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Bimaxillary protrusion: A literature review

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Abstract

Introduction: Bimaxillary protrusion is an occlusal feature characterized by protrusive and proclined upper and lower incisors, associated with increased flattening of the lips and greater than average degree of lip prominence. It is considered one of the malocclusion types that stimulate patients to seek orthodontic treatment to improve facial symmetry.

Objective: To conduct a literature review on bimaxillary protrusion with respect to its aetiological factors, morphological features, prevalence, diagnosis, and management.

Methods: Relevant sources of information were searched using electronic databases including Google Scholar, PubMed, Elsevier, ResearchGate, and Web of Science. A total of 28 articles were considered and included in the literature review.

Results: It was observed that bimaxillary proclination is prevalent among Asian, African, African-American, and the Caribbean regions, but less prevalent in white Caucasian populations. Treatment of patients with bimaxillary protrusion by extraction of four premolars was found to be successful in decreasing the dental and soft tissue procumbency seen in patients with bimaxillary protrusion.

Conclusion: Successful treatment of patients with bimaxillary protrusion starts with a good understanding of the patient's concerns and sometimes, a close collaboration between an orthodontist and an oral surgeon.

Keywords: Incisor Protrusions; Malocclusion; Appliance; Orthodontic

1. Introduction

Bimaxillary protrusion is a feature characterized by protrusive and proclined upper and lower incisors and an increased procumbency of the lips and greater than average degree of lip prominence [1]. It is considered one of the malocclusion types that stimulate patients to seek orthodontic treatment to improve facial congruency [2]. Bimaxillary protrusion, also known as dentoalveolar protrusion or bialveolar protrusion occurs when the maxillary and mandibular incisors are proclined relative to their dental bases and the cranial base leading to soft tissue prominence [2, 3]. It is a common dentofacial trait particularly prevalent among Asian [4], African [5], African -American [6], and Afro- Caribbean [7] populations, but It is less prevalent in white Caucasian populations [8].

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Aetiological factors responsible for bimaxillary protrusion may include genetic factors [4], as well as environmental factors [2, 4, 9}, such as mouth breathing, tongue and lip habits, and tongue size. Features associated with bimaxillary proclination include skeletal prognathism, alveolar protrusion, convex lower facial appearance, flattened lips, lip incompetence, mentalis strain, and excessive gingival display [3]. Some patients find this esthetically unacceptable thereby seeking treatment from an orthodontist or oral surgeon to improve facial balance.

Orthodontic treatment has been reported to correct dentoalveolar protrusion by retracting the anterior teeth [2], while surgical treatment reduces protrusion by repositioning segments of the jaws [10]. Both treatment approaches reduced facial convexity and improve lip posture significantly. Improvement of the soft-tissue profile depends on many variables related to the anatomy of the face, including lip thickness, facial muscle activity, and ethnicity [3].

The objective of this review is to analyze aetiological factors, morphological features, prevalence, and management of bimaxillary proclination.

2. Material and methods

To ensure that all relevant information regarding bimaxillary proclination were obtained, a wide selection of sources was searched in April 2022 and summarized. These sources included peer-reviewed literature publications from electronic databases such as Google Scholar, PubMed, Elsevier, ResearchGate, and Web of Science. Articles included were those that focused on aetiological factors, morphological features, prevalence, diagnosis, and management of bimaxillary protrusion or proclination (Table 1).

Table 1 Sources of Literature and Information Included in This Review

Ref no	Author	Country	Title/Topic	Type of Study
1	Aldrees AM, Shamlan MA.(2010)	Saudi Arabia	Morphological features of bimaxillary protrusion in Saudis	Scientific research
2	Bills DA, Handelman CS, Begole EA. (2005)	Saudi Arabia	Bimaxillary Dentoalveolar Protrusion: Traits and Orthodontic Correction.	Scientific research
3	Solem RC, Marasco R, Guiterrez-Pulido L, Nielsen I, Kim SH, Nelson G. (2013)	United States of America	Three-dimensional soft-tissue and hard-tissue changes in the treatment of bimaxillary protrusion.	Scientific research
4	Lamberton CM, Reichart PA, Triratananimit P. (1980)	Thailand	Bimaxillary protrusion as a pathologic problem in the Thai.	Scientific research
5	Beukes S DSHP.(2007)	Saudi	Soft tissue profile analysis in a sample of South African Blacks with bimaxillary protrusion	Scientific research
6	Farrow AL, Zarrinnia K, Azizi K. (1993)	United States of America	Bimaxillary protrusion in black Americans-an esthetic evaluation and the treatment considerations.	Scientific research
7	Carter NE, Slattery DA. (1988)	United Kingdom	Bimaxillary proclination in patients of Afro-Caribbean origin.	Case series
8	Keating PJ. (1985)	United Kingdom	Bimaxillary protrusion in the Caucasian: a cephalometric study of the morphological features.	Scientific research
9	Hoyte, T; Ali, A; Hernandez, J; Bearn DR. (2018)	United Kingdom	Bimaxillary protrusion: Prevalence and associated factors in the Trinidad and Tobago population	Review
10	Chu YM, Po-Hsun Chen R, Morris DE, Wen-Ching Ko E, Chen YR. (2007)	Taiwan	Surgical Approach to the Patient with Bimaxillary Protrusion	Essay

11	Soh J, Chew MT, Wong HB. (2007)	Singapore	An Asian community's perspective on facial profile attractiveness	Review
12	daCosta OO. (1999)	Nigeria	The prevalence of malocclusion among a population of northern Nigeria school children.	Scientific research
13	Isiekwe M. (1990)	Nigeria	Prevalence of bimaxillary protrusion in a Nigerian population.	Scientific research
14	Naini FB, Gill DS (2008)	United Kingdom	Facial aesthetics: 2. Clinical assessment.	Essay
15	Adesina BA, Otuyemi OD, Kolawole KA, Adeyemi AT. (2013)	Nigeria	Assessment of the impact of tongue size in patients with bimaxillary protrusion	Scientific research
16	McCann J, Burden DJ. (1996)	Ireland	An investigation of tooth size in Northern Irish people with bimaxillary dental protrusion.	Investigational
17	Murshid ZA, Amin HE, Al-Nowaiser AM. (2010)	Saudi Arabia	Distribution of certain types of occlusal anomalies among Saudi Arabian adolescents in Jeddah city.	Scientific research
18	Othman RM, Koay NA, Ghani SH, Norman NH. (2019)	Malaysia	Prevalence of Bimaxillary Protrusion among UiTM Orthodontic Patients.	Scientific research
19	Proffit WR. (1994)	United States of America	Forty year review of extraction frequencies at a university orthodontic clinic.	Scientific research
20	Iared W, Em KDS, Iared W, Rufino MC. (2016)	United States of America	Esthetic perception of changes in facial profile resulting from orthodontic treatment with extraction of premolars: a systematic review.	Review
21	Dawjee SM, Becker PJ, Hlongwa (2010)	South Africa	Is orthodontics an option in the management of bimaxillary protusion?	Scientific research
22	Lew K. (1989)	Singapore	Profile changes following orthodontic treatment of bimaxillary protrusion in adults with the Begg appliance.	Scientific research
23	Celli D, Garcovich D, Gasperoni E, Deli R. (2007)	Italy	Bimaxillary protrusion treated without extractions.	Case Report
24	Upadhyay M, Yadav S, Patil S. (2008)	United States of America	Mini Implant Anchorage for Enmasse Retraction of Maxillary Anterior Teeth: A Clinical Cephalometric Study.	Scientific research
25	Yassir YA, Nabbat SA, McIntyre GT, Bearn DR. (2022)	Iraq	Which anchorage device is the best during retraction of anterior teeth? An overview of systematic reviews.	Review
26	Chu YM, Bergeron L, Chen YR. (2009)	Taiwan	Bimaxillary Protrusion: An Overview of the Surgical-Orthodontic Treatment.	Essay
27	Ayoub AF, Stirrups DR, Moos KF (1993)	United Kingdom	The stability of bimaxillary osteotomy after correction of skeletal Class II malocclusion.	Case Report
28	Al-Moghrabi D, Pandis N, Fleming PS. (2016)	United Kingdom	The effects of fixed and removable orthodontic retainers: a systematic review.	Review

3. Discussion

A total of 28 articles were included in the review. It was reported that although bimaxillary proclination was highly prevalent among Asian [4, 11], African [5, 12, 13], African-American [6], and the Afro-Caribbean[7] regions, it however is less prevalent in white Caucasian populations [8].

Treatment of patients with bimaxillary protrusion by extraction of four premolars was found to be successful in decreasing the dental and soft tissue procumbency seen in patients with bimaxillary protrusion [2]. In addition, surgical intervention with orthodontic treatment has been used successfully [10].

3.1. Etiology

Etiological factors include skeletal factors related to underlying genetic factors [4]. Soft tissue factors are related to the lip and tongue size, morphology and position [14], with the lips incompetent at rest, the tongue rests and cause proclination of the incisors. Habits such as endogenous tongue thrust and other tongue habits have been linked to bimaxillary proclination [15]. It is associated with anterior open bite and lisping. Dental factors include tooth size discrepancy and direction of eruption of the incisors [16].

3.2. Prevalence

Bimaxillary protrusion is a common dentofacial trait particularly prevalent in Asian and African populations but less prevalent in white Caucasian populations [8]. The prevalence of bimaxillary proclination among different population in Northern Nigeria, Saudi Arabia and Trinidad and Tobago was 3.7% [12], 8% [17], and 68.8% [11] respectively, while among orthodontic patients attending a Malaysian teaching hospital, it was found to range from 31% to 37% [18]. However, another study in Nigerian population recorded the prevalence of bimaxillary protrusion as 20% with majority having Class 1 skeletal antero-posterior jaw relationship [13].

3.3. Diagnosis of bimaxillary proclination

Bimaxillary dentoalveolar protrusion is usually a clinical diagnosis made from the facial appearance based on the following characteristics: 1) lip incompetence, 2) lip strain and 3) prominent lip in the profile view [19]. However, cephalometric studies have also reported morphological features. These include:

Skeletal features such as skeletal bimaxillary protrusion, long and prognathic maxilla and mandible, short cranial base length, divergent facial plane, mild skeletal Class II, Increased Frankfort-mandibular plane angle and increased ANB [8]. Soft tissue features include convex facial form, acute nasolabial angle and labiomental angle, reduced lip length, incompetence of the lips, low lip line, increased Holdaway angle and receded chin [8]. Dental characteristics include dental bimaxillary proclination, reduced interincisal angle, increased dental arch length with spacing, normal or increased overjet, reduced overbite or anterior open bite, and variable molar relationship but usually normal [8], and larger teeth compared to normal population [16].

3.4. Aims for treatment

The objectives for treatment of bimaxillary proclination may include to relieve crowding, alignment and levelling, close diastema and spacing, achieve normal overjet and overbite, correct incisor relationship, normalization of buccal occlusion, maintain a stable result, improve facial aesthetics by flattening the profile and enable lip competence [2].

3.5. Treatment

The reasons for orthodontic treatment of bimaxillary protrusion include the retraction and retroclination of maxillary and mandibular incisors which in turn reduces parallel soft tissue and arch [20]. Mild to moderate bimaxillary protrusion among races characterized by this condition does not routinely require treatment. However, the inability of the patient to close the lips without strain, the severity of incisor protrusion and a respect for the patients' desire for change may sometimes warrant therapeutic intervention [21]. Correction of bimaxillary protrusion achieves favourable soft tissue changes without causing undesirable effects on the underlying hard tissues [6, 8, 22]. As the anterior teeth are retracted, the facial soft tissues tend to flatten with an increased nasolabial angle. The lower lip follows the lower incisor retraction more closely than the upper lip follows the upper incisors [23], thus indicating that mildly incompetent lips become competent by the retraction of the incisors [2].

For moderate cases, enmasse retraction can be done with or without extraction. It was reported that nonextraction therapies are effective treatment alternatives for Class I borderline patients with good facial profile and moderate dental

crowding [23]. Space for retraction may be obtained by interproximal enamel reduction or extraction in both arches usually first premolars [2]. Enmasse retraction after extraction of maxillary and mandibular premolars may require the use of reinforced anchorage. This could be in the form of conventional anchorage devices such as transpalatal arch, headgear, and Nance appliance; or by the use of temporary anchorage devices (TADS) using miniscrew implants [24, 25]. Skeletal anchorage using TADS have resulted in better skeletal, dental and soft tissue changes in bimaxillary protrusion compared to conventional anchorage devices [24, 25].

In severe bimaxillary protrusion cases, use of orthognathic surgery is indicated to correct significant skeletal problems. Differential intrusion of maxilla or maxillary segments with clockwise rotation of the occlusal plane is a useful technique for treatment of anterior open bite and creation of a consonant smile arc [26]. Surgical methods including subapical osteotomies with extraction with or without genioplasty, and Le Fort I osteotomy with setback sometimes provide an alternative to segmental maxillary osteotomies [26].

3.6. Stability & Relapse

A good stability at the end of treatment could be obtained by normalizing interincisal angle, achieve competence of the lower lip and good buccal intercuspation. Long term stability after correction of bimaxillary proclination is however unpredictable [27]. The use of permanent fixed retainers supported with vacuum formed retainers in both arches has been advocated [28].

4. Conclusion

This study focused on aetiological factors, morphological features, prevalence, diagnosis, and management of bimaxillary protrusion. The significance of this research is early diagnosis and treatment of individuals with functional or aesthetic impairment associated with bimaxillary proclination such as speech defects, adaptive tongue thrust, anterior open bite, spacing and psychosocial abnormalities.

Compliance with ethical standards

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