Australian Society of Orthodontists

THE UNIVERSITY OF SYDNEY

MANAGEMENT OF ANTERIOR OPEN BITE CASES

Creating Brighter Futures

EDITION 4 2023

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Anterior open bite (AOB) is characterised by a lack of overlap of the upper and lower incisors in centric relation. It can range from mild 'edge-to-edge' contact to a more severe skeletal problem where only the molars touch (Figure 1).

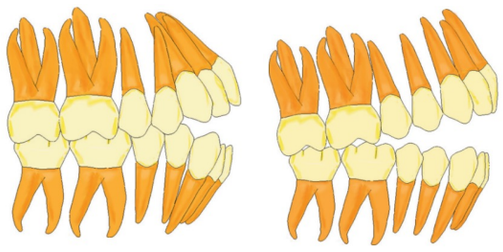

Figure 1. Moderate (left) and severe (right) AOB malocclusion[36]

Incidence

AOB is more common in children than adults, especially in the mixed dentition partly due to partially erupted teeth and sucking habits, with a prevalence of 17.7%.[1,2] A 2021 study found AOB in 24.1% of 7 to 12-year-old Australian children.[3] There is also a racial predisposition with 16.3% of African Americans and only 3.5% of Caucasian Americans with an openbite.[4] In the U.K, the overall incidence in adults is 4%.[5]

Aetiology

The aetiology of AOB is multifactorial, with genetic and environmental causes contributing to the skeletal, dental and soft tissue environment which can create and maintain an open bite.

Some of the common environmental aetiologies for AOB are:

a) Sucking habits

b) Trauma/pathology – condylar fracture, juvenile rheumatoid arthritis, idiopathic condylar resorption

c) Local dental factors (transitional during incisor eruption)

d) Soft tissue – lip pattern

e) Abnormal tongue posture/size/activity & swallowing pattern

f) Nasorespiratory function and head posture

g) Weak masticatory muscular tone

h) Iatrogenic (due to poorly controlled orthodontic forces)

i) Neurological – e.g. cerebral palsy & muscular dystrophy

Classification

There are different classification systems for AOB, including nomenclatures based on severity[6] and site (anterior or lateral). The most important distinction to make is whether the AOB is skeletal or dentoalveolar. Skeletal open bite occurs with abnormal skeletal patterns, particularly mandibular morphology, while dental open bite affects only the teeth.[7] There are key clinical and radiographic signs that suggest an open bite is skeletal or dentoalveolar, or a combination. (Table 1).

Table 1

DENTOALVEOLAR OPEN BITE	SKELETAL OPEN BITE
Normal facial thirds (Figure 3)	Increased lower facial third - distance from the base of the nose to the chin. (Figure 2)
Normal facial appearance	'Long face' appearance often with retruded chin
Only a few anterior teeth not in contact	Many posterior teeth not in contact
Normal mandibular plane angle	Steep mandibular plane angle
Asymmetrical AOB (if due to a sucking habit)	Often increased upper incisor display at rest
More common in younger patients	More apparent in older patients
If present, milder constriction of the maxilla is typically seen	Usually more severely narrow maxilla with posterior crossbite
Less likely to have gingival inflammation	Gingival hypertrophy more common due to mouth breathing and lip incompetence
Cephalometric measurements closer to normal see the 2023-3 issue of Brighter Futures which reviewed cephalometric analysis.	Cephalometric measurements, such as divergent Sassouni planes, deviate more from the norm

Figure 2. Skeletal open bite patient (with TADs in place in preparation for molar intrusion)

Figure 3. Dentoalveolar open bite patient

Why should we treat an AOB?

AOB can adversely impact several areas:

1. Function: patients may have difficulties incising food due to the lack of anterior contact, and masticating food when only second molars are in occlusion. Swallowing pattern can be compromised with difficulty closing lips.
2. Speech: there is a higher prevalence of speech distortion like lisping, and increasing severity of AOB is linked to distortion of consonant sounds.[8]
3. Facial and dental aesthetics: treating AOB can improve the Oral-Health Related Quality of Life in adolescents and adults, as well as in children aged 8-10 years old.[9]
4. Increased incidence of TMD.[10]

Treatment options

When treatment planning for the correction of an AOB, the environmental aetiologies should be identified and addressed where possible. The management of dentoalveolar open bite is usually more straightforward than for skeletal open bite.

A. Dentoalveolar Open Bite Management:

1. No treatment

In the early mixed dentition, when no skeletal abnormalities or habits are present, the AOB will spontaneously correct in 75% of patients as they transition from pre-puberty to young adulthood.[10]

2. Habit cessation

The severity of AOB from sucking habits depends on the patient's age, frequency, duration and intensity of the habit. Persistent habits of more than 6 hours per day can be associated with a significant malocclusion. Cessation of a sucking habit can lead to spontaneous partial or complete correction of AOB when stopped before about 9 years of age.[11] This often occurs within about 6 months of habit cessation. For more details see Brighter Futures 2022-2

3. Management of mouth breathing

Adenoidectomy and/or tonsillectomy should not be performed purely as a treatment for AOB. Surgical removal of adenoids and tonsils to normalise mouth breathing might be undertaken for other reasons such as obstructive sleep apnoea, but it does not correct AOB in children.[14] In any case, appropriate referral to a sleep physician and otolaryngologist is recommended.

4. Orofacial myofunctional therapy

Orofacial myofunctional therapy (OMT) aims to correct abnormal swallowing patterns and resting posture of the tongue and lips. This usually involves exercises where small items are held in certain positions as well as lip-sealing exercises. When combined with orthodontic treatment OMT 'might' be beneficial in helping to close and maintain open bite correction, when compared to orthodontic treatment alone.[15] However, the effectiveness of OMT has traditionally been shown to be limited.

5. Active orthodontic mechanotherapy

Fixed appliances are commonly used to extrude incisors to close the open bite and improve incisor aesthetics.

B. Skeletal Open Bite Management:

1. Growth modification

Skeletal open bite (hyperdivergent growth pattern) is usually established before the eruption of the permanent dentition.[2] In a growing child, growth modification techniques aim to control posterior vertical growth of the maxilla, redirecting mandibular growth anteriorly instead of vertically. Posterior bite blocks, opening the bite by 3-4mm, reduce posterior eruption and encourage anterior eruption to close the open bite.[16] Repelling magnets have also been incorporated into bite blocks.[17] Children with a skeletal open bite and retruded mandibles can be treated with modified functional appliances, like Twin-Blocks with thick acrylic coverage of lower posterior teeth to prevent their eruption. Vertical pull chin cup and high pull headgear were historically popular and are still sometimes combined with functional appliance treatment. However, functional appliances produce mainly dentoalveolar changes with limited skeletal changes.

2. Full fixed appliances

The three main ways orthodontic fixed appliances resolve AOB is with posterior tooth intrusion, anterior tooth extrusion, and distal tipping of the entire arch.

Treatment modes which extrude posterior teeth, like prolonged elastic use and bonding upper second molars, should be minimised. Posterior extractions are favoured in open bite patients because of the "wedge effect", where forward movement of posterior teeth leads to a closing rotation of the mandible.[18] Anterior vertical elastics are not usually indicated in skeletal open bite, because the incisors are often already over erupted and more extrusion is often unstable and unaesthetic. However, they can be useful at the end of fixed appliance treatment to 'settle' an AOB.[19] Molar teeth are usually mesially tipped in skeletal open bite patients.

Multi-loop arch wires can be used to intrude and distally tip the molars, closing the open bite.[20]

3. Clear aligner therapy

Clear aligner therapy (CAT) is increasingly viewed as an effective strategy for treatment of mild to moderate AOB. CAT facilitates molar intrusion with the posterior coverage, when compared to archwires which tend to extrude posterior teeth. The presence of plastic is thought to have a role in reducing an adaptive tongue thrust, if present.[21] However, a recent retrospective study has called into doubt whether CAT has any effects beyond incisor extrusion.[22] Attachments bonded to anterior teeth can help overcome difficulties with extrusion, while 'ghost attachments', or raised areas of plastic on the occlusal surface of posterior teeth, are included to improve molar intrusion. Care should be taken to avoid excessive incisor extrusion in patients who already have normal or increased incisal display, as too much extrusion can make these patients look more 'gummy'.

4. Skeletal anchorage supported intrusion

Posterior intrusion helped by temporary anchorage devices (TADs) or skeletal plates has developed as a camouflage technique for skeletal AOB and is a viable alternative to orthognathic surgery in some cases (Figure 2). It works on the principle of forward rotation of the mandible following intrusion of the posterior teeth as in Figure 4.
Depending on the position of the TAD or skeletal plate, between 3-5mm of maxillary and mandibular molar intrusion can be accomplished.[23,24,25] Each millimetre of molar intrusion produces approximately 2mm reduction of the open bite.[26,27]

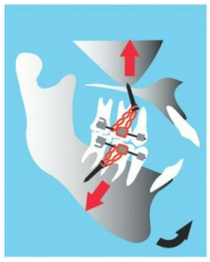

Figure 4. Molar intrusion with TADs resulting in forward mandibular autorotation

5. Orthognathic Surgery

Orthognathic surgery was the gold-standard treatment for skeletal open bites in adults prior to the development of molar intrusion supported by TADs and skeletal plates. Skeletal open bites greater than 5mm should be treated surgically.[28] Surgery usually involves Le Fort I osteotomy with posterior impaction plus or minus mandibular surgery.[29]

Maxillary impaction also allows for forward rotation of the mandible and can be combined with other surgeries when there are problems in the sagittal and transverse planes.

Stability & Retention

Skeletal open bite correction is more unstable than dentoalveolar AOB correction. Unfavourable growth patterns, habit resumption and inappropriate orthodontic movements, like anterior extrusion of incisors, as well as soft tissue factors like tongue size, posture and breathing mode can all contribute to relapse.[30]

A 10-year follow-up study of adolescent patients found that 35% of patients had relapse of 3mm or more.[31] Long-term stability seems to be better for AOB treated with extractions compared to non-extraction.[32] A 2011 meta-analysis found that a positive overbite was maintained for both surgical and non-surgical methods (without skeletal anchorage) in over 75% of patients.[33] For TAD-supported intrusion of molars, maxillary first molars relapsed by 0.5-1.5mm one year post-retention.[34] Three-years post-retention, overbite can relapse by 18% but this mostly occurs in the first year post-treatment.[35] While molar re-eruption might increase facial height, the compensatory eruption of the incisors often maintains the overbite.

Enhanced retention methods for AOB include prolonged used of fixed retention (particularly during growth), retainers with passive posterior occlusal coverage and/or bite blocks, continued use of a functional appliance, incorporating tongue cribs and spurs into the retainer and myofunctional exercises.

Conclusion

Open bite can be a challenging malocclusion to manage, and the results are often unstable. An awareness of the various treatment modalities, as well as their potential for unwanted iatrogenic side-effects, is necessary. Above all, appropriate diagnosis and treatment planning are key in the management of this multifactorial malocclusion.

References available upon request

Past issues of Brighter Futures can be accessed at: www.aso.org.au/resources/brighter-futures-newsletters

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Brighter Futures is published by the Australian Society of Orthodontists (NSW Branch) Inc. in conjunction with the Orthodontic Discipline at the University of Sydney.

The newsletter is intended to help keep the dental profession updated about contemporary orthodontics, and also to help foster co-operation within the dental team.

Without the generous support of Henry Schein, who are an integral part of the dental team, this publication would not be possible.

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