

Tongue Posture in Anterior Open Bite Malocclusion - A Critical Review and Therapeutic Prospects of Device of Own Design

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Abstract

Muscle homeostasis plays a pivotal role in the development and maintenance of appropriate scheme of stomatognathic system. Forces exerted by the tongue, lips and cheeks influence occlusion and lack of muscle balance leads to development and consolidation of malocclusion. Tongue dysfunction in the form of altered tongue rest position and tongue tip protrusion during swallowing, go along with anterior open bite malocclusion in majority of cases. Neurophysiological basis of appliance therapy to correct forward tongue rest posture in open bite involves form-function concept. Stimulation or restrain facilitated by tongue appliance establishes new function which in turn results in changed rest posture of tongue, leading to alteration of form by allowing dental compensations to

take place. The aim of this review is to critically relate treatment choices to the resting posture of the tongue and to analyze various issues pertaining to treatment alternatives. Possibility of vertical elevation of tongue in cases with low resting posture; by stimulating posterior part of tongue, is also touched upon.

Keywords: Open bite, Resting tongue posture, Crib appliance, Dental spur, Tongue beads

Introduction

Malocclusions having multifactorial etiology such as anterior open bite (AOB) are often associated with orofacial dysfunctions.¹ Very often researchers have paid attention to the tongue and tongue habits as possible etiologic factors of AOB. Proffit et al ² measured force level of the tongue against the upper incisors and palate

during rest and normal swallowing. They found that the resting posture of the tongue holds more significance than the swallowing position in determining dental arch form. From equilibrium theory³, it could be stated that forward resting posture of the tongue with its light and sustained pressure against the teeth would be expected to affect vertical and horizontal positioning of teeth. On the other hand forward tongue thrust during swallowing is of too short duration to have an impact on tooth position. Thereby tongue tip protrusion during swallowing might be regarded as result of pre-existing morphological aberrations, thus as an outcome and not as a cause of AOB.⁴ Proffit⁵ contemplated this tongue thrusting as a physiologic adaptations in presence of openbite to form an anterior seal, thereby preventing food and liquid from escaping while swallowing. Supported by the research carried out by Huang;⁶ Justus⁷ concluded that anterior tongue rest posture is a frequent risk factor for anterior open bite and reasoned that, failure of tongue posture adaptation following orthodontic and/or surgical treatment might be responsible for relapse of AOB. Therefore it is no-brainer that successful management of anterior open bite malocclusion revolves around recognition and modification of forward resting posture of tongue.

Different Resting Postures of Tongue:

Normal position of tongue at rest is one in which the tip of the tongue rests on the incisive papilla and its rear lies along the palate, maintaining anterior occlusion and transverse dimension of upper arch (Fig 1).³ However AOB presents positional changes in both maxillary and mandibular incisors at different combinations based on various postures of the tongue at rest. Different resting positions of tongue are suggested as high, horizontal, low and very low (Fig 2).⁸

A high posture of the tongue is associated with protruded upper incisors that are positioned above the occlusal

plane. A single occlusal plane is usual feature as leveling of mandibular arch remains relatively unaffected. Posterior crossbites are absent as back of the tongue rests on the palate, thereby maintaining upper arch width. In the horizontal posture, tongue appears lower than in the high position, resting on the palatal surfaces of upper incisors and on the incisal edges of lower incisors. Protrusion of maxillary incisors are more pronounced and interposed tongue by preventing incisor eruption cause AOB. Increased overjet is also noted. Transverse changes may occur as tongue positions itself lower and moves its posterior part away from the palate. As the tongue assumes more lower position, pressure begins to be exerted on lower incisors. In the low posture, tongue rests on lingual surface of crown of the lower incisors. Consequently tongue protrudes these teeth and inhibits their eruption, thereby positioning lower incisors below the occlusal plane. As result moderate openbite with reduced overjet associated with posterior crossbite become salient features. A very low tongue posture happens when tongue rests below the crowns of the lower incisors in the lingual region of mandibular alveolar ridge. Open bite becomes more severe as direction of tongue pressure produces retroclination of lower incisors and prevents their eruption. Posterior crossbite along with an expanded lower arch are prominent aspects as tongue spread across the floor of the mouth.

Treatment Options Based on Tongue Posture at Rest

Traditionally tongue dysfunction is usually dealt with either by tongue restrictor appliances such as tongue cribs, spur and rakes;^{9,10} and/or tongue stimulator appliances namely blue grass appliances¹¹ and tongue practice beads. Myofunctional therapy consisting of a set of exercises to modify tongue behaviour, is another way to harmonize orofacial functions.⁴ Restrictors present mechanical barrier and act as obstacle to the continuity of the incorrect

function that may or already has changed the occlusion. Whereas stimulators are intended to resolve an altered function by re-educating the faulty neuromuscular impulses in a stable manner.¹² Bondable lingual tongue spur therapy is also effective in increasing overbite in subjects who solely have anterior tongue posture problems.¹³ Lingual orthodontic appliance therapy similarly contributes to improve tongue posture: firstly by virtue of its spur effects, and secondly, due to the tongue exercises, by using the lingual brackets as a guide for the tongue.¹⁴

Identifying particular posture of the tongue at rest by analysing morphological features of malocclusion, acts as usher in choosing the treatment capable of bringing the tongue back to its correct resting posture, thus alleviating the causative factor of the malocclusion. High and horizontal tongue postures are close to normal posture that call for control in the horizontal direction only. Restrictors such as crib aims to achieve this tongue retraction and compel it to assume its correct posture at rest. However in the low and very low tongue postures, the tongue is not only protruded but also lies below its correct position and needs retraction and elevation as well. This process is difficult to learn and automate,¹⁵ necessitating training devices like spurs or tongue stimulators that foster vertical lift of the tongue. This type of treatment could also be referred to as orienting treatment.⁸

Potential Issues Related to Treatment Options

Conventional wisdom suggests that voluntary activities such as swallowing and speech are easier to rectify using myofunctional exercises, on the contrary, tongue posture is not constantly monitored; it is subconscious and not amenable to easy modification by volition.^{7,16} Therefore, many authors are in favour of appliance therapy instead of exercises to modify tongue posture. However, as shown by cinefluoroscopic method,¹⁷ deliberate placement of

tongue on smoothly structured crib may impede functional reeducation of tongue; leading to AOB relapse as tongue returns to its previous position following treatment. Moreover, Haryett¹⁸ reported that some patients who used smooth cribs were able to continue to thrust the tongue below the crib in order to create a seal during swallowing. Geron et al¹⁴ reported that adults treated with lingual appliances showed higher stability than the results presented in the literature for surgical correction of AOB or conventional orthodontics with temporary anchorage devices and lower stability than the results presented for the crib appliance. On the other hand, despite being effective, treatment using sharp spurs sometimes deemed as punitive.¹⁹ Even though there are no reports of pain or injury to the tongue,⁷ Haryett et al²⁰ linked psychological disorder with use of habit breaking appliances that incorporate spurs. Contrarily, although well tolerated by patients, tongue stimulators like blue grass appliances and tongue practice beads require great patients engagement to be clinically efficacious.²¹ In patients where compliance with tongue exercise regimen is suboptimal; the tongue may still be placed between the teeth, thereby missing the stimulant effect of the anteriorly placed practice bead altogether.

Therapeutic Potential of Restrain-cum-Retrain Approach

Habit correcting appliances integrating palatal crib and tongue bead, such as Hybrid Habit Correcting Appliance (HHCA) has been reported in the literature. It incorporates palatal crib, a tongue bead next to the incisive papilla and a U loop which is attached to the molar band on either sides.²²

To address low tongue posture problem, an attempt has been made by present author to modify existing tongue habit breaking appliances by incorporating a spinnable acrylic bead posteriorly, instead of placing it in rugae

area. Therapeutic fundamental is based upon tongue curiosity; the tongue while always remain in contact with the acrylic bead will gradually assume a more posterior and superior position with minimum patient engagement.

Appliance Description

Detailed impression of the upper arch was taken and poured with dental stone for fabrication of working cast. Tailor-made metal bands were then placed on first permanent molars and a stainless steel wire of 0.9 mm width was adapted along the neck of molars and premolars. Stretching from one canine to the opposing one, wire forms a crib containing 5-6 bends of height around 15-25 mm and ran up to 15 mm posterior to the upper incisors. It should be constructed in such a way as to not interfere with occlusion and to not cause any impingement on mucosa. Additionally a transpalatal arch (TPA) incorporating omega loop in the center was made with 0.9 mm diameter stainless steel wire. Assembly of metal crib and TPA were then soldered to the molar bands to form a composite appliance. Thereafter small amount of cold cure acrylic was molded around the omega and cured to form a movable acrylic sphere. Utility of this composite habit breaking appliances (CHBA) (Fig 3) has been illustrated in the following case report.

Case Report

We present a case of 34 year old female complaining of low self esteem due to unaesthetic spacing among upper and lower anterior teeth. On clinical examination she was diagnosed with simple tongue thrust habit that led to generalized spacing in the upper and lower dental segment and a Class I dental open bite malocclusion with a symmetric 3mm open bite extending from lateral incisor to incisor (Fig 4a-c). The main objective of the treatment was to eliminate the aetiology which in this case was the forward low tongue rest posture. The other treatment objectives were to improve the profile, smile aesthetics

and to achieve normal overjet, overbite along with securing an ideal inter-incisal relationship. The treatment plan included retraction of upper and lower incisors with fixed mechanotherapy and placement of composite habit breaking appliance to mitigate tongue habit in the first phase (Fig 4d-e), followed by keeping the same device as retention appliance in the second phase. The transpalatal part of the assembly was placed 4-5 mm away from the palate to avoid any extrusive component acting on molars which could worsen the profile. After 8 month of treatment case was debonded but the habit breaker was kept retained in the mouth for another six month (Fig 4f-g). Two years post treatment photograph showing preservation of pleasing upper lip-smile line and a positive incisor overbite (Fig 4h-i). The stability is probably due to establishment of normal tongue rest posture.

Conclusion

Clinical studies of AOB are generally case-control experimental models with small samples and absence of control groups render the informations about this malocclusion inconclusive. Present review reiterated significance of anterior tongue posture in overall management strategy of open bite malocclusion. Determining type of resting posture of tongue and it's targeted addressal while planing mechanotherapy, is of paramount importance to ensure long term stability. Demand on patient's compliance with tongue exercise instructions, may be reduced by stimulating hind part of the tongue; thereby favouring effortless vertical elevation in cases associated with low tongue rest posture.

References

1. Stahl F, Grabowski R. Orthodontic findings in the deciduous and early mixed dentition- interference for a preventive strategy. *J Orofac Orthop* 2003;64:401-416

2. Proffit WR, Chastain BB, Norton LA. Lip and tongue pressure related to dental arch and oral cavity size in Australian aborigines. *Journal of Dental Research* 1975;54;1161-117
3. Proffit WR. Equilibrium theory revisited: factors influencing position of the teeth. *Angle Orthod* 1978;48(3):175-18
4. Dyck CV, Dekeyser A, Vantricht E, Manders E, Goeleven A, Fieuws S, Willems G. The effect of orofacial myofunctional treatment in children with anterior open bite and tongue dysfunction: a pilot study. *Er J Orthod* 2016;38(3):227-234
5. Proffit WR, Fields HW, Sarver DM. Contemporary orthodontics. Elsevier Health Sciences, 2014, 5th ed., 142–150
6. Huang GJ, Justus R, Kennedy DB, Kokich VG.: Stability of anterior open bite treated with crib therapy. *Angle Orthod* 1990; 60:17–26.
7. Justus R. Correction of anterior open bite with spurs: long-term stability. *World J Orthod* 2001;2(3):219-31
8. Artese A, Drummond S, Nascimento JM, Artese F. Criteria for diagnosing and treating anterior open bite with stability. *Dental Press J Orthod* 2011;16(3):136-161
9. Parker J. The interception of the open bite in the early growth period. *Angle Orthod* 1971; 41:24–44.
10. Rogers A.P. Open bite cases involving tongue habits. *Int J Orthod* 1927;13:837.
11. Haskell BS, Mink JR. An aid to stop thumbsucking: The “Bluegrass Appliance.” *Pediatric Dentistry* 1991;13(2):83-85.
12. Limbrock GJ, Hoyer H, Scheying H. Regulation therapy by Castillo-Morales in children with Down syndrome: primary and secondary orofacial pathology. *ASDC Journal of Dentistry for Children* 1990; 57(6):437–441
13. McRae, Elissa J. “Bondable Lingual Spur Therapy to Treat Anterior Open Bite” (2010). Master’s Thesis(2009-). Paper 25. http://epublications.marquette.edu/theses_open/25
14. Geron S, Wasserstein A, Geron Z. Stability of anterior open bite correction of adults treated with lingual appliances. *Er J Orthod* 2013;35(5):599-603
15. Meyer-Marcotty P, Hartmann J, Stellzig-Eisenhauer A. Dentoalveolar open bite treatment with spur appliances. *J Orofac Orthop* 2007 Nov;68(6):510-21
16. Yashiro K, Takada K. Tongue muscle activity after orthodontic treatment of anterior open bite: a case report. *Am J Orthod Dentofacial Orthop* 1999 June;115(6):660-6.
17. Long JM. A cinefluorographic study of anterior tongue-thrust. *Am J Orthod* 1963;49(11):865
18. Haryett RD, Hansen FC, Davidson PO, Sandiland ML. Chronic thumb-sucking: a second report on treatment and its psychologic effects. *Am J Orthod* 1970;57:164-78.
19. Subtelny HD, Sakuda M. Open bite: diagnosis and treatment. *Am J Orthod* 1964 May;50(5):337-5
20. Haryett RD, Hansen FC, Davidson PO, Sandiland ML. Chronic thumb-sucking: the psychologic effectiveness of various methods of treatment. *Am J Orthod* 1967;53(8):569-85
21. Osiewacz S, Jurecka M, Pawlowska E. Tongue function correction appliances. The current state of knowledge and therapeutic possibilities including a device of own design- review of literature. *Dent. Med.Probl* 2015;52(2):227-234
22. Abraham R, Kamath G, Sodhi JS, Sodhi S, Rita C, Kalyan SS. Habit breaking appliance for multiple corrections. *Case Reports in Dentistry*.2013,<http://dx.doi.org/10.1155/2013/647649>

Legends Figure

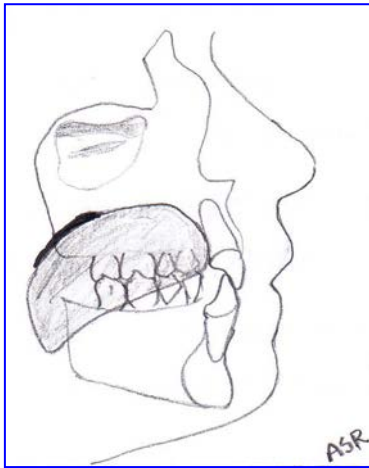


Fig.1: Normal rest posture of tongue

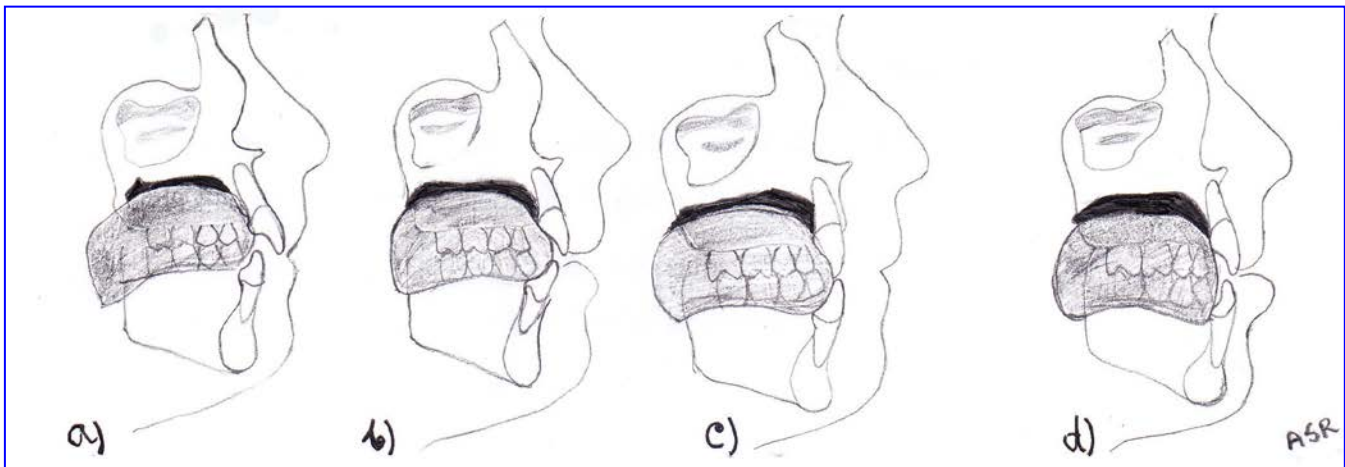


Fig. 2: Different postures of tongue at rest

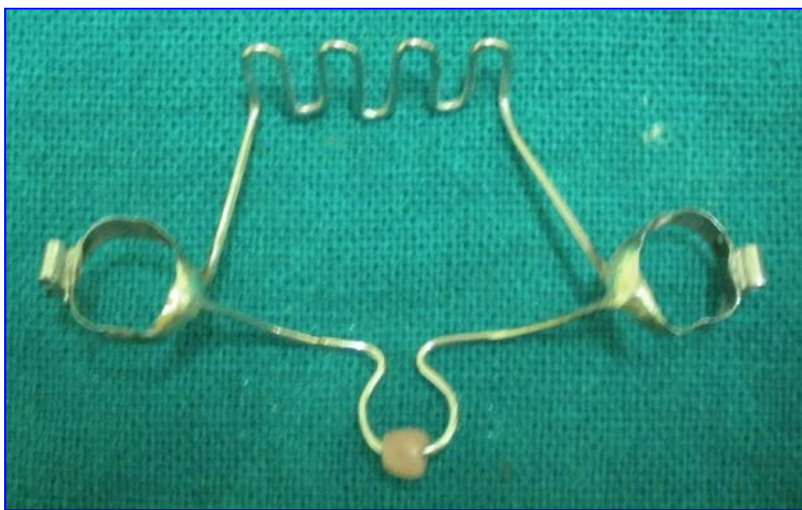


Fig. 3: Composite habit breaking appliances(CHBA) with posteriorly placed acrylic bead

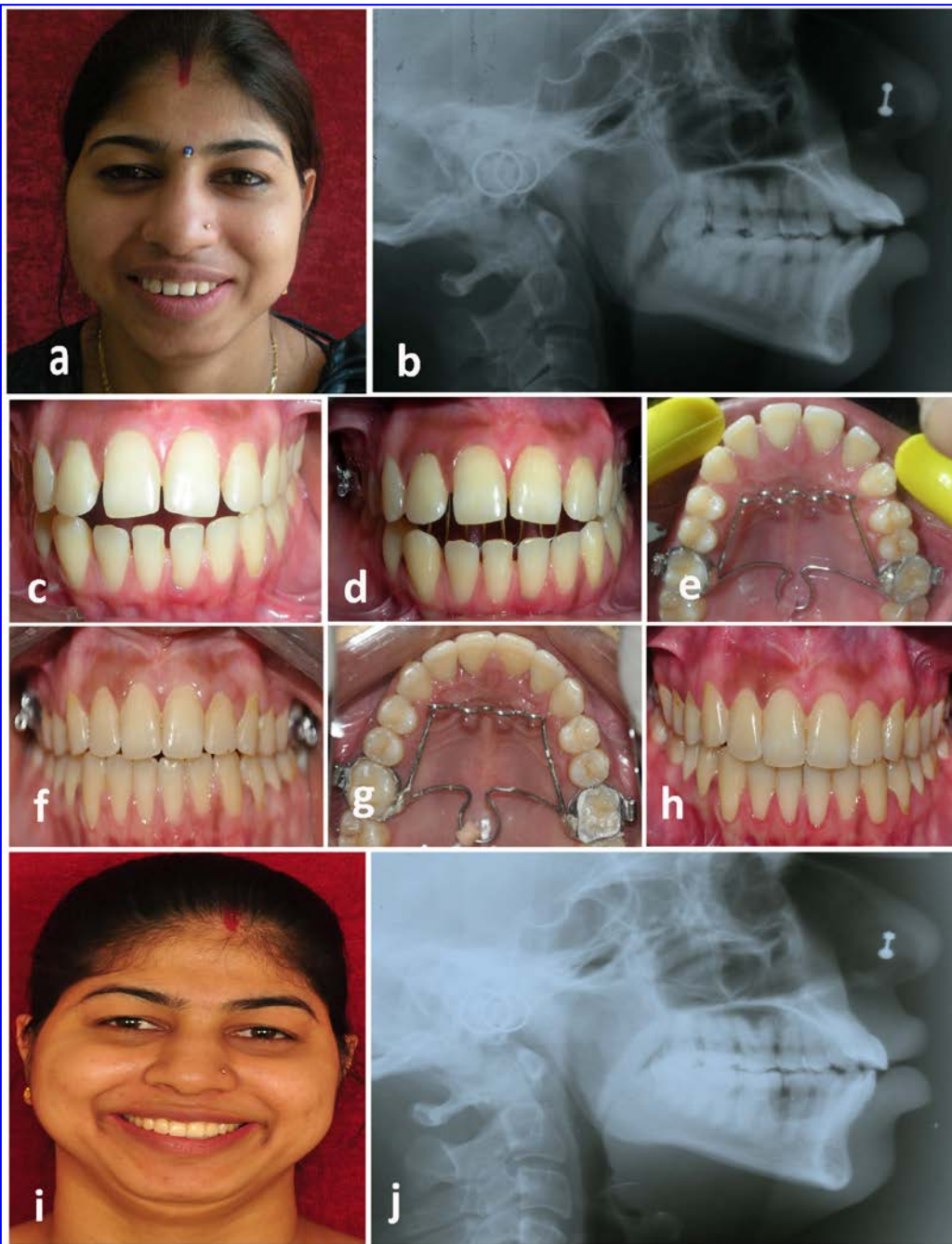


Fig.4: The patient is a woman 34 years of age. (a to c) Initial photographs and lateral cephalogram. Note the anterior open bite with dento-alveolar protrusion and low tongue posture. (d-e) Treatment started and composite habit breaking appliance in place. (f-g) Following debonding, the appliance was kept as retainer. (h-j) Two years posttreatment record. Note the stability of corrected open bite, pleasing upper lip smile line and improved resting tongue posture.