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Deep Bite Malocclusion: A Comprehensive Review of Epidemiology, Etiology, Clinical Consequences, and Treatment Approaches

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ABSTRACT: Deep bite, defined as excessive vertical overlap of the maxillary incisors over the mandibular incisors, is a highly prevalent and persistently challenging malocclusion, with reported prevalence ranging from 8.4% to 51.5% across populations. It is a clinical presentation rather than a single diagnosis, arising from dentoalveolar causes, an underlying hypodivergent skeletal growth pattern, or both, and its clinical consequences extend beyond occlusion to palatal and gingival soft-tissue trauma, accelerated incisal wear, and an association with signs of temporomandibular disorder. Effective management therefore requires distinguishing dental from skeletal etiology and identifying whether posterior extrusion, incisor intrusion, or both are indicated. In growing patients, anterior bite planes, bite turbos, and functional appliances exploit posterior dentoalveolar eruption to reduce overbite. In adolescents and adults, curve of Spee leveling with continuous archwires corrects the bite mainly through premolar and molar extrusion, whereas segmented intrusion arches, temporary anchorage device (TAD)-supported intrusion, and clear aligner therapy allow more direct incisor intrusion; recent meta-analyses show TAD-supported intrusion produces statistically greater, though often modestly larger, overbite reduction than conventional arches. Severe skeletal deep bite in nongrowing patients may require combined orthodontic-surgical treatment, including anterior segmental osteotomy. Long-term data indicate most corrections remain substantially stable, although partial relapse toward the original overbite is common. This review synthesizes epidemiological, etiological, clinical, and treatment-related evidence on deep bite malocclusion.

KEYWORDS: *deep bite; deep overbite; etiology; temporomandibular disorders; periodontal trauma; curve of Spee; incisor intrusion; orthognathic surgery; review*

I. INTRODUCTION

A deep bite, or excessive overbite, is present when the maxillary incisors overlap the mandibular incisors vertically beyond the normal range of approximately one-third of the mandibular incisor crown height in centric occlusion [2]. It is a clinical presentation rather than a distinct diagnosis, since it may arise from purely dentoalveolar causes (supraeruption of incisors, infraocclusion of posterior teeth), from an underlying skeletal pattern (a hypodivergent, short-face growth pattern with reduced lower anterior facial height), or from a combination of both, and it is a defining feature of Class II Division 2 malocclusion [1,2]. Beyond its impact on occlusion, an uncorrected deep bite can be a genuine source of clinical morbidity, and it is one of the more difficult malocclusions to correct predictably and retain [2]. This review takes a comprehensive approach to deep bite malocclusion, covering not only its treatment but also its epidemiology, etiology and pathogenesis, and clinical and functional consequences, before addressing diagnostic classification and the full range of contemporary treatment modalities, from growth-phase management through adult biomechanical correction to orthognathic surgery, with an emphasis on current systematic-review and meta-analytic evidence.

II. EPIDEMIOLOGY

Reported deep bite prevalence varies markedly across populations and diagnostic thresholds, ranging from approximately 8.4% to 51.5% (Fig. 1) [2]. This wide range reflects both genuine population differences and inconsistent case definitions across studies, underscoring the importance of a standardized clinical measurement (overbite as a percentage of mandibular incisor crown height) when diagnosing and reporting deep bite.

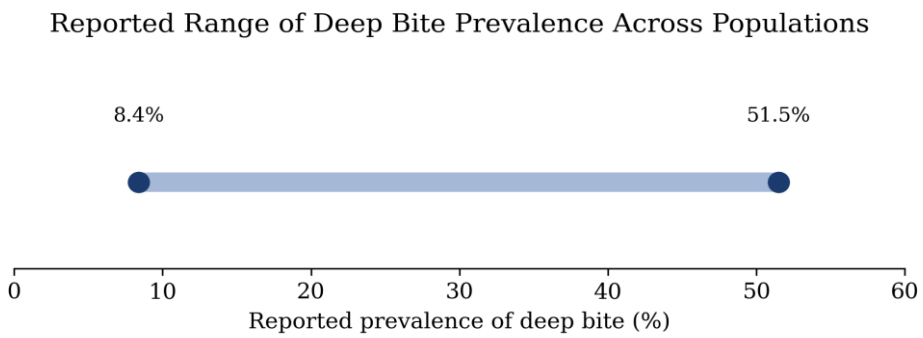

Fig. 1. Reported range of deep bite prevalence across populations and diagnostic thresholds. Data from Watted et al. [2].

III. ETIOLOGY AND PATHOGENESIS

A deep bite may result from inherent factors-tooth morphology, skeletal growth pattern, and condylar growth direction-or from acquired factors such as loss of posterior occlusal support, parafunctional habits, or abnormal tongue posture [2]. Because deep bite is a clinical sign rather than a single disease entity, successful treatment planning depends on first identifying which of these underlying mechanisms, alone or in combination, is responsible in a given patient. Skeletal deep bite is closely linked to the direction of mandibular growth rotation: classic longitudinal implant studies of facial growth demonstrated that a forward (counterclockwise) pattern of mandibular rotation during growth, in which posterior facial height increases relative to anterior facial height, is associated with a hypodivergent growth pattern and a tendency toward reduced lower anterior facial height and increased overbite, whereas a backward (clockwise) rotation pattern is associated with the opposite, open-bite tendency [3]. Beyond these classic growth-pattern observations, contemporary research combining human clinical data with animal models has identified a heritable, genetic and epigenetic component to deep bite malocclusion, indicating that variation in genes and signaling pathways governing jaw growth, tooth eruption, and dentoalveolar development contributes to the expression of the deep bite phenotype alongside environmental and functional factors [2].

IV. CLINICAL AND FUNCTIONAL CONSEQUENCES

An uncorrected or traumatic deep bite can produce measurable soft-tissue and joint-related morbidity. When the mandibular incisor edges contact the palatal gingiva of the maxillary incisors (or the maxillary incisors traumatize the labial gingiva of the mandibular incisors), the resulting mechanical trauma can produce localized gingival recession and loss of clinical attachment; a clinical study of adults with traumatic deep bites found that orthodontic correction of the deep bite, including removal of the traumatic contact and intrusion of the affected incisors, produced significant reductions in both clinical crown length and recession depth at the traumatized sites, indicating that at least part of this soft-tissue damage is reversible once the traumatic occlusal contact is eliminated [4]. A deep bite with minimal horizontal overlap has also been specifically linked to temporomandibular disorders: a controlled clinical study comparing patients with increased vertical overlap and minimal horizontal overlap to a control group without anterior tooth contact found a significantly higher frequency of temporomandibular disorder signs, myofascial pain, and psychological/somatic symptom scores in the deep bite group, suggesting that this particular occlusal pattern may act as a contributing factor in some patients' temporomandibular symptoms [5]. Beyond these documented periodontal and temporomandibular associations, a pronounced deep bite can also compromise incisor esthetics, accelerate incisal wear through concentrated anterior occlusal contact, and, in patients with reduced lower anterior facial height, contribute to an aged or over-closed facial appearance-consequences that, together with the periodontal and joint findings above, form part of the functional rationale for treating a clinically significant deep bite rather than regarding it as a purely cosmetic dental finding.

V. DIAGNOSIS AND CLASSIFICATION

Diagnosis begins with distinguishing dental/dentoalveolar deep bite, in which the overbite results from overerupted incisors or undererupted posterior teeth in the presence of a normal skeletal pattern, from skeletal deep bite, in which a hypodivergent growth pattern and reduced lower anterior facial height are the primary cause [1,2]. A further useful distinction is between true (complete) deep bite, in which the mandibular incisors contact the palatal soft tissue or the maxillary incisor cingulum, and incomplete (pseudo) deep bite, in which full contact is not present. Cephalometric evaluation of the mandibular plane angle, lower anterior facial height, and the curve of Spee, together with clinical assessment of incisor display and posterior occlusal support, allows the clinician to determine whether extrusive mechanics (favored in patients with reduced lower facial height and a hypodivergent pattern) or intrusive mechanics (favored in patients with excessive incisor or gingival display and a normal-to-increased lower facial height) are more appropriate [13].

VI. DEEP BITE CORRECTION IN THE GROWING PATIENT

In growing patients, posterior dentoalveolar extrusion is generally the preferred mechanism for deep bite correction, since it is well tolerated as long as the physiologic freeway space is not violated and can take advantage of ongoing vertical alveolar development [13]. Anterior bite planes and bite turbos-available as removable appliances, fixed acrylic or composite bite planes, or bonded bite turbos-create a posterior occlusal disengagement that allows the posterior teeth to erupt while the incisors are held out of occlusion. A systematic review focused specifically on growing patients found that a flat fixed acrylic bite plane achieved deep bite correction in a shorter treatment time than an inclined fixed acrylic bite plane or a utility arch combined with posterior intermaxillary elastics, although the review noted that the evidence base for growing patients remains limited to a small number of comparative studies [8]. When a deep bite occurs together with a Class II skeletal discrepancy, as in Class II Division 2 malocclusion, fixed functional appliances can be used to simultaneously advance the mandible and open the bite; a long-term case report of Forsus fatigue-resistance device treatment for Class II Division 2 malocclusion with severe deep bite demonstrated stable skeletal and dental correction maintained at 5-year follow-up [9].

VII. BIOMECHANICAL PRINCIPLES AND CORRECTION IN ADOLESCENTS AND ADULTS

A. Curve of Spee Leveling with Continuous Archwires

In nonextraction patients with a moderate curve of Spee (2 to 4 mm), leveling with a continuous archwire, often incorporating a reverse curve, is a widely used and effective technique. A long-term cephalometric study following patients from an initial mean curve of Spee of 2.47 mm to a posttreatment mean of 0.19 mm (a 72.97% reduction) found that most of this leveling was accomplished through extrusion of the premolars, with a comparatively smaller contribution from incisor intrusion (Fig. 3) [7]. This mechanism has direct clinical implications: because continuous archwire leveling relies substantially on posterior extrusion, it is best suited to patients with a hypodivergent or normal vertical pattern and adequate freeway space, and less suited to patients in whom further posterior extrusion or an increase in lower anterior facial height would be undesirable.

B. Segmented and TAD-Supported Incisor Intrusion

When true incisor intrusion is the treatment goal-typically in patients with excessive incisor or gingival display or an already increased lower facial height-segmented intrusion mechanics, such as the Burstone-style utility or intrusion arch, apply a controlled intrusive force directly to the incisor segment through a cantilever design, a principle first described in Burstone's classic biomechanical analysis of deep overbite correction by intrusion [6]. Temporary anchorage devices (TADs) have since been introduced to provide skeletal anchorage for incisor intrusion, avoiding the reciprocal extrusion of posterior anchor teeth that can accompany tooth-borne intrusion mechanics. A systematic review and meta-analysis of TAD-supported anterior intrusion found that miniscrews produced a greater reduction in overbite (mean difference, approximately 0.45 mm) and greater true incisor intrusion (mean difference, approximately 0.62 mm) than other intrusion methods, while producing approximately 0.4 mm less undesired molar extrusion (Fig. 2) [12]. A separate systematic review focused specifically on adult patients similarly found that TADs achieved 0.78 mm more upper incisor intrusion than conventional segmented arches, a statistically significant but modest difference [11]. The most recent systematic review and meta-analysis in this area, which pooled randomized controlled trials comparing miniscrew-supported intrusion with the Connecticut intrusion arch, utility arch, and J-hook headgear, confirmed that miniscrew-supported intrusion produced statistically greater overbite reduction and incisor intrusion than these conventional methods, but concluded that the differences were frequently below the threshold of clinical significance and that the certainty of evidence remained low to moderate (Fig. 4) [13].

C. Clear Aligner Therapy

Clear aligner therapy has become an increasingly common approach to deep bite correction. A retrospective study directly comparing curve of Spee leveling achieved with continuous archwire fixed appliances and with the Invisalign clear aligner system found that both approaches effectively leveled the curve of Spee, but through different mechanisms: continuous archwire treatment achieved leveling mainly through extrusion of the molars and flaring of the incisors, whereas the clear aligner system achieved leveling predominantly through intrusion of the anterior teeth, with good control of incisor inclination during that intrusion [10]. This mechanistic difference is clinically relevant when selecting a modality for patients in whom incisor intrusion, rather than posterior extrusion, is the preferred approach.

VIII. COMBINED ORTHODONTIC-SURGICAL TREATMENT FOR SEVERE SKELETAL DEEP BITE

When a deep bite has a severe skeletal component-most often a markedly reduced lower anterior facial height with vertical maxillary or mandibular dentoalveolar excess-that is beyond the scope of orthodontic camouflage, combined orthodontic-surgical treatment is indicated. Anterior segmental osteotomy, used to reposition the anterior dentoalveolar segment of the maxilla or mandible, was described in a classic combined orthodontic-surgical approach to Class II deep bite correction that established the principles still used for these severe cases: presurgical orthodontic alignment and decompensation, surgical repositioning of the affected

segment(s), and postsurgical orthodontic finishing [14]. Such surgical approaches remain reserved for adult patients in whom growth is complete and the magnitude of the skeletal discrepancy exceeds what dentoalveolar compensation can reasonably achieve.

IX. STABILITY AND LONG-TERM RELAPSE

A systematic review of 26 studies examining deep bite correction from the initial, posttreatment, and long-term posttreatment time points found that the mean overbite improved from 5.3 mm before treatment to 2.6 mm immediately after treatment, but that some relapse occurred over time, with the mean long-term overbite settling at 3.4 mm (Fig. 5) [15]. This review also found that greater initial severity of the deep bite was associated with reduced long-term stability, although this relationship was difficult to isolate from other contributing factors, and that the duration of posttreatment follow-up itself did not appear to influence the amount of relapse observed [15]. These findings indicate that, while deep bite correction is generally successful and largely maintained over the long term, some degree of relapse toward the original overbite should be anticipated and discussed with patients, reinforcing the importance of adequate anterior retention regardless of the specific mechanism used to achieve the initial correction.

X. COMPARATIVE SUMMARY AND DECISION FRAMEWORK

Table 1 summarizes the treatment modalities discussed in this review according to their typical indication and primary mechanism of correction, and Figure 6 presents a simplified decision framework integrating growth status, etiology, and severity to guide modality selection in practice.

TABLE 1

Summary of Treatment Modalities for Deep Bite Malocclusion

Treatment modality	Typical indication	Primary mechanism of correction	Key references
Anterior bite planes/turbos (growing patients)	Growing patients; short-to-normal lower facial height; excessive curve of Spee	Creates posterior occlusal disengagement, permitting posterior eruption/extrusion while incisors are held	[8,13]
Functional appliances (Class II Division 2 with deep bite)	Growing patients with a Class II skeletal component and deep bite	Combines mandibular postural advancement with a bite plane effect to open the bite	[9]
Curve of Spee leveling with continuous archwires	Adolescents/adults; nonextraction cases with a 2-4 mm curve of Spee	Levels the arch mainly through premolar/molar extrusion, with lesser incisor intrusion and flaring	[7]
Segmented/intrusion arches (Burstone, Connecticut intrusion arch)	Adults; long lower facial height; excessive incisor/gingival display	Applies a controlled intrusive force directly to incisors via a cantilever/segmented mechanism	[6,13]
TAD/miniscrew-supported incisor intrusion	Adults; cases requiring true incisor intrusion with minimal posterior side effects	Skeletally anchored intrusive force on the incisor segment, avoiding reciprocal molar extrusion	[11,12,13]
Clear aligner therapy	Adolescents/adults; esthetic preference; mild-to-moderate deep bite	Levels the curve of Spee predominantly through anterior intrusion with programmed incisor inclination control	[10]
Combined orthodontic-surgical treatment (e.g., anterior segmental osteotomy)	Nongrowing adults with severe skeletal deep bite beyond orthodontic correction	Direct surgical repositioning of the dentoalveolar segment(s) or jaw base	[14]

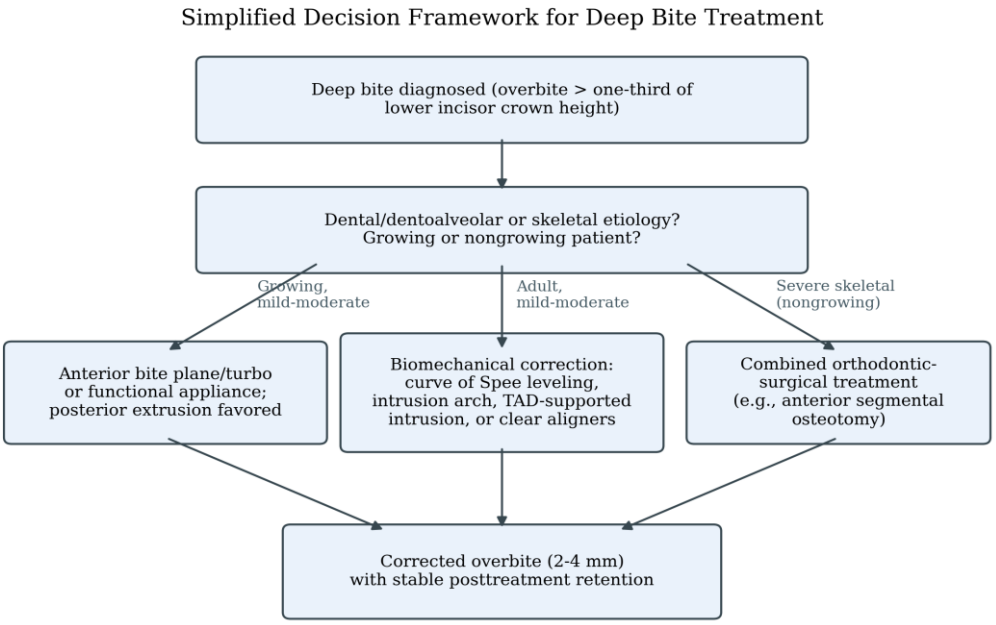

Fig. 2. Simplified decision framework for deep bite treatment, integrating dentoalveolar versus skeletal etiology, growth status, and severity to guide selection among posterior extrusion, incisor intrusion, and orthognathic surgical approaches.

As Table 1 and Figure 6 illustrate, treatment selection for deep bite follows a similar logic to other vertical and sagittal discrepancies: growing patients with adequate freeway space are generally managed with extrusive mechanics that harness ongoing eruption, adolescents and adults with a largely dentoalveolar discrepancy are managed with biomechanical correction selected according to whether extrusion or intrusion is preferred, and adults with a severe, growth-independent skeletal component require combined orthodontic-surgical treatment. Within the biomechanical correction category, the choice among continuous archwire leveling, segmented or TAD-supported intrusion arches, and clear aligner therapy should be guided primarily by the patient's vertical facial pattern and the degree of incisor or gingival display, since these approaches achieve overbite correction through meaningfully different combinations of posterior extrusion and incisor intrusion.

XI. CONCLUSION

Deep bite malocclusion encompasses a heterogeneous group of dentoalveolar and skeletal presentations, and its correction can be achieved through growth-phase bite planes and functional appliances, a range of adult biomechanical techniques spanning continuous archwire leveling to TAD-supported intrusion and clear aligner therapy, and, in severe skeletal cases, combined orthodontic-surgical treatment. Selecting among these approaches requires careful attention to the patient's growth status, vertical facial pattern, and the balance of posterior extrusion versus incisor intrusion needed to correct the overbite, informed by the cephalometric and biomechanical principles reviewed here. Because meta-analytic evidence increasingly shows that differences among contemporary intrusion techniques are often statistically significant but clinically modest, and because a degree of long-term relapse is common across all correction methods, continued attention to retention protocols remains as important as the choice of initial correction technique.

CONFLICT OF INTEREST

The authors declare no conflict of interest related to this review.

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