

Orthodontic Management of an Anterior Open Bite in a Nigerian Adult

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ABSTRACT

This article is a case of successful orthodontic management of an anterior open bite in a 32-year-old married woman using a full fixed orthodontic appliance (straight wire technique). Her orthodontic treatment was hinged on correcting the vertical relationship of the posterior segment by the intrusion of the posterior teeth, from the premolars to the first molar of both arches, closing all available spaces, including the midline diastema, which was used to correct overjet and overbite of the patient, restoring both aesthetic and functional properties.

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INTRODUCTION

Open bite is a condition where a space exists between incisal or occlusal surfaces of maxillary and mandibular teeth when the mandible is brought into habitual or centric occlusion. Anterior open bite is defined as the absence of vertical overlap of the incisors (Subtelny & Sakuda, 1964; Proffit & Fields, 2007). A malocclusion characterized by open bite is one of the most difficult malocclusions to treat. Onyeaso, 2004, carried out a study on a group of secondary school children in Nigeria and obtained a prevalence of 7.1%, this is slightly lower than 9.1% which was recorded by Fayemi 2002. Studies on orthodontic populations have recorded prevalence of 11.2% and 5.4% by daCosta & Utomi, 2009 and Onyeaso et al., 2002 respectively.

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The aetiology of anterior open bite is multifactorial, these include vertical growth deficiencies or excessive lower facial height, abnormalities in dental eruptions, anterior positioning of the tongue or tongue thrust and digits sucking habits. Other causes include adenoid hypertrophy leading to airway obstructions, syndromes, occlusal and eruptive forces, dental ankylosis, postural mandibular imbalance, septum problems, and enlarged tonsils (Subtelny & Sakuda, 1964; Dawson, 1989; Ngan & Fields, 1997).

The social impact of open bite include masticatory (Lufner et al., 1976) and speech problems (Laine, 1992). Facial aesthetics could be compromised as a result of open bite (El-Dawlatly et al., 2017). Williamson, 1997, reported that anterior open bite is associated with pain dysfunction symptoms. Egermark-Ericksson, et al., 1990 also reported functional malocclusion as a factor or cause of temporomandibular joint dysfunction. The authors also revealed that anterior open bite might be a potential risk factor in the development of temporomandibular joint dysfunction (Egermark-Ericksson, et al., 1990).

Anterior open bite can be classified into simple or complex open bite. The simple open bite occurs during mixed dentition stage, and usually resolves without treatment. The complex open bite extends further into the premolar and molar regions, and it does not resolve by the end of mixed dentition stage and may require orthodontic or/and surgical intervention- orthognathic surgery (Subtelny & Sakuda, 1964; Ngan & Fields, 1997). Sassouni, 1969, classified open bite into skeletal and dental open bites. Dental open bite has no significant skeletal abnormality.

The inability to bite or cut food is always the chief complaint voiced by patients with anterior open bite. Anterior open bite can be diagnosed both clinically and through radiographic investigation, (Subtelny & Sakuda, 1964; Ngan & Fields, 1997). The clinical features which can be specific of anterior open bite include, vertical space between the maxilla and the mandible, excess/increased lower facial height, lip incompetence (Ngan & Fields, 1997). It could be associated with class II malocclusion and features of mandibular deficiency, lower arch crowding, a narrow maxilla and a posterior cross bite (Ngan & Fields, 1997). Cephalometric features associated with open bite include steep palatal plane and increased percentage of lower facial height, excess eruption of the maxillary posterior teeth, downward and backward rotation of the mandible and excess eruption of the maxillary and mandibular incisors (Ngan & Fields, 1997).

The treatment protocol for open bite generally ranges from observational or simple habit control, like the use of tongue rake, tongue tamers and palatal cribs, to complex treatments like fixed or removable appliances, orthodontic camouflage with premolars or first molars extraction, magnets, mini-implants, mini-plates and orthognathic surgery (Stuani & Stuani, 2005; Matsumoto et al., 2012). However, appropriate diagnosis and treatment plan are needed before deciding for the most suitable approach (Subtelny & Sakuda, 1964; Melsen et al., 1995; Cabrera et al., 2010; Ferreira et al., 2012).

DIAGNOSIS AND AETIOLOGY

Patient is a 32-year old Nigerian female who was seen on the 11th of march 2010, at the orthodontic clinic of

the Child Dental Health Department, Lagos University Teaching Hospital, Lagos. Her chief complaint was: "my tongue protrudes when I talk and it affects my speech.

The main aetiological factor for anterior open bite in this case, was a habit of tongue thrust, though patient had stopped the habit years before presentation at the hospital. Her Medical history was uneventful. She had a good oral hygiene, clinically healthy periodontium and no caries.

Extra oral examination revealed a slightly increased lower facial height, competent lips, convex soft tissue facial profile. Patient had a full profile

The intra oral examination showed teeth present to be central incisor to the third molar in all quadrants except in the upper left quadrant where the second molar was missing due to extraction. Patient had an Angle's Class 1 molar relationship, moderate spacing of about 5.5mm in the upper and 4.5mm in lower anterior segments, a lingually rotated lower left third molar and anterior open bite, which was from the upper right to left canine, and the space between the upper and lower incisors was asymmetrical, about 4mm on the right and 2mm on the left.

INVESTIGATIONS

Patient's study model was obtained from alginate impression of both arches. Lateral Cephalometric radiograph was taken and manually traced (figure 1).

TREATMENT OBJECTIVES

The objectives were to achieve a normal overbite and overjet, to close residual spaces, to also reduce the lower facial height, to correct the positioning of the tongue and overall improvement of patient's profile.

TREATMENT ALTERNATIVES

These included

- Non extraction-fixed orthodontic appliance using preadjusted Edgewise appliance, and a habit breaker.
- Fixed orthodontic appliance in conjunction with high pull head gear therapy
- Use of temporary anchorage device system to intrude the posterior teeth.

Patient was treated with a non-extraction-fixed orthodontic appliance – preadjusted edgewise appliance, with a tongue rake. Anchorage device system is on the high side financially, the patient could not afford the third treatment alternatives. The patient rejected the second treatment option because of the unsightly appearance of the head gear.

TREATMENT PROGRESS

Fixed conventional slot size 0.022 x 0.028 (Roth) preadjusted edgewise appliance was placed and molar bands with welded buccal tubes were cemented to all first permanent molars, the tongue rake attached to upper bands.

Archwire sequence progressed from 0.014 nickel titanium round wires to 0.019x0.025 rectangular stainless-steel wire.

Space closure in the labial segment was achieved by using an elastic chain from upper right canine to the left canine, while active-tie backs were used to close residual spaces in the buccal segments.

Initial proper bracket placement slightly coronal/cuspal on the posterior teeth and slightly gingival on the anterior teeth and the use of short vertical elastics were used to close the anterior open bite with the aid of Kobayashi hooks placed on all central and lateral incisors.

Active treatment duration was 38 months. Treatment duration was prolonged because patient was unable to keep to clinic appointments for about a year because she was pregnant. Patient was debonded and maxillary modified Hawley's retainer was fitted. Tongue rake was incorporated into the Hawley's retainer to consolidate the correct tongue position and prevent relapse

TREATMENT RESULTS

After 38 months of treatment there was improved overbite and overjet, the spaces were closed, tongue thrusting habit was broken, her speech got better and improved facial profile.

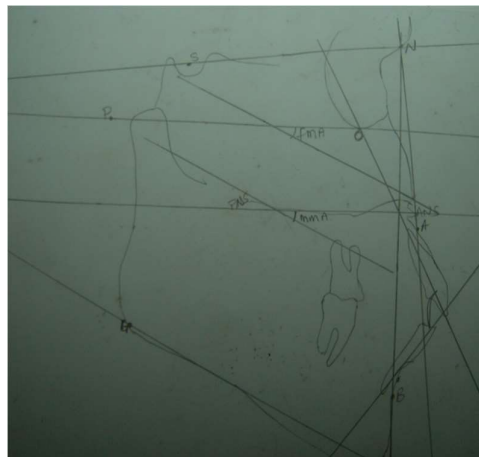


Figure 1: Pretreatment records

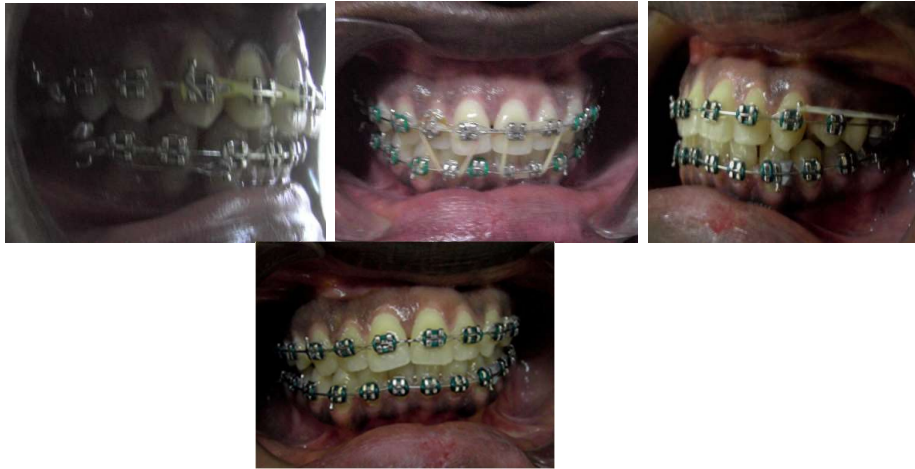


Figure 2. Peri-treatment clinical photographs



Figure 3. Post treatment clinical photographs



Figure 4: comparison between the Pre and Post-treatment clinical photographs

Table 1. Cephalometric radiograph analysis: pretreatment, post-treatment and normal values (Isiekwe and Sowemimo, 1984)

MEASUREMENT	Pre-treatment values (^o)	Post-treatment values (^o)	Normal values
SNA	89	85	85.5±3.5 ^o
SNB	85	82	82.7±3.0 ^o
ANB	4	3	2-4 ^o
UI to FP	120	118	119-127 ^o
LI to MP	105	101	96-104 ^o
FMA	32.5	30.5	20-26 ^o
MMA	30	29	21-26 ^o
UI to LI	112	109	108-116 ^o

Table 2. Paired t-test on pre and post values for cephalometric radiograph analysis

	Mean	t-value	p-value
Pre-treatment value	72.185 ± 43.751	5.916	0.001*
Post-treatment value	69.688 ± 42.903		

*significant

DISCUSSION

A non-extraction-orthodontic camouflage approach with a habit breaker was utilized to successfully management an anterior open bite in an adult. This approach controlled the vertical height by active intrusion of the posterior teeth without the use of extra-oral force and chin cup. Most patients who present with skeletal anterior open bite often reject the option of surgical intervention even when they stand to benefit from it. Most of the patients opt for orthodontic camouflage therapy. Some authors are of the opinion that treatment of anterior open bite involving extraction cannot provide stability because of the reduction in tongue space (Matsumoto et al., 2012). Though, as its expected, few other authors disagree

with non-extraction approach (Janson et al., Matsumoto et al., 2012). The use of vertical elastics to correct anterior open bite by mild extrusion of the anterior teeth, replaces the extraction approach involving retraction of the anterior segment which promotes bite closure. The aetiology of the open bite in this case was as a result of prolonged tongue thrusting habit, which can be considered as a secondary habit owing to an adaptation to the pre-existing space, which further will aggravate and maintain the open bite, instead of it being the cause (Matsumoto et al., 2012). The habit was broken with the use of a tongue rake. A tongue rake is an appliance which acts as a deterrent to oral habits, apart from tongue thrusting habits, thumb or digit sucking habits can also be discouraged by the

use of a habit breaker. There are other devices which are equally useful in breaking oral habits, these include goal post, and tongue tamers (Ngan and Fields, 1997). The disadvantages associated with the use of these appliances in habit-breaking, include tongue irritation, difficulty in maintaining good oral hygiene and self-inflicted trauma (Proffit, 2000), emotional reactions as well as effects on speech and feeding (Harvett et al., 1970). The habit breakers, arch expanders and myofunctional therapy fall under the simple techniques. These techniques remove the aetiological factors and the bite closes by normal eruption process, or enhanced by the use of orthodontic appliances (Matsumoto et al., 2012). These simple techniques, to some extent, impede dental eruption posteriorly, control vertical development and reduce vertical skeletal growth using intraoral forces (Matsumoto et al., 2012).

The complex techniques include fixed orthodontic appliance (braces) with or without extraction, and surgical procedures- orthognathic surgeries. The extraction may either be the premolars or the second or third molars, if they are the only source of centric occlusion or contact. The fixed appliance involves intrusion, active or passive, which is achieved by inhibiting eruption of the posterior teeth. One or more techniques maybe combined when the aetiology is multifactorial or unclear (Ngan & Fields, 1997; Matsumoto et al., 2012).

Glossectomy may also be carried out when the size of the tongue is the main aetiological factor to the anterior open bite. Surgical procedures, like adenoidectomy can also be done to improve the patency of the airway. Severe skeletal open bites can be treated by combined orthodontic appliance and orthognathic surgery (Matsumoto, et al., 2012).

The Cephalometric analysis showed significant changes in the SNA, SNB and the ANB. The LI to MP, FMA and the UI to LI all showed significant reduction (p-value=0.001) in their values (Table 2).

Important factors in the successful treatment of this malocclusion include, firstly, the incorporation of the tongue rake to break the habit of tongue thrusting and secondly the correct positioning of the brackets. The brackets were positioned close to the cusps on the posterior teeth to slightly intrude them and on the anterior teeth, they were positioned more gingival to extrude the anterior teeth slightly, thereby correcting the over bite. Park et al. (2008), in their report, used mini-screws to intrude posterior teeth and Sugawara et al. (2002) reportedly intruded the mandibular molars with the application of micro-screw and miniplates which are both skeletal anchorage system devices, for open bite correction. The fixed appliance with passive bite has the advantage of low cost and simple method of application when compared to skeletal anchorage system. On the other hand, the skeletal anchorage

system gives better and more stable result (Xun et al., 2007). The midline diastema was closed up, using an elastic chain, and the space was used to correct the overjet. At the end of treatment, a permanent retainer, made up of twixyflex wire was placed on the palatal surface of the upper anterior teeth to prevent relapse, which is strongly associated with open bites. A modified Hawley's retainer with tongue rake was fitted, to maintain the correct tongue resting position achieved, this would further prevent relapse.

CHALLENGES

Clinicians face serious challenges with the treatment of anterior open bite. It is one of the most difficult malocclusions to treat to a successful and stable result. During the retentive phase, it is difficult to maintain the occlusion due to the lack of control over the tongue position and movements in open bite cases (Williamson, 1997). Most clinicians tend to overcorrect the anterior open bite, also use different retainers such as occipital headgears, functional appliances with posterior thick bite plane (Egermark-Eriksson et al., 1990), or palatal cribs (Sassouni, 1969), as well as fixed retainers, to overcome the challenges of relapse; Salehi et al. (2015), reported that there was no significant difference between the extraction and non-extraction groups (Denison et al., 1989) in terms of stability. Jason et al. (2003) reported a relapse rate of 25.8% and 38.1% in extraction and non-extraction groups respectively.

Some authors have suggested the use of adjunctive treatment like, non-surgical treatments with temporary anchorage devices (Razavi, 2012) and orofacial myofunctional therapy (Smithpeter & Covell, 2010), to reduce the relapse of treated cases, though these suggestions would need further evaluation.

The way forward is to counsel patient on the need to wear retainers for life, (when noticeable tooth movement has finally reduced) and educate patient on proper tongue positioning.

CONCLUSION

This case shows the successful management of an anterior open bite in an adult Nigerian patient. Anterior open bite has been prominently associated with abnormal tongue habit. Tongue position in turn is related to the posture of the entire head and neck. Effective orthodontic management of open bite is quite challenging and lack of stability of the extruded anterior teeth is widely recognized as one of the causes of relapse.

Source of support

None

Conflict of Interest

None

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