is common in individuals with Class II malocclusion due to the altered jaw alignment, and this head-forward posture can lead to cascading effects on the rest of the body. Anterior head posture shifts the body's center of gravity forward, forcing the muscles and joints to adjust in order to maintain balance. This change causes strain on the cervical spine, particularly the upper trapezius, sternocleidomastoid, and levator scapulae muscles, which have to work harder to support the head's new position. Over time, this can lead to chronic neck pain, tension headaches, and an increased likelihood of developing cervical spine degeneration (8,29).

More importantly, this forward head posture affects the body's overall alignment. By shifting the center of gravity forward, the body compensates by adjusting the position

of the spine, pelvis, and lower limbs. Studies suggest that anterior pelvic tilt often occurs in response to forward head posture, as the pelvis tilts forward to counterbalance the weight shift caused by the head. This posture affects the way a person walks and stands, leading to alterations in gait and an increased risk of falling (30–32).

Gait changes in individuals with Class II malocclusion often manifest as shorter stride lengths and altered foot placement, as the body tries to maintain equilibrium. A study found that subjects with significant malocclusion exhibited asymmetry in their gait patterns, particularly in the swing phase of walking. This asymmetry is linked to compensatory mechanisms in the hips and lower back, where muscles are forced to adapt to the forward-shifted center of gravity. These compensations increase stress on the lumbar spine and lower extremity joints, particularly the hips, knees, and ankles, potentially leading to early joint degeneration, arthritis, and chronic pain in these areas (33,34).

Moreover, the increased strain on the knees and hips can lead to joint imbalances, affecting the distribution of weight across the legs and feet. As a result, individuals with Class II malocclusion may be prone to developing patellofemoral pain syndrome (pain around the kneecap) and plantar fasciitis (pain in the heel or foot). The connection between malocclusion and lower limb disorders suggests that dental health and body posture are more intricately linked than traditionally believed, calling for a multidisciplinary approach to treatment (4,35,36).

Class III Malocclusion and Compensatory Postural Adjustments

In contrast, Class III malocclusion, characterized by an underbite (where the

lower teeth protrude in front of the upper teeth), leads to a different set of postural and biomechanical challenges. In individuals with Class III malocclusion, the mandibular prognathism or excessive forward positioning of the lower jaw forces the head to tilt backward to maintain visual alignment. This backward head posture alters the orientation of the cervical spine, shifting the body's center of gravity posteriorly. The backward shift in head posture requires significant compensatory adjustments from the spine and pelvis. Individuals with Class III malocclusion often develop a flattened thoracic curve or even thoracic kyphosis (an exaggerated outward curvature of the upper spine) as their bodies attempt to counterbalance the jaw's forward position. This compensation places increased stress on the thoracic and lumbar regions of the spine, which have to bear the weight of a poorly aligned head (37,38).

As a result, the lumbar spine, in particular, experiences excessive lumbar lordosis (an exaggerated inward curvature of the lower spine) as the body tries to maintain a stable posture. This hyperextension of the lumbar spine not only strains the lower back muscles but also affects the pelvis. The backward head posture associated with Class III malocclusion is often linked to posterior pelvic tilt, a compensatory adjustment where the pelvis rotates backward. This postural adjustment can cause muscle imbalances in the lower back and hips, increasing the risk of lumbar disc herniation and sciatica over time (39).

Additionally, this backward shift in the center of gravity affects gait and mobility in individuals with Class III malocclusion. Studies suggest that these individuals may experience pelvic instability and altered hip biomechanics as their bodies struggle to balance the forces caused by a misaligned

jaw. The pelvis, acting as the body's core stabilizer, plays a crucial role in gait mechanics. When the pelvis is tilted backward, it affects the entire kinetic chain, leading to inefficient walking patterns and increased stress on the knees and ankles (40,41).

Individuals with Class III malocclusion may compensate for their altered center of gravity by taking wider strides or adjusting their foot placement during walking. However, these compensations often lead to muscle fatigue and joint wear in the lower extremities, particularly in the hip flexors, gluteal muscles, and hamstrings. Over time, the increased strain on these muscles can lead to hip bursitis, IT band syndrome, and lower back pain.

Both Class II and Class III malocclusions lead to altered postural dynamics, which directly influence the health of the joints. Misalignment of the jaw affects not only the neck and head but also propagates downward, leading to postural adjustments that can harm the hips, knees, and ankles. This is because posture affects how forces are transmitted through the body during movement. When the body's center of gravity is shifted due to a malocclusion, the joints have to compensate for the imbalance, often leading to unequal weight distribution and asymmetric joint loading (27,42,43).

For example, the compensatory mechanisms seen in individuals with Class II malocclusion can lead to an increased risk of osteoarthritis in the lower extremities. Uneven joint loading, particularly in the knees, can accelerate the wear and tear of the cartilage, leading to joint degeneration and pain. Similarly, individuals with Class III malocclusion may experience accelerated wear on the lumbar spine and hip joints due

to the increased strain from compensatory postures, potentially leading to conditions such as lumbar spondylosis (degenerative arthritis of the spine) and hip osteoarthritis.

The effects of malocclusion on posture and musculoskeletal health highlight the need for a multidisciplinary treatment approach. Addressing malocclusion through orthodontic intervention can correct the alignment of the teeth and jaws, which may improve head posture and reduce the associated strain on the neck, spine, and lower extremities. However, comprehensive care may also involve physical therapy, chiropractic care, and postural re-education to correct compensatory postural imbalances and strengthen the muscles that support proper alignment (42).

Orthodontic Interventions

Orthodontic treatment serves as a primary intervention for correcting malocclusion and mitigating its associated postural consequences. Orthodontic devices such as braces, clear aligners, and functional appliances work to realign teeth and restore a functional occlusal plane, improving both dental health and overall body alignment. For patients with Class II malocclusion (characterized by an overbite), the goal of treatment is to advance the lower jaw or modify the upper jaw's alignment, which helps reduce the tendency for anterior head posture. Anterior head posture is commonly seen in Class II patients due to the retruded position of the lower jaw, which forces the head to protrude forward in an attempt to maintain visual and postural balance. Orthodontic treatments, such as mandibular advancement devices or headgear, can guide jaw growth and alignment, alleviating the strain on the cervical spine and upper back caused by a forward head position. This intervention can improve not only the

aesthetic appearance of the jaw but also reduce musculoskeletal strain, lowering the risk of neck pain, shoulder tension, and headaches often associated with Class II malocclusion (1,24).

In contrast, patients with Class III malocclusion, which involves a protruding lower jaw or a retruded upper jaw (underbite), experience compensatory movements that affect posture differently. Class III malocclusions can lead to posterior head posture, where the head is tilted backward to compensate for the forward position of the lower jaw. This backward tilt can place significant strain on the cervical spine, leading to discomfort and pain in the neck and upper back. Orthodontic treatments for Class III malocclusion often involve jaw surgery (orthognathic surgery), reverse-pull headgear, or other appliances designed to adjust the position of the upper or lower jaw. These treatments help restore a balanced head and neck posture, reducing the compensatory strain on the muscles of the neck, shoulders, and upper spine. In more severe cases, orthognathic surgery may be needed to reposition the jaw and achieve a stable bite, thereby correcting the root cause of the postural imbalance (28,44).

While orthodontic treatments address the dental causes of malocclusion-related postural issues, physical therapy plays a crucial role in treating the musculoskeletal consequences. Patients with malocclusion often develop chronic muscle strain, particularly in the neck, back, and shoulders, as the body compensates for altered head and jaw positions. Physical therapy can help alleviate this muscle tension by strengthening the supporting muscles and restoring balance in the body's postural system. Neck strengthening exercises, for example, target the muscles that support proper cervical spine alignment, helping to reduce forward or

backward head postures that can contribute to chronic neck pain and headaches (19,45).

For patients with TMJ dysfunction related to malocclusion, specialized TMJ therapy may be required in addition to orthodontic treatment. TMJ therapy aims to reduce joint strain and restore proper jaw alignment, which in turn can improve posture and alleviate musculoskeletal symptoms. One common intervention is the use of custom splints or mouthguards, which are designed to reposition the jaw and relieve pressure on the TMJ. These devices are often worn at night to prevent teeth grinding (bruxism), a common contributing factor to TMJ dysfunction (19,45).

In addition to using splints or mouthguards, TMJ therapy may involve manual manipulation and massage to relax the muscles around the jaw and neck, improving mobility and reducing muscle tension. Physical therapy exercises focused on strengthening the masticatory muscles (the muscles used for chewing) can help stabilize the jaw and reduce the likelihood of further strain on the TMJ (46).

Furthermore, some patients may benefit from postural re-education as part of their TMJ therapy. Since poor posture can contribute to TMJ dysfunction, exercises that promote better alignment of the head, neck, and shoulders can help relieve pressure on the jaw joint. For example, correcting forward head posture can reduce the amount of strain placed on the TMJ, as it shifts the jaw into a

more neutral position. As part of a comprehensive treatment plan, TMJ therapy can not only alleviate pain in the jaw but also improve posture, reduce neck and back strain, and enhance overall musculoskeletal health (21,22,28).

4. Conclusion

This review underscores the significant influence of dental occlusion, particularly malocclusion, on body posture and musculoskeletal health. Misalignments in the bite—Class I, II, and III—have distinct postural implications that can lead to chronic pain, muscle strain, and compensatory mechanisms affecting the entire musculoskeletal system. The relationship between occlusion and posture suggests that addressing dental misalignments is essential not only for oral health but also for preventing or mitigating broader musculoskeletal disorders.

Future research should aim to explore longitudinal outcomes of integrated treatment approaches that address both orthodontic alignment and postural correction. Studies assessing the efficacy of multidisciplinary interventions—including orthodontics, physical therapy, and chiropractic care—could provide valuable insights into optimizing patient outcomes. Additionally, further investigation into the role of malocclusion in specific populations, such as athletes or individuals with chronic pain conditions, could yield targeted treatment protocols. Overall, a comprehensive understanding of the interplay between dental health and body posture will be crucial for developing effective treatment strategies and improving patient well-being.

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