Journal of Oral Medicine and Dental Research

Genesis-JOMDR-3(1)-22
Volume 3 | Issue 1
Open Access
ISSN: 2583-4061

Multidisciplinary Approach in Adult Orthodontic Patient Affected by Severe Obstructive Sleep Apnoea: A Case Report

Robert Lin*

Dentist, Universitat Jaume I, Castellón de la Plana, Spain Bachelor of Dental Science (University of Queensland), Australia

***Corresponding author**: Robert Lin, Dentist, Universitat Jaume I, Castellón de la Plana, Spain Bachelor of Dental Science (University of Queensland), Australia

Citation: Lin R. (2022) Multidisciplinary Approach in Adult Orthodontic Patient Affected by Severe Obstructive Sleep Apnoea: A Case Report. J Oral Med and Dent Res. 3(1):1-09.

Received: March 09, 2022 | **Published:** May 11, 2022

Abstract

This case report describes the successful multidisciplinary treatment of an adult orthodontic patient with severe obstructive sleep apnoea (OSA). The patient presents with class I dental occlusion and lower anterior crowding. Upon comprehensive orthodontic examination, it was suspected the patient had sleep disordered breathing and was sent for a polysomnography (PSG). The sleep physician diagnosed severe sleep apnoea with an apnoea hypopnoea index (AHI) of 54.1. Cone beam computerized tomography (CBCT) scan, which was taken as part of the orthodontic records, revealed airway issues so the patient was referred to an ear nose throat (ENT) doctor with a sub specialty in airway and sleep. ENT surgery was performed resulting in the AHI coming down to 20.4. Orthopaedic expansion was done using removable appliances followed by fixed appliances (braces) using the controlled arch technique and protraction mechanics. The post orthodontic treatment AHI was 14.4 and a Farrar splint was made as the retainer which resulted in an AHI of 6.4. This case report demonstrates why a comprehensive orthodontic examination and multidisciplinary approach is essential to successful treatment of orthodontic patients with obstructive sleep apnoea.

Keywords
Orthodontics; Expansion; Obstructive sleep apnoea; PSG; AHI; CBCT; ENT

Introduction

Modern day orthodontics is no longer just about moving the teeth within the jaws to improve aesthetics and function. A good example is the increasing interest in the role orthodontic practitioners can play in the screening for sleep disordered breathing (SDB) and obstructive sleep apnoea. In fact, orthodontic practitioners can play a key role in the multidisciplinary management of OSA in both children and adults [1]. This is a current hot topic because the level of awareness of OSA and its related health issues is rapidly growing within the general population [2]. In addition, the prevalence of OSA is also increasing due to obesity and the ageing population [3]. In fact, it wouldn't be surprising to see orthodontic patients come in asking about airway and sleep, therefore orthodontic practitioners need to know how to screen for airway and sleep issues and its management [2]. Integrating airway and sleep into orthodontic practice, in addition to working with other health professionals, will achieve the best possible outcome for the patients' overall health.

OSA is now one of the most common medical disorders in the general population. The prevalence in adults ranges from 9% to 38%, and is typically higher in men and older people [4]. More specifically, the presence of moderate or severe OSA ranges from 6% to 17% [5].Another study revealed approximately 1 billion adults globally aged 30-69 years have OSA, and of which 425 million have moderate to severe OSA [6]. Unfortunately, OSA prevalence is rising and affects all countries because as the prevalence of the ageing population and obesity increases, the vulnerability towards having OSA increases [3]. The countries most affected by OSA are China, USA, Brazil and India [6].

Furthermore, there is a higher paediatric sleep disordered breathing prevalence in the orthodontic population (10.8%) than a healthy paediatric population (5%). The prevalence of snoring and sleepiness in the orthodontic population is 13.3% and 17.9%, respectively. Therefore orthodontic practitioners should make airway and sleep screening a routine part of their clinical practice [7].

This case report describes a unique situation where a young dentist discovers he may have sleep disordered breathing while attending an orthodontics course in Sydney, Australia. The goal is to guide you through the entire treatment process and demonstrate how a multidisciplinary approach can achieve a great outcome not just orthodontically, but also for the patients overall health and wellbeing.

Case Report

A 26 year old male dentist was evaluated at the International Academy of Advanced Dentistry (IAA Dent) orthodontics residency. He was fit and healthy with a clear medical history and body mass index (BMI) of 23.3. The patient had no orthodontic concerns but thorough examination revealed dental crowding, RHS TMJ clicking, allergies, snoring and daytime sleepiness.

Facial analysis indicated mesofacial, midface deficiency, low tongue posture, lips competent but dry (suspect mouth breathing), flat profile, small nares, lack of cheek bones and forward head posture. Intra oral analysis indicated slightly V-shaped arches, lower posteriors lingually tilted, lower anterior moderate crowding, normal frenal attachments, class I molar relationships, malampatti class 4, tonsils grade 4, transverse and sagittal deficiencies as indicated by Schwarz-Korkhaus analysis and Mews indicator line (Figure 1).

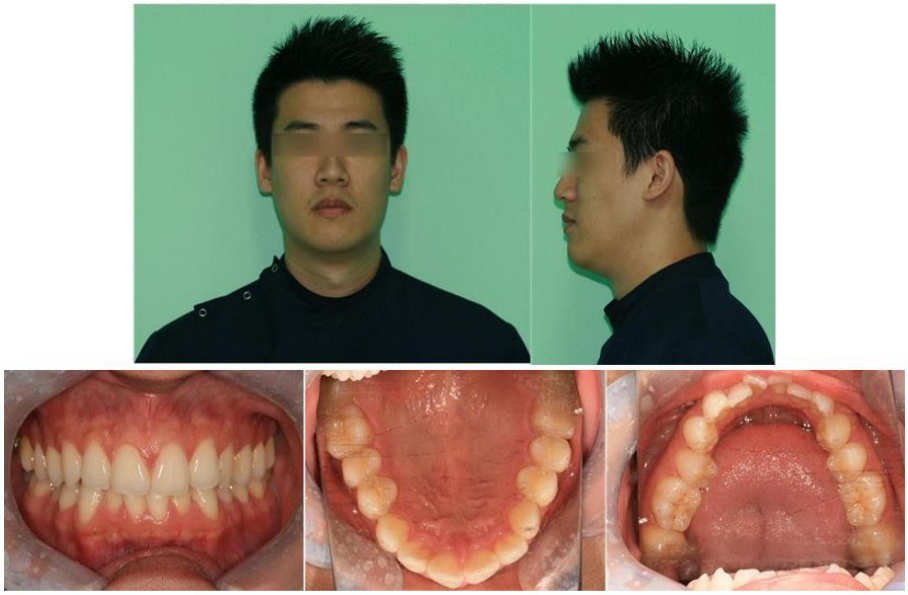

Figure 1: Pre-treatment extra oral and intral oral photographs.

Cone beam computerized tomography (CBCT) scan was analysed and reported on by a dental maxillofacial radiologist. It revealed minor mucosal thickening on the floor of both maxillary sinuses, slight bowing of the nasal septum to the left, right-sided concha bullosa, slight prominence of the adenoidal tissue, prominent palatine tonsils with associated narrowing of the airway, slight prominence of the left anterior joint space and considerable prominence of the right anterior joint space which often correlates with anterior disc displacement. All these radiographic findings plus an Epworth Sleepiness Score (ESS) of 13/24 and STOP BANG score of 5/8 were suggestive of sleep disordered breathing, therefore the patient was referred for a sleep study. Type 2 polysomnography (PSG) diagnosed the patient with severe sleep apnoea with an apnoea hypopnoea index (AHI) score of 54.1, longest apnoeaof 46 seconds and oxygen nadir to 83%. Following the alarming sleep study results, referral to an ENT with a sub specialty in airway and sleep was arranged. The ENT used nasal endoscopy for assessment and took images for records purposes and to help explain to the patient. A decision was made to perform ENT surgery to clear the airway passage to improve breathing and sleep. The ENT procedures performed included septoplasty, turbinectomy, adenoidectomy, tonsillectomy, tongue coblation and modified uvulopalatopharyngoplasty (UPPP). Another type 2 PSG was done 5 months after ENT surgery to ensure healing was complete and to determine if surgery was successful in improving breathing and sleep. The AHI score came down to 20.4 (62% reduction), longest apnoea of 24 seconds and oxygen nadir to 90%. The surgery achieved a successful result based on the ENT's guidelines of success, which includes improvement in quality of life, reduction of OSA symptoms, reducing AHI greater than 50% and improving oxygen nadir to 90% (Figure 2).

Figure 2: Pre ENT surgery vs post ENT surgery photos.

For orthodontic purposes, the CBCT scan was also used to reconstruct alateral cephin order to do a Jefferson ceph analysis to determine the skeletal class of the patient. The Jefferson tracing diagnosis was a slight class IIIA skeletal and short vertical with both jaws just shy of the anterior arc. Airway analysis revealed a narrow oropharyngeal airway with a minimum axial area of 54.9mm^2. Occlusal analysis with muscle palpations and Schwarz analysis were also performed. Despite being a slight class IIIA, the patient was 26 years old with no family history of class III, so there was no concerns about the possibility of late mandibular growth (Figure 3).

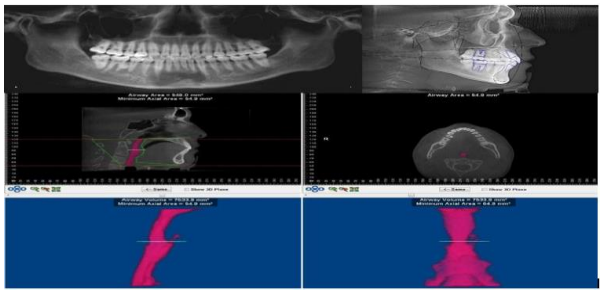

Figure 3: Pre-treatment radiographic records including Jefferson ceph tracing and 3D airway analysis with minimal axial area measurement of 54.9mm^2.

Upon discussion of the various treatment options, including orthognathic surgery and dental extractions, it was decided that maxillary orthopaedic development would be done using removable appliances. The patient chose removable appliances because he wears a mouthguard for sport and is able to remove the appliance for cleaning so his mouth won't smell bad when talking to patients. The patient started with an anterior push sagittal appliance for 6 months, followed by a 50/50 sagittal for 4 months. Following that, fixed orthodontic appliances (braces) were done using controlled arch technique. Protraction mechanics were performed in the upper arch to move the teeth forward due to class III, improve the profile and nasolabial angle, and to minimize any retraction which may worsen an already compromised airway. In the lower arch, the wire was advanced to upright the posterior segments, which resulted in more tongue space and helped alleviate the anterior crowding. Vertical elastics were used to extrude the lower posteriors, in order to level the curve of Spee and increase the vertical height (Shimbashi) to better support the TMJ. The total fixed appliance process took exactly 3 years to complete. Coincidently, the patient's RHS TMJ clicking spontaneously disappeared after 2 years into orthodontic treatment. This may have been due to the downward and forward movement of the mandible, resulting in a decompression of

the condyle and favourable changes in the disc position and overall TMJ structure (Figure 4).

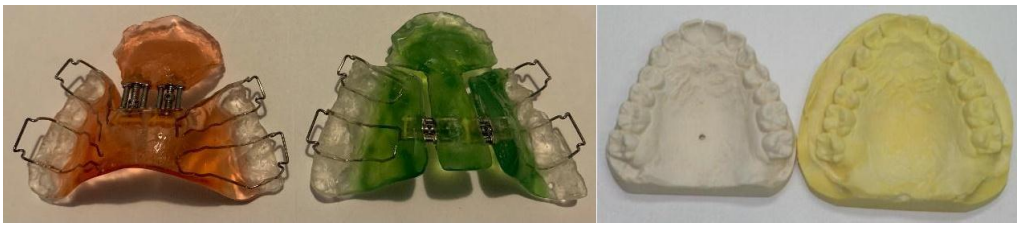

Figure 4: Upper removable orthopaedic appliances used (anterior push sagittal and 50/50 sagittal); pre vs post expansion study models.

In addition, the patient went to see an immunologist for allergy testing, which revealed a severe allergy to dust mites. Other allergies included grass, mould, cats, dogs and pollen. The patient decided to go through multiple rounds of immunotherapy treatment and also made lifestyle changes such as getting rid of carpet, washing bedsheets weekly and buying an air purifier which significantly helped with the dust mite allergy.

Final orthodontic records were taken including CBCT scan, intra and extra oral photos including profile, occlusal analysis, Schwarz analysis, Jefferson ceph analysis and another sleep study for comparison. The Jefferson tracing showed the patient finished in a class I skeletal with a slightly higher vertical than before and both jaws just in front of the anterior arc. The sleep study showed the AHI score came down further to 14.4 and oxygen nadir to 85%. The patient elected not to have a mandibular advancement splint (MAS) made, due to the risk of long term bite changes resulting in an underbite. Instead, an upper Farrar splint with a lower 3-3 2mm thick Essix retainer was made as a night time appliance. The Farrar splint had a hole in the ramp to attract the tongue forwards and prevent it from blocking the airway. The lower Essix prevents dental pain resulting from the lower anteriors hitting the ramp, and prevents the posteriors from contacting the Farrar splint, which decreases muscle tension by decreasing the masseter activity strength. Another sleep study was done wearing the night time appliance for comparison. The result showed the AHI score came down even further to 6.4 and oxygen nadir improved to 88%. Airway analysis was not done immediately after orthodontic treatment, but a 4 year follow up CBCT revealed a larger oropharyngeal airway with a minimum axial area of 94.9mm^2 (Figures 5-7).

Date	AHI	Min SpO2	Avg Apnoea	Arousals	Limb Movements
13/02/2014 Pre ENT surgery	54.1	83%	22s (longest 46s)	40.3/hr	18/hr
20/08/2014 Post ENT surgery	20.4	90%	15s (longest 24s)	N/A	N/A
04/12/2017 Post ortho	14.4	85%	16s	51.6/hr	N/A
05/12/2017 Post ortho with Farrar splint	6.4	88%	12.3s	44.1/hr	N/A

Figure 5: Summary table of PSG results with each phase of treatment; Upper Farrar splint with lower 3-3 2mm thick Essix retainer.

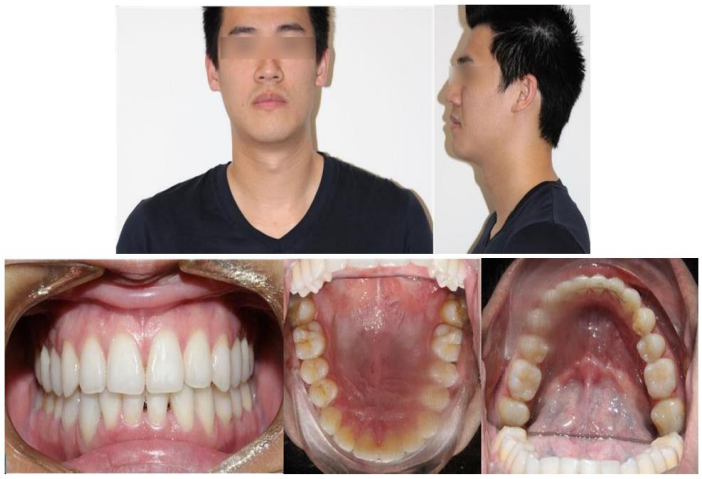

Figure 6: Post-treatment extra oral and intra oral photographs.

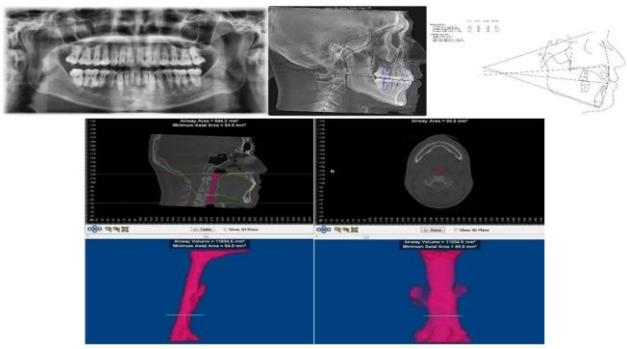

Figure 7: Post-treatment radiographic records including Jefferson ceph tracing and 3D airway analysis with minimal axial area measurement of 94.9mm^2.

Discussion

A typical situation in orthodontic practice is a patient seeking to correct their malocclusion. Due to the higher prevalence of sleep disordered breathing in orthodontic patients, the need for orthodontic practitioners to be able to screen for airway and sleep disorders has become apparent. An excellent guideline is the American Association of Orthodontists (AAO) White Paper: Obstructive Sleep Apnoea and Orthodontics, published in 2019. The White Paper is a document designed to provide guidance to orthodontists on the suggested role of the specialty of orthodontics in the management of obstructive sleep apnoea [1].

Risk factors for OSA include age, male gender, obesity, smoking, family history, nasal congestion, allergies, craniofacial and upper airway abnormalities. Asians and Hispanics have higher rates of OSA, even in non-obese individuals [8]. African American children are 4 to 6 times more likely to have OSA and African American adults are 2.1 times more likely to have severe OSA [9]. Women tend to have less severe OSA than males, with a lower AHI and shorter apneas and hypopneas. However, episodes of upper airway resistance that do not meet the criteria for apneas are more common in women [10].

The general public is becoming increasingly aware of the adverse health effects associated with OSA. OSA patients show a high prevalence of cardiovascular diseases (systemic hypertension, coronary artery disease, arrhythmias, ischemic stroke), respiratory diseases (COPD, asthma), and metabolic disorders (diabetes mellitus, dyslipidaemia, gout). Other disorders identified include peptic ulcer disease, gastroesophageal reflux, chronic liver disease, anxiety, insomnia and depression [11]. On the flip side, OSA prevalence is 40% to 80% in patients with hypertension, heart failure, coronary artery disease, pulmonary hypertension, atrial fibrillation and stroke [12]. Alternatively, it has been shown that OSA leads to worsening of patients' personal relationships, decreasing work productivity, and increasing occupational accidents as well as motor vehicle accidents [13].

The CBCT scan findings prompted the referral to an ENT doctor specializing in airways and sleep. Tonsillectomy and adenotonsillectomy may be indicated in adults with sleep disordered breathing and tonsil hypertrophy [14]. Multiple studies have shown the effectiveness of modified Uvulo Palato Pharyngoplasty (UPPP) with follow up studies up to 8 years confirming its long term success rate. Even though its effect on AHI decreased over time, daytime sleepiness remained improved long term [15]. This case study further supports ENT surgery for treating OSA, as the patient's AHI went from
to 20.4 and oxygen nadir from 83% to 90% after surgery.

Despite not being main stream in orthodontic practices, numerous studies have shown non-surgical maxillary expansion in adults to be an effective treatment. Calvo-Henriquez C et al [16] showed a significant reduction in nasal resistance after palatal expansion and Brunetto et al [17] revealed areduction in upper airway resistance. Kim et al showed that volume and cross-sectional area of the nasal cavity and nasopharynx significantly increases and remains stable at 1 year review [18]. Nonsurgical rapid maxillary expansion has been shown to be a viable procedure for young adults well into their early twenties [19]. In addition, a 3 year follow up study revealed that the dental and skeletal changes achieved with semi-rapid maxillary expansion in the transversal dimension were stable [20]. Furthermore, a 6 year follow up study indicated that nonsurgical RME in adults is a clinically successful and safe method for correcting transverse maxillary arch deficiency [21]. It's considered a safe treatment as complications during treatment were not clinically significant, including non-clinical negative effects on the periodontium [22,23].

On the contrary, there are also studies that indicate expansion may not be as successful in adults. Celebi and Akbulut proposed that patients with CVMS6 (cervical vertebral maturation stage) had a 16.8 times higher risk of palatal expansion failure than CVMS5. However, their study only had 50 subjects (35 female and 15 male), of which only 11 had failed treatment according to their own success criteria [24]. In addition, Agostino et al concluded that there is insufficient evidence on orthodontic treatment of adults with posterior crossbites because their research excluded orthodontic-surgical interventions [25]. This case report demonstrates the importance of a multidisciplinary approach in treating adult orthodontic patients with OSA. It displays the effectiveness of combining ENT surgery and comprehensive orthodontic treatment in improving OSA. There was improvement of OSA at every stage of treatment, from ENT surgery to dentofacial orthopaedics, to protraction orthodontics and post treatment retention. The AHI scores went from 54.1 to 20.4 to 14.4 and 6.4 at each treatment stage respectively. This highlights the

importance of airway and sleep screening for orthodontic patients, therefore it is critical that orthodontic practitioners are familiar with the signs and symptoms of sleep disordered breathing.

Conclusion

This present case report illustrates the success of combining ENT surgery and comprehensive orthodontic treatment in improving OSA. There was significant improvement in the patient's OSA at each stage of treatment. Early diagnosis of OSA in childhood and adolescence is critical in preventing the many negative health consequences related to adult OSA. Orthodontic practitioners see many young patients in their clinics daily, which emphasizes the need to have the knowledge and understanding to screen for airway and sleep issues, in conjunction with having an interdisciplinary approach, to ensure the best possible treatment outcome. Ultimately, this helps serve in the best interests of orthodontic patients.

Acknowledgements

The author would like to acknowledge Professor Kenneth Lee, who oversaw the entire treatment provided by his Today's Dental team in Sydney, Australia. Dental maxillofacial radiologist Dr Raahib Dudhia, who took all the CBCT scans and did the reports, ceph tracings and airway analysis using dolphin software. ENT specialist Dr David McIntosh for performing the ENT surgery. Sleep Services Australia and My Sleep for providing the type 2 home sleep studies. Immunologist Dr Yee Thong for the allergy testing and immunotherapy treatment.

Disclaimer

There was no financial support or sponsorship for this project. Informed consent was obtained from the patient in this case report for the images and publication.

References

1. Behrents RG, Shelgikar AV, Conley RS, Flores-Mir C, Hans M, et al. (2019) Obstructive sleep apnea and orthodontics: An American Association of Orthodontists White Paper. Am J Orthod Dentofacial Orthop. 156(1):13-28.
2. Banabilh SM. (2017) Orthodontic view in the diagnoses of obstructive sleep apnea. J Orthodont Sci. 6:81-5.
3. Lyons, MM, Bhatt, NY, Pack, AI, Magalang, UJ. (2020) Global burden of sleep-disordered breathing and its implications. Respirology. 25:690-702.
4. Hamilton GS, Joosten SA. (2017) Obstructive sleep apnoea and obesity. The Royal Australian College of General Practitioners. 46(7):460-63.
5. Senaratna CV, Perret JL, Lodge CJ, Lowe AJ, Campbell BE, et al. (2017) Prevalence of obstructive sleep apnea in the general population: A systematic review. Sleep Med Rev. 34:70-81.
6. Benjafield AV, Ayas NT, Eastwood PR, Heinzer R, Ip MSM, et al. (2019) Estimation of the global prevalence and burden of obstructive sleep apnoea: a literature-based analysis. The lancet respiratory med. 7(8):87-698.
7. Abtahi S, Witmans M, Alsufyani NA, Major MP, Major PW. (2020) Pediatric sleep-disordered breathing in the orthodontic population: Prevalence of positive risk and associations. Am J Orthod Dentofacial Orthop. 157(4):466-473.
8. Chen X, Wang R, Zee P, Lutsey PL, Javaheri S, et al. (2015) Racial/ethnic differences in sleep disturbances:

the Multi-Ethnic Study of Atherosclerosis (MESA). Sleep. 38(6):877-88.

9. Dudley KA, Patel SR. (2016) Disparities and genetic risk factors in obstructive sleep apnea. Sleep Med. 18:96-102.
10. Wimms A, Woehrle H, Ketheeswaran S, Ramanan D, Armitstead J. (2016) Obstructive Sleep Apnea in Women: Specific Issues and Interventions. BioMed Research International. 2016: 1764837.
11. Bonsignore, MR, Baiamonte, P, Mazzuca E. (2019) Obstructive sleep apnea and comorbidities: a dangerous liaison. Multidiscip Respir Med. 14:8.
12. Yeghiazarians Y, Jneid H, Tietjens JR, Redline S, Brown DL, et al. (2021) Obstructive Sleep Apnea and Cardiovascular Disease: A Scientific Statement From the American Heart Association. Circulation. 144:e56-e67.
13. Morsy, Nesreen E, Farrag, Nesrine S Zaki, Nevin FW, et al. (2019) Obstructive sleep apnea: personal, societal, public health, and legal implications. Rev Environ Health. 34(2):153-169.
14. Randall DA. (2020) Current Indications for Tonsillectomy and Adenoidectomy. J Am Board Fam Med. 33(6):1025-1030.
15. Sundman J, Browaldh N, Fehrm J, Friberg D. Eight-Year Follow-up of Modified Uvulopalatopharyngoplasty in Patients With Obstructive Sleep Apnea. Laryngoscope. 2021 Jan;131(1):E307-E313.
16. Calvo-Henriquez C, Megias-Barrera J, Chiesa-Estomba C, Lechien JR, Alvarado BM, et al. (2021) The Impact of Maxillary Expansion on Adults' Nasal Breathing: A Systematic Review and Meta-Analysis. Am J Rhinol Allergy. 35(6):923-34.
17. Brunetto DP, Sant'Anna EF, Machado AW, Moon W. (2017) Non-surgical treatment of transverse deficiency in adults using Microimplant-assisted Rapid Palatal Expansion (MARPE). Dental Press J Orthod. 22(1):110-125.
18. Kim SY, Park Ychel, Lee KJ, Lintermann A, Han SS, et al. (2018) Assessment of changes in the nasal airway after nonsurgical miniscrew-assisted rapid maxillary expansion in young adults. Angle Orthod. 88(4):435-41.
19. Hussain A, Fatima S, Haneef M. (2015) Nonsurgical Maxillary Expansion in Adults: Report of Two Cases. J Orofacial Res. 5(4):151-154.
20. Iseri H, Ozsoy S. (2004) Semirapid Maxillary Expansion - A Study of Long-Term Transverse Effects in Older Adolescents and Adults. Angle Orthod. 74:71-78.
21. Handelman CS, Wang L, BeGole EA, Haas AJ. (2000) Nonsurgical rapid maxillary expansion in adults: report on 47 cases using the Haas expander. Angle Orthod. 70(2):129-44.
22. Ghergu JA, Chaqués-Asensi J, Llamas CJM, Perillo L. (2019) Nonsurgical maxillary expansion in adults: report on clinical cases using the Hyrax expander. Minerva Stomatol. 68(2):95-103.
23. Mobrici P, Lanteri C, Beretta M, Caprioglio A. (2012) Slow maxillary expansion in adult patients: A pilot study. Mondo ortodontico. 37:S7-S13.
24. Celebi F, Akbulut S. (2020) Relationship between the skeletal position of maxilla and rapid maxillary expansion failure. South Eur J Orthod Dentofac Res. 7(2):49-54.
25. Agostino P et al. Orthodontic treatment for posterior crossbites (Review). Cochrane Database Syst Rev. 8:CD000979.