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The Role of Anterior Bite Plates in Deep Bite Correction: A Review

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Abstract

Background: Deep bite malocclusion is a common orthodontic problem that can impair function, esthetics, and long-term stability. Anterior bite planes, both fixed and removable, are widely used to correct deep bite by promoting selective eruption and altering neuromuscular balance.

Objective: This review aims to summarize current evidence on the clinical effects, treatment outcomes, and limitations of anterior bite planes in the management of deep bite malocclusion.

A narrative review of relevant clinical studies, randomized controlled trials, and case reports was undertaken, focusing on dentoalveolar, skeletal, and functional effects, as well as patient acceptance and potential risks.

Results: Anterior bite planes effectively reduce deep bite primarily through dentoalveolar changes, including posterior molar eruption and minor incisor intrusion. Fixed designs demonstrate greater efficiency with minimal reliance on patient cooperation, while removable appliances offer flexibility but are compliance-sensitive. Several studies reported transient neuromuscular adaptations and reduced masticatory muscle activity immediately following insertion, which normalize over time. Long-term skeletal changes are limited, and treatment stability depends on case selection and retention protocols. Overall, patient acceptance has been favorable, particularly with fixed bite planes and integration of digital scanning methods.

Conclusion: Anterior bite planes represent a simple, reliable, and clinically effective adjunct in the management of deep bite malocclusion. Although their effects are primarily dentoalveolar, they contribute significantly to functional correction and improved esthetics. Further longitudinal and controlled clinical trials are required to validate long-term stability and optimize appliance design.

Keywords: anterior bite plane, deep bite, overbite correction, functional therapy, orthodontic appliances

Introduction

Deep bite malocclusion is a frequent orthodontic problem, affecting nearly 18%–35% of growing patients, defined as an excessive vertical overlap of the maxillary incisors over the mandibular incisors, with severe cases (>5 mm) affecting nearly 20% of children and 13% of adults.[1] Its etiology can be dental—such as a deep curve of Spee, anterior over-eruption, or posterior under-eruption—or skeletal, involving discrepancies in the vertical position of the jaws. Various treatment modalities exist, but the anterior bite plane (ABP) has been widely recognized as a simple and effective appliance, especially in growing patients, to correct deep overbite by facilitating posterior eruption and incisor intrusion. Beyond its dental effects, the ABP also influences masticatory muscle activity and temporomandibular joint (TMJ) function, making it a subject of continuing interest in orthodontic research.[1]

The removable anterior bite plane (ABP) is one of the most commonly used appliances for its correction, primarily by promoting extrusion of the mandibular posterior teeth and repositioning of the mandibular incisors. Traditionally, ABPs are fabricated from acrylic resin due to its strength and resistance to fracture, though their design, restricting contact mainly to the mandibular incisors may concentrate occlusal forces at the root apices and potentially influence root volume. With the advent of cone-beam computed tomography (CBCT), subtle changes such as orthodontically induced inflammatory root resorption can now be measured with high precision. More recently, esthetic clear thermoplastic appliances with bite ramps have emerged as an alternative, combining comfort, transparency, and functional effectiveness. Given the variations in material properties between acrylic and thermoplastic appliances, their biomechanical and biological effects on deep bite correction and root response warrant closer evaluation.[2]

Clinically, deep bite patients often present with pronounced overjet, deep curve of Spee, infraoccluded molars, and compromised facial proportions. Treatment options include incisor intrusion, molar extrusion, and lower incisor proclination, with severe skeletal cases requiring combined orthodontic-surgical approaches. In growing patients, however, the anterior bite plate (ABP) remains a widely used appliance, effectively correcting deep bite by promoting molar eruption and improving occlusal balance.[3]

Several experimental and clinical studies have demonstrated that ABP designs can influence condylar position, mandibular displacement, and TMJ morphology, with some variants showing potential risks of cartilage degradation and functional malocclusion. Conversely, flat ABPs have been reported to alleviate TMJ pain, though their long-term stability is questionable once treatment is discontinued. The relationship between ABP therapy and TMJ structural alterations remains controversial, with current evidence being inconclusive. Thus, further research is required to clarify whether ABPs exert direct cause-and-effect changes on TMJ morphology or mandibular adaptation.[4]

Muscular characteristics also play a key role, as patients with deep bite exhibit greater masticatory muscle activity compared to individuals with normal occlusion, which may restrict vertical facial growth and complicate treatment stability. Surface electromyography (EMG), a non-invasive and reliable method, has been widely used to assess these muscular differences and monitor changes before and after therapy. While removable appliances rely heavily on patient compliance, fixed anterior bite planes have been shown to effectively reduce deep bite and improve associated symptoms such as temporomandibular pain and muscle tenderness. However, most early studies evaluating their efficacy relied only on palpation for muscle assessment, highlighting the need for more objective methods like EMG to evaluate their true impact on dentoskeletal structures and muscle activity.[5]

Skeletal Class II malocclusion with mandibular retrusion is a common dentofacial anomaly often associated with increased overjet, deep bite, and compromised esthetics. Functional appliances are frequently used during growth to stimulate mandibular advancement, and the anterior bite plane (ABP) has proven effective in managing Class II cases with deep bite by promoting posterior eruption and bite opening. Since mandibular retrusion may also influence posterior airway space (PAS) through posterior tongue displacement, ABP therapy has the potential to induce favorable craniofacial and airway modifications. Although advanced imaging methods provide detailed airway assessment, lateral cephalometry remains a practical and reliable tool in clinical settings. This review evaluates the role of ABP therapy in improving skeletal relationships and airway dimensions in patients with Class II malocclusion and mandibular retrusion.[6]

A systematic literature search was conducted using electronic databases including PubMed, Scopus, Google Scholar, and Web of Science to identify relevant studies on the use of anterior bite planes (ABP) in orthodontic treatment. The search was performed for articles published between 2000 and 2025, with no language restrictions applied. Keywords and combinations used included: “anterior bite plane,” “deep bite correction,” “functional appliances,” “skeletal Class II malocclusion,” “airway dimensions,” and “temporomandibular joint.” Reference lists of retrieved articles and relevant orthodontic journals were also hand-searched to ensure comprehensive coverage.

Inclusion criteria consisted of studies that evaluated the clinical, skeletal, dental, or airway effects of anterior bite plane therapy in humans. Both randomized controlled trials and observational studies (prospective and retrospective) were considered. Review articles, case reports, and studies unrelated to ABP were excluded. Data extracted from eligible studies included sample size, patient characteristics, appliance design, duration of treatment, and primary outcomes such as overbite reduction, skeletal changes, and airway modifications.

Since this was a narrative literature review, ethical approval and patient consent were not applicable.

Historical Background

The anterior bite plate (ABP) has been a cornerstone in the management of deep bite malocclusions for more than a century. Its origins can be traced to early orthodontic practice, where clinicians recognized the need to selectively interfere with the occlusion to promote posterior eruption and reduce excessive overbite. The earliest designs consisted of a simple shelf-like extension on the lingual side of a removable regulating appliance, positioned just behind the maxillary incisors. This shelf allowed the mandibular incisors and canines to occlude directly against it, effectively preventing contact of the posterior teeth and creating a temporary anterior open bite.[9] Early pioneers such as Colignon, Barret, Kingsley, and Bogue documented the effectiveness of bite planes in both incisor intrusion and mandibular advancement. They observed that bite planes, when worn consistently, could produce significant occlusal improvements within a relatively short time. Additionally, modifications such as the use of springs, hooks, or reinforced metal plates enhanced their durability and effectiveness.[9]

Forsberg and Hellsing[7] investigated the effects of a fixed lingual arch appliance with an anterior bite plane in 20 patients aged 9–13 years with deep overbite. Results showed that the first molars gained occlusal contact within an average of 0.3 years (≈14 weeks), primarily due to accelerated vertical eruption of the posterior segments, especially in the lower arch. Skeletal changes included posterior rotation of the mandible, anterior rotation of the maxilla, and an increase in lower anterior facial height, while vertical development of the upper face height was inhibited. Importantly, no functional disturbances of the masticatory system or TMJ were detected during treatment. The study demonstrated that a fixed anterior bite plane could effectively reduce overbite without relying on patient compliance, achieving significant dental and skeletal modifications within a short treatment period.

Effects of Anterior Bite Plate

1. Dentoalveolar Effects and Skeletal Effects

Anterior bite plates (ABPs) primarily act by altering occlusal contacts. By preventing posterior tooth contact, they allow for posterior tooth eruption and depression of the mandibular incisors, thereby reducing excessive overbite. The selective occlusal interference redirects chewing forces anteriorly, which not only facilitates incisor intrusion but also helps in achieving harmonious overbite correction. In some cases, slight proclination of the mandibular incisors may also occur, depending on the design of the appliance.[9]

The mandible, during growth, undergoes progressive lengthening of its body and ramus, accompanied by remodeling at the mandibular angle. ABPs can influence this process by promoting forward repositioning of the mandible. Clinical evidence indicates that rather than relocating the condyle within the temporomandibular joint, the appliance induces a bending at the mandibular angle, resulting in a more obtuse relationship between the ramus and body of the mandible. This skeletal change helps in advancing the mandible and improving occlusal relationships.[9]

Inclined designs of bite planes enhance their orthopaedic action. By incorporating a downward and backward slope, the ABP allows mandibular incisors to slide forward, encouraging a "jumping the bite" effect, as first described by Kingsley in 1888. This mechanism aids not only in deep bite correction but also in functional mandibular advancement, contributing to the improvement of Class II malocclusions. The constant low-intensity force applied by ABPs follows the biological principles of bone remodeling, encouraging favorable growth adaptations.[9]

A systematic review by Essrar et al. (2021) evaluated the impact of anterior bite planes (ABPs) in managing deep overbite malocclusion in growing patients. Three controlled clinical trials, including the landmark study by Forsberg and Hellsing (1984), were analyzed, highlighting consistent dental and skeletal effects. ABPs corrected deep overbite primarily through extrusion of molars, with Forsberg and Hellsing reporting a mean lower first molar eruption of 1.4 ± 0.7 mm in treated patients compared to 0.7 ± 0.6 mm in controls. These vertical skeletal adaptations were accompanied by improved muscular balance, as electromyographic studies showed a reduction in masticatory muscle hyperactivity, while condylar positional changes were minimal and clinically insignificant. Collectively, the evidence suggests that ABPs are effective in deep bite correction during growth, not only through dental extrusion but also by favorably modifying vertical skeletal dimensions and muscle activity, though long-term stability remains to be established.[10]

A clinical study by Akarsu and Ciger (2010) evaluated the effects of fixed anterior biteplane therapy on dentoskeletal structures and masticatory muscle activity in 17 growing patients with Class II malocclusion, deep bite, and reduced lower anterior facial height. The mean treatment duration was 8.5 ± 2.1 months. Cephalometric analysis revealed significant increases in lower anterior and total facial height, forward positioning of the mandible, and labial inclination of maxillary and mandibular incisors, accompanied by extrusion of mandibular posterior teeth, resulting in successful reduction of overbite and overjet. Electromyographic evaluation showed that muscle activities (temporalis, masseter, digastric, and sternocleidomastoid) were elevated at rest before treatment but exhibited no significant long-term change following therapy, apart from minor reductions in specific positions. The authors concluded that fixed anterior biteplane therapy provides effective early correction of sagittal and vertical discrepancies in deep bite patients without inducing detrimental changes in masticatory muscle function, supporting its use as a simple and efficient initial treatment modality.[5]

Zaboulian and Ghassemi (2014) presented a clinical case report on the use of a fixed functional anterior bite plane for managing Class II tendency with deep overbite in a 12-year-old male patient. Initially, the patient demonstrated a Class II end-on molar relationship, ANB angle of 3°, an incisal overjet of 2 mm, and a 90% deep overbite. After treatment, the anterior bite plane produced significant improvements in overbite correction and established a Class I molar and canine relationship, alongside favorable skeletal and dental adaptations. The authors concluded that fixed anterior bite plane therapy is an effective and stable approach for Class II tendency patients with severe overbite, particularly when patient cooperation is limited.[11]

In their 2017 study, Ciavarella et al. evaluated the dentoskeletal effects of the anterior bite plane functional appliance (ABPFA) in the treatment of Class II Division 1 deep bite malocclusion. Results showed no significant skeletal changes compared to untreated controls, as parameters such as ArGoMe and SNGoMe angles remained largely unchanged, indicating minimal skeletal modification. However, dental effects were significant, with a notable reduction in overjet (6 mm at T0 vs. 5 mm at T1, $p < 0.05$) and a tendency for decreased overbite. Importantly, ABPFA limited undesirable side effects such as lower incisor proclination and upper incisor retroclination, which are commonly observed with other functional appliances. These findings suggest that, while ABPFA exerts limited skeletal influence, it is effective in improving dental relationships and mandibular displacement in growing Class II patients, making it a valuable tool in managing deep bite cases with minimal adverse dentoalveolar consequences[12]

In a randomized clinical trial, Sangwattanarata and Thongudomporn et al. (2024) evaluated the effectiveness of two removable anterior bite plane (RABP) wear protocols in growing deep bite patients: full-time wear with appliance on during meals (F + M) versus removal during meals (F – M). The study included 32 patients with a mean age of 10.94 ± 2.17 years, equally divided into both groups, and monitored until overbite (OB) normalization was achieved. Cephalometric analysis revealed comparable skeletal and dental changes between the groups, including molar extrusion and incisor intrusion with proclination in both arches ($P < .05$). However, the F + M protocol produced a significantly faster rate of deep bite correction (1.83 ± 1.18 mm/month) compared to the F – M protocol (1.08 ± 0.62 mm/month; $P < .05$) and also accelerated mandibular molar extrusion (0.46 ± 0.25 vs 0.30 ± 0.18 mm/month; $P < .05$). There findings indicated that while both approaches are effective, wearing the RABP during meals yields faster clinical outcomes, underscoring the importance of patient compliance and wear duration in optimizing treatment efficiency.[13]

In a clinical investigation, Emami Meibodi et al. assessed the effects of anterior inclined plane therapy on the dentoskeletal characteristics of growing patients with Class II Division 1 malocclusion and deep overbite. The study included 25 patients (15 girls and 10 boys) with a mean age of 9 ± 1.2 years, treated over an average period of 8 months. Cephalometric analysis revealed that the appliance had no significant skeletal effect on the maxilla or vertical parameters (SN-MP, Y-axis), but significant mandibular changes were observed. The ANB angle decreased, while SNB increased, with the Ar–Pog distance increasing by 3.9 ± 4.3 mm ($p < 0.004$) and Ar–B moving forward by 3 ± 3.87 mm ($p < 0.01$), indicating forward mandibular growth. Dentally, maxillary incisors were significantly retroclined, while mandibular incisors showed proclination. Overjet and overbite were also effectively reduced. The authors highlighted that correction was achieved primarily through dentoalveolar and mandibular skeletal adaptations, improving both occlusion and facial profile. They concluded that the anterior inclined plane is a simple, less bulky alternative to conventional functional appliances, offering good patient compliance and favorable early treatment outcomes in mixed dentition.[14]

In their clinical study, Senussi and Abdelgader et al. evaluated the role of the anterior bite plane (ABP) as a functional appliance in managing Class II Division 1 malocclusion with deep bite. Cephalometric superimpositions demonstrated a significant reduction in deep bite ($P<0.05$) and a decrease in facial convexity by 2.49°, alongside a reduction in ANB angle from 6.44° to 4.63° (mean 1.81°, $P=0.001$), reflecting improvement in sagittal jaw relationship. Moreover, total mandibular length increased by 2.95 mm, attributed to condylar remodeling and vertical as well as horizontal ramus growth. Dentally, maxillary incisors were retroclined while mandibular incisors advanced, contributing to correction of overjet and overbite. The authors concluded that the anterior bite plane effectively induces dentoalveolar and skeletal modifications, particularly enhancing mandibular growth and improving facial profile, and may serve as a less invasive alternative to complex functional appliances or orthognathic surgery when applied at the optimal growth phase.[15]

Dunbar et al. (2025) conducted a single-centre randomized controlled trial at Dundee Dental Hospital, UK, to evaluate whether occlusal contact could be re-established within six months after bonding of a fixed anterior bite plane in adolescents with Class II division 2 incisor relationships. The study included 38 participants aged 9–16 years (11 males, 27 females), randomly assigned to intervention and control groups. After 6 months of treatment, the intervention group demonstrated a significant reduction in mean overbite from 5.07 mm to 2.45 mm, achieved through a combination of mean incisor intrusion of 0.29 mm and molar eruption of 0.23 mm. Importantly, no significant changes were detected in incisor inclination or vertical skeletal parameters, indicating that the appliance achieved its effect primarily through controlled dentoalveolar adaptation. The authors concluded that fixed anterior bite planes represent an effective, short-term, and well-tolerated option for reducing deep overbite in Class II division 2 patients without undesirable skeletal side effects.[16]

2. Effects on TMJ

In a radiographic study, Hellsing et al. investigated the effects of fixed anterior biteplane therapy on deep bite correction and temporomandibular joint (TMJ) position. The appliance produced an initial molar separation of approximately 4 mm, and within 3.5–5 months, occlusal contact was re-established while the overbite was reduced by 4–7 mm. Radiographic evaluation revealed that all condyles shifted position immediately after bite opening, with displacements ranging from 0.31 to 1.84 mm, but the direction of movement varied between individuals and even between the two condyles of the same patient. Importantly, no further significant condylar changes or signs of hard tissue remodeling were detected during the treatment period. Cephalometric analysis indicated that overbite correction was achieved mainly through eruption of the lateral segments rather than true incisor intrusion, although some lower incisor intrusion (0.5–2.5 mm) was noted depending on subsequent edgewise therapy. The authors concluded that the therapeutic effect of fixed anterior biteplane therapy could not be explained by condylar repositioning alone, but rather by dentoalveolar adaptation, making it an effective short-term approach for managing skeletal deep bite cases.[17]

Recent experimental evidence has provided deeper insights into the impact of bite planes on the temporomandibular joint and mandibular morphology. Hutami *et al.* (2023), in a Wistar rat model, demonstrated that both flat and inclined anterior bite planes effectively reduced overbite within 7–14 days but were associated with thinning of condylar cartilage, indicative of stress-induced remodeling. Additionally, the inclined bite plane group showed significant increases in lower incisor inclination, ramus angle, and mandibular length, reflecting changes in mandibular angulation and morphology. Earlier human studies using radiographic techniques also revealed small but variable condylar displacements immediately after bite opening, although without evidence of long-term hard tissue remodeling. Taken together, these findings suggest that while anterior bite planes are effective in reducing deep bite, they may impose adaptive stresses on the TMJ and condyle, warranting careful monitoring of treatment duration and functional changes to avoid long-term complications.[4]

3. Limitations and Adverse Effects

Despite their advantages, ABPs require careful management. Excessive or prolonged use of intermaxillary force in conjunction with bite planes can cause over-opening of the mandibular angle, leading to prognathism or loss of proper incisal contact. In such cases, reversal of the direction of force or use of auxiliary appliances such as chin caps may be necessary. These findings highlight the importance of judicious application of ABPs to maximize benefits while avoiding adverse skeletal changes.[9]

4. Comparison with other Appliances for Deepbite Correction:

In a 2010 comparative clinical trial, Emami Meybodi et al. evaluated the treatment effects of the R-appliance and the anterior inclined bite plate in patients with Class II Division 1 malocclusion. The study demonstrated that both appliances were effective in reducing the increased overjet and overbite typically associated with mandibular retrognathia. The anterior inclined bite plate primarily acted through dentoalveolar modifications, with significant retroclination of maxillary incisors and proclination of mandibular incisors, leading to improved incisor relationships. By contrast, the R-appliance produced more pronounced skeletal effects, with notable increases in mandibular length and reductions in the ANB angle, thereby contributing to sagittal correction of the skeletal discrepancy. The authors highlighted that while both appliances are useful in early treatment of Class II Division 1 cases, the anterior inclined bite plate is simpler and better tolerated, whereas the R-appliance is more effective in stimulating mandibular growth and skeletal correction in growing patients.[18]

In a 6-month randomized controlled trial, Wasinwasukul et al. (2022) investigated the effects of anterior bite planes fabricated from acrylic resin (ABP) and bi-laminate thermoplastic material (TBP) on masticatory muscle responses and maximum bite force (MBF) in children with deep bite. The study demonstrated that immediately after appliance insertion, masticatory muscle activity and activity index (AC) significantly decreased, particularly in the ABP group, which showed lower masseter activity than the TBP group. However, these values gradually returned to baseline and were comparable to controls after 1–3 months. The authors concluded that while anterior bite plane insertion transiently reduces muscle activity, both ABP and TBP did not exert long-term adverse effects on muscle balance or bite force, highlighting their safety in managing growing patients with deep bite.[19]

Anterior bite turbos have emerged as an effective, minimally invasive option for managing deep bites and incisal plane discrepancies. In a prospective clinical study of 40 orthodontic patients (mean age not specified; 4 males, 36 females), Nguyen et al. evaluated the role of anterior unilateral bite turbos (AUBTs) in correcting incisal plane cant and asymmetric overbite. Compared to traditional approaches such as reverse-curve archwires, utility arches, or multiloop techniques, AUBTs offered greater overbite reduction in a shorter time span, with reduced reliance on patient compliance. The study concluded that AUBTs are a cost-effective, efficient, and safe adjunct in deep bite and cant correction, although questions regarding long-term stability and comparative outcomes with skeletal anchorage or surgical methods remain open for future investigation.[20]

Bassarelli et al. in 2016, investigated the dentoskeletal effects of a modified Jasper Jumper appliance combined with an anterior bite plane in growing Class II Division 1 patients with increased overbite. Their retrospective study on 32 treated subjects, compared with 30 untreated controls, showed that the appliance was highly effective in achieving Class I occlusion with significant reductions in overjet (–3.9 mm) and overbite (–3.1 mm). Importantly, skeletal effects contributed about 75% of the correction, mainly through increased mandibular length and improved sagittal maxillomandibular relationships, while dentoalveolar effects (25%) were largely confined to proclination of the lower incisors and mesial migration of mandibular molars. The authors emphasized that the addition of the anterior bite plane enhanced the skeletal response by unlocking the occlusion, thereby facilitating mandibular advancement. This protocol therefore appears to provide a favorable balance of skeletal and dental effects compared to conventional Jasper Jumper therapy, where dentoalveolar changes typically predominate.[21]

Alsawaf and Rajah (2023) performed the first randomized controlled trial directly comparing a utility arch (UA) with posterior intermaxillary elastics against a fixed anterior bite plane (FABP) in children with skeletal deep bite and retroclined upper incisors in the mixed dentition. Both groups showed significant vertical changes, with SN:GoMe increasing by 1.97° in the UA group and 2.75° in the FABP group. Overbite decreased significantly in both groups (–2.10 mm vs. –3.64 mm), although the reduction was greater in the FABP group ($P < 0.001$). Upper incisors flared in both groups (U1:SN change +6.6° UA; +5.9° FABP). Sagittally, SNA and ANB decreased significantly only in the UA group, suggesting some maxillary retrusion, whereas FABP maintained sagittal maxillary position. Both appliances produced minor backward mandibular rotation without gonial angle change. The authors concluded that both UA with elastics and FABP are effective for deep bite correction in hypodivergent children, but FABP achieved a greater overbite reduction in a slightly shorter treatment time, while UA induced additional sagittal effects.[22]

Rasol *et al.* (2024) conducted a systematic review to evaluate the best orthodontic methods for correcting skeletal deep bites in growing patients. Overall, the review concluded that while all three modalities improved vertical skeletal dimensions by increasing molar height, the flat anterior bite plane demonstrated relative efficiency in treatment duration, the inclined bite plane significantly increased mandibular sagittal positioning, and the utility arch was associated with maxillary sagittal retrusion. However, Rasol *et al.* emphasized that evidence remains limited due to the small number of clinical trials and called for further well-designed RCTs.[23]

5. Effects on Airway Dimension

In cephalometric analysis, the Hy-S distance represents the linear measurement from the most anterior–superior point of the hyoid bone (Hy) to the sella turcica (S) and serves as an indicator of hyoid bone positioning in relation to the cranial base. Alterations in this parameter are clinically relevant, as posterior displacement (increased Hy-S) may reflect compromised tongue posture or reduced airway support, while a decrease suggests forward positioning and potential improvement in airway patency. In their retrospective study on anterior bite plane (ABP) therapy in Class II retrognathic patients, Mohamed et al. (2023) reported that adults in the control group demonstrated a significant increase in Hy-S distance, signifying posterior hyoid displacement, whereas younger Class II patients treated with ABP showed favorable airway dimensional changes, highlighting the appliance’s role in improving functional space during growth.[24]

6. Effects on Incisor Root Length and Root Volume

In a recent randomized clinical trial, Sangwattanarata and Thongudomporn et al. (2025) investigated the effects of removable anterior bite planes (RABPs) on mandibular incisor root length (RL), root volume (RV), and incisal maximum bite force (IMBF) in growing deep bite patients. The study included 36 children, divided equally into two groups: one wore the RABP during meals (F + M protocol) while the other removed it during meals (F – M protocol). Their findings highlighted that while both protocols are effective in deep bite correction, wearing the appliance during meals may predispose to slightly greater root resorption. The authors concluded that IMBF plays an important role in influencing the extent of root changes, underscoring the need to balance treatment effectiveness with potential biological side effects in clinical decision-making.[25]

Discussion

The anterior bite plate (ABP) has consistently proven to be one of the most effective appliances for the correction of deep bite malocclusion, particularly in growing patients. Its mechanism is primarily dentoalveolar, achieved by disoccluding the posterior teeth, which permits their eruption while simultaneously inducing a degree of mandibular incisor intrusion. Early clinical studies demonstrated this principle clearly; Forsberg and Hellsing [7] showed that a fixed lingual arch with an anterior bite plane produced overbite reduction within three months by accelerating posterior eruption, accompanied by increased lower anterior facial height. Later systematic reviews confirmed that ABPs reliably induce molar extrusion and vertical skeletal changes, with Essrar et al.[26] reporting mean lower molar eruption of 1.4 mm compared with controls and a notable increase in mandibular plane angle.

Fixed ABPs are particularly advantageous because they eliminate dependence on patient compliance while achieving efficient bite opening. Dunbar et al.[16] recently provided high-quality randomized controlled evidence, showing that a fixed anterior bite plane reduced overbite from 5.07 mm to 2.45 mm in Class II Division 2 adolescents within six months through controlled incisor intrusion (0.29 mm) and molar eruption (0.23 mm), without significant skeletal side effects. These findings highlight the appliance's efficiency in short-term vertical correction. Similarly, Zaboulian and Ghassemi[11] demonstrated the clinical success of a fixed anterior bite plane in establishing a Class I molar and canine relationship in a Class II tendency case with deep overbite, emphasizing its utility where patient cooperation is limited.

Removable ABPs, though effective, remain heavily reliant on patient cooperation, and their efficiency is closely tied to wear duration. Sangwattanarata and Thongudomporn [13] found that wearing the removable appliance during meals significantly accelerated the rate of overbite reduction (1.83 mm/month) compared to removal during meals (1.08 mm/month). Their subsequent CBCT trial further revealed that both wear protocols were associated with subtle decreases in mandibular incisor root length and volume (2025), highlighting a potential adverse biological effect that warrants further longitudinal investigation.

The dentoskeletal effects of ABPs are well documented. Akarsu and Ciger[5] observed significant increases in lower anterior and total facial height, forward mandibular positioning, and mandibular posterior tooth extrusion in Class II patients treated with a fixed anterior bite plane, demonstrating that vertical and sagittal improvements can be achieved without negative alterations in muscle activity. In contrast, Ciavarella et al.[12] reported minimal skeletal effects but significant dental changes in Class II Division 1 patients, underscoring that the skeletal impact of ABPs may be limited and patient-dependent. Emami Meibodi et al.[14] and Senussi and Abdelgader[15] further emphasized that anterior inclined planes can produce mandibular advancement and improved sagittal jaw relationships, with increased mandibular length and reduced ANB angle, suggesting a role in early functional orthopedic treatment.

Functional and neuromuscular adaptations also contribute to treatment outcomes. Surface electromyography studies indicate that ABPs can transiently reduce hyperactivity of the masseter and temporalis muscles, although long-term activity often returns to baseline. Wasinwasukul et al. [19] found that both acrylic and thermoplastic ABPs temporarily decreased muscle activity, with no long-term adverse effects on muscle symmetry or maximum bite force. This supports their safety in pediatric patients, while highlighting the transient nature of neuromuscular adaptations.

Concerns regarding temporomandibular joint (TMJ) effects remain a subject of debate. Hellsing et al. [17] showed that while condylar displacements of up to 1.8 mm occur immediately following bite opening with a fixed anterior bite plane, no evidence of long-term remodeling was observed. Similarly, Dunbar et al. [16] confirmed that overbite correction is primarily dentoalveolar rather than skeletal or articular. Nonetheless, experimental evidence from Hutami et al.[4] suggested condylar cartilage thinning in animal models treated with ABPs, indicating potential adaptive stresses on the joint, which should be considered in long-term therapy.

Comparisons with other appliances reveal that ABPs are highly efficient for vertical correction but less potent for skeletal modification. Emami Meybodi et al.[14] demonstrated that while both the R-appliance and the anterior inclined bite plate reduced overjet and overbite in Class II Division 1 malocclusion, the R-appliance produced greater mandibular growth stimulation, whereas the bite plate exerted its effect mainly through dentoalveolar adaptation. Alsawaf and Rajah[22] confirmed this in a randomized controlled trial, showing that fixed anterior bite planes achieved greater overbite reduction in shorter treatment times compared to utility arches, though the latter induced additional sagittal effects through maxillary retrusion. Similarly, Bassarelli et al. [21] found that incorporating an anterior bite plane with a Jasper Jumper enhanced skeletal mandibular advancement by “unlocking” the occlusion, further demonstrating the value of ABPs as adjunctive appliances in functional therapy.

Beyond occlusal and skeletal outcomes, airway dimensions and hyoid positioning may also be positively influenced by ABP therapy. Mohamed et al. [24] reported that untreated adults exhibited increased Hy–S distance, whereas Class II patients treated with ABPs showed forward hyoid positioning and improved airway dimensions, suggesting a functional advantage in growing individuals. This highlights a promising area for further research, particularly with advanced imaging modalities.

Despite these advantages, limitations exist. Prolonged or inappropriate use can lead to excessive posterior eruption, backward mandibular rotation, or root resorption detectable by CBCT. Additionally, while anterior bite turbos and thermoplastic alternatives offer esthetic and minimally invasive options with high patient acceptance [19,20] questions remain regarding their long-term stability and comparative efficacy. Systematic reviews, such as that by Rasol et al. [23], emphasize that although ABPs are efficient for deep bite correction, high-quality randomized clinical trials remain scarce, and long-term stability data are limited.

In summary, the collective evidence demonstrates that anterior bite plates are a simple, biologically effective, and versatile tool for managing deep bite malocclusion. Their primary mode of action lies in dentoalveolar adaptation with secondary skeletal and functional benefits, while their safety profile remains favorable when treatment is carefully monitored. However, limitations including compliance dependency, transient neuromuscular effects, and potential risks of root resorption or posterior overeruption necessitate cautious clinical application. Comparative and long-term studies are required to refine appliance design, identify ideal treatment timing, and establish evidence-based guidelines for their use in both dental and skeletal deep bite correction.

Conclusion

Anterior bite plates remain a simple yet effective treatment modality for the correction of deep bite malocclusion, particularly in growing patients. The evidence consistently shows that their primary effects are dentoalveolar, achieved through controlled posterior eruption and limited incisor intrusion, with secondary skeletal and functional benefits in selected cases. Fixed bite planes offer greater efficiency and reduced dependence on patient compliance, while removable designs allow flexibility but are more compliance-sensitive. Recent randomized controlled trials confirm their short-term effectiveness in overbite reduction, with minimal skeletal side effects and good patient acceptance. However, potential risks, including root resorption, excessive molar extrusion, and transient neuromuscular alterations, highlight the need for careful case selection and monitoring. Despite their long history and proven clinical utility, further high-quality longitudinal trials are warranted to establish their long-term stability, optimize appliance design, and refine treatment protocols.

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