Original Article

Prevalence of Bimaxillary Protrusion Among UITM Orthodontic Patients

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Abstract

Objective: To determine the prevalence of bimaxillary protrusion in general and the prevalence of skeletal Class I and dental Class I bimaxillary protrusion/ proclination among orthodontic patients attending postgraduate orthodontic clinic at Faculty of Dentistry, Universiti Teknologi MARA (UiTM), Sungai Buloh, Malaysia.

Materials and Methods: This is a cross sectional study which was carried out in two stages. The first part involves a random selection of 100 extra-oral profile photographs taken from postgraduate orthodontic residents' patient list. The photographs were taken using Canon digital SLR camera EOS 70D with macro lens EF 100mm (Canon Inc., Tokyo, Japan) with patients in natural head position. The photographs were visually analysed for its bimaxillary protrusion features by two operators. The second part comprises of analyses of extra-oral profile photographs as well as intra-oral photographs of right buccal segment view which was conducted in two separate sittings. In the first sitting, five assessors analysed 259 extra- and intra-oral photographs followed by 40 photographs assessed in the second sitting for skeletal and dental Class I bimaxillary protrusion/ proclination. Statistical analysis for Kappa score was performed to assess the agreement between assessors using SPSS version 23 and Stata version 13.

Results: The first part of the study showed an average prevalence of 34% with bimaxillary protrusion in 100 orthodontic patients. Whilst in the second part, prevalence of skeletal and dental Class I bimax ranging from 28 -33 per cent and 38-40 per cent respectively with very good and good inter-reliability agreement for both component.

Conclusion: The prevalence of bimaxillary protrusion in general among UiTM orthodontic patients was found to range from 31

per cent to 37 per cent. Whilst the prevalence of skeletal and dental Class I bimax ranging from 28-33 per cent and 38-40 per cent respectively.

Keywords: bimaxillary protrusion, bimaxillary proclination, incisor inclination

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Introduction

Characteristic facial profile of bimaxillary protrusion may result from prognathic maxilla and mandible (bimaxillary prognathism) as well as proclined upper and lower incisors (bimaxillary

proclination), which lead to lips procumbency and face convexity (1). Bimaxillary protrusion has been reported to be prevalent in Afro-Caribbean, African-American, Asian, and other populations (1-6). In a recent 2018 epidemiological survey conducted by Trudee Hoyte et al, the prevalence of bimaxillary protrusion and bimaxillary proclination in Trinidad and Tobago school children was 64.4% and 68.8% respectively with 46.6% of the total sample having Class I incisor relationship (7). A study in Nigerian population recorded the prevalence of bimaxillary protrusion as 20% with majority showed Class 1 skeletal antero-posterior jaw relationship (8). However in Malaysia, data on the prevalence of bimaxillary protrusion and bimaxillary proclination was not established.

Because facial protrusion is deemed unattractive across the cultures and in most communities (9-11), many patients with bimaxillary protrusion seek orthodontic treatment to decrease the procumbency and increase the facial balance. This is also reflected in the rise of demand for orthodontic care from patients with protrusive profiles attending postgraduate orthodontics clinic, UITM Sungai Buloh campus.

Provision of orthodontic services in publicly funded healthcare system heavily relies on the Index of Orthodontic Treatment Need (IOTN) in order to prioritise treatment based on dental health benefits and aesthetic handicapping. IOTN was developed by Brook and Shaw in 1989 within the UK where the orthodontic treatment are mostly provided within a state-funded health service (12). Although recognised and widely used, this index was developed for populations where bimaxillary protrusion is least prevalent and therefore may be considered biased when used in the local setting. Theoretically there will be a discrepancy to meet the demand and need of orthodontic treatment in patients with this malocclusion as it does not objectively satisfy the index criteria.

With scarce data on cases of bimaxillary protrusion and bimaxillary proclination in Malaysia, it will be difficult to objectively adopt the use of IOTN locally for bimaxillary protrusion cases. Therefore, this study was undertaken with the aim to determine the prevalence of bimaxillary protrusion in general and the prevalence of Class I bimaxillary protrusion/ proclination among orthodontic patients attending postgraduate orthodontic clinic at Universiti Teknologi MARA (UiTM), Sungai Buloh Campus, Selangor, Malaysia.

Material and methods

Ethical approval from UITM Research Ethics Committee was obtained for this descriptive cross sectional study. This study was carried out in two stages.

The first part of the study involved extra-oral assessment of 100 profile photographs taken from postgraduate orthodontic residents' patient list. The photographs were taken using Canon digital SLR camera EOS 70D with macro lens EF 100mm (Canon Inc., Tokyo, Japan) with patients in natural head position (13) (Figure 1). These photographs were visually analysed for

Figure 1 Patient in natural head position

presence of bimaxillary protrusion by two operators and reassessed after a four-week interval to prevent memory biased.

Bimaxillary protrusion was indicated with the presence of bimaxillary prognathism, acute nasolabial angle, and lip protrusion. The skeletal component was assessed anteroposteriorly between maxilla and mandible by dropping an imaginary line down from the soft tissue nasion (zero meridian) perpendicular to the Frankfort horizontal plane (Figure 2). In normally positioned jaw, the maxilla should be approximately 2-4 mm in front of the mandible. In addition, it is important to note that anteoposteriorly, bimaxillary protrusion can present with Class I, Class II or Class III skeletal relationships.

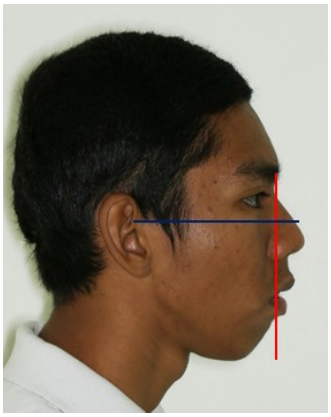

Figure 2 Zero meridian perpendicular to the Frankfort horizontal plane

For soft tissue, nasolabial angle and lip protrusion were examined. Nasolabial angle is formed between the upper lip and columella (Figure 3) and should be between 90 to 110 degrees. Upper and lower lips were examined in relation to the E-line (Figure 4). Well-balanced and harmonious lips should be 2 mm ahead or behind the E-line.

Statistical analyses were performed using SPSS Version 23.0 (IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp) and Stata Version 13 (StataCorp.2013. Stata Statistical Software: Release 13. College Station, Texas, USA) to check for the percentage of bimaxillary protrusion and to test for Kappa coefficient of intra-reliability and inter-reliability agreement.

Figure 3 Nasolabial angle in bimax patient

Figure 4 Rickett E-line in bimax patient with protrusive lips

The second part of the study involved assessment of extra-oral profile photographs and intra-oral photographs of the right buccal segment view with the aim to assess the prevalence of skeletal and dental Class I bimaxillary protrusion.

Five assessors analysed 259 cases using extra- and intra-oral photographs. All profile photographs were standardised and taken using the same camera as previously. Intra -oral photographs of the right buccal segment view showed an occlusion in maximum intercuspation with incisor

inclination and right buccal occlusion clearly seen (Figure 5).

Figure 5 Occlusion in maximum intercuspation

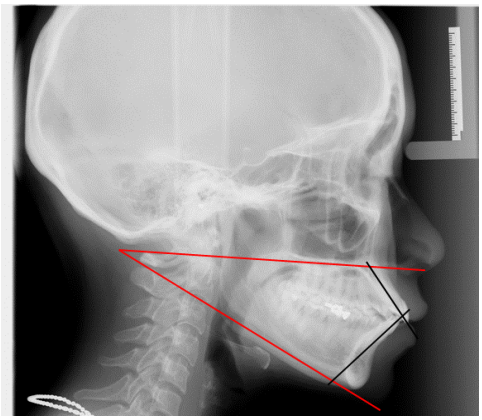

Figure 6 Incisor inclination and inter-incisal angle

Bimaxillary proclination was indicated with the presence of proclined upper and lower incisors and reduced inter-incisal angle. For Caucasians, normal values for upper and lower incisors are 109 ± 6 degrees and 93 ± 6 degrees respectively whilst normal value for inter-incisal angle is 135 ± 10 degrees (14). For Malays population, normal value for upper and lower incisors are 114 ± 6 degrees and 97 ± 6 degrees respectively and normal value for inter-incisal angle is 124 ± 8 degrees (15).

The incisors inclination and inter-incisal angle were eyeballed for whether they were increased or reduced. With the aid of lateral cephalometric view, imaginary lines were drawn for maxillary plane, mandibular plane and along the axes of upper and lower incisors (Figure 6).

Forty out of 259 photographs were randomly selected using Microsoft Excel 2013 version 15.0 (Microsoft Corporation, USA) after a two-week interval for assessment of reliability agreement. Data was analyzed using SPSS Version 23.0 and Stata Version 13 to assess the percentage of skeletal and dental Class I bimaxillary protrusion and to test for inter-reliability agreement between assessors using Kappa statistic.

Result

First Part

The assessment of 100 profile photographs by two assessors showed that the prevalence of bimaxillary protrusion among postgraduate orthodontic patients was ranged 31-37% from the total photographs assessed (Table 1.1).

Time point	Assessor 1 (Q)	Assessor 2 (M)
T1	31 (31%)	35 (35%)
T2	37 (37%)	36 (36%)

Table 1.1 Prevalence of Bimaxillary Protrusion from the Assessment of 100 Profile Photographs.

Table 1.2 showed very good and good agreement for intra-reliability and moderate

	Intra reliability			Inter reliability	
	Kappa score	Strength of agreement		Kappa score	Strength of agreement
Assessor 1	0.87	Very good	T1	0.59	Moderate
Assessor 2	0.80	Good	T2	0.59	Moderate

Table 1.2 Intra and Inter-reliability Agreement of 100 Profile Photographs Assessment by 2 operators on 2 occasions.

agreement for inter-reliability score achieved during assessment of 100 profile photographs.

Second Part

The assessment of 259 photographs as in table 2.1 showed that the prevalence of Class I bimaxillary protrusion (skeletal) had a range of 14–43% with the mean percentage of 31.5 % (SD: 12.08). For bimaxillary proclination (dental), the prevalence was 14-51% with the mean percentage of 35.08 (SD: 15.77).

Reassessment of randomly chosen 40 photographs showed the percentage of Class I bimaxillary protrusion (skeletal) was 28-33% with the mean percentage of 30% (SD: 2.5). Whilst for Class I bimaxillary proclination (dental), the prevalence ranged from 38-40% with the mean percentage of 38.5 % (SD: 1.37) as illustrated in Table 2.2.

Inter-reliability agreement between 5 panel of assessors showed fair agreement for both skeletal and dental component in the first sitting of assessing 259 photographs. Whilst in the second sitting of 40 photographs assessment, result showed very good and good agreement for skeletal and dental component respectively (Table 2.3).

Results from this study showed that the prevalence of bimaxillary protrusion in general among orthodontic patients at UiTM ranging from 31-37 per cent. Whilst the prevalence of skeletal and dental Class I bimax ranging from 28-33 per cent and 38 -40 per cent respectively.

Component	Frequency *n* (%)				
	Assessor 1 (Q)	Assessor 2 (M)	Assessor 3 (S)	Assessor 4 (A)	Assessor 5 (AR)
Skeletal Class I bimax	34 (14.2)	72 (30.9)	50 (26.6)	100 (42.7)	103 (43.1)
Dental Class I bimax	33 (14)	59 (25.2)	67 (36)	115 (49.6)	119 (50.6)

Table 2.1 Prevalence of Skeletal and Dental Class I Bimaxillary Protrusion/ Proclination from the Assessment of 259 Photographs.

Component	Frequency *n* (%)				
	Assessor 1 (Q)	Assessor 2 (M)	Assessor 3 (S)	Assessor 4 (A)	Assessor 5 (AR)
Skeletal Class I bimax	12 (30)	13 (32.5)	13 (32.5)	11 (27.5)	11 (27.5)
Dental Class I bimax	16 (40)	16 (40)	15 (37.5)	15 (37.5)	15 (37.5)

Table 2.2 Prevalence of Skeletal and Dental Class I Bimaxillary Protrusion/ Proclination from the Assessment of 40 Photographs

Time point	Inter reliability	
	Kappa score	Strength agreement
T1 (*n*=259 photographs)		
a) Skeletal Class I bimax	0.40	Fair
b) Dental Class I bimax	0.32	Fair
T2 (*n*=40 photographs)		
a) Skeletal Class I bimax	0.83	Very good
b) Dental Class I bimax	0.73	Good

Table 2.3 Inter-reliability Agreement for Class I Photographs Assessment by 5 assessors

Discussion

Studies on prevalence of malocclusions have been done in various populations worldwide. For example, the proportion of types of malocclusion among Malay, Chinese and Indian school children with permanent dentition in Malaysia have been reported (16). They found that the ethnic group of Malay and Chinese had similar distribution of various types of malocclusion with higher prevalence of Class III malocclusion when compared to the Indian ethnic group. Edge to edge incisor relationship was observed around 54 per cent among Chinese and 50 per cent among Malays. Whilst 50 per cent of Indians showed 2-4 mm of overjet with overbite around 1/3 to 2/3. While in Sweden, the prevalence of malocclusion in an adult Swedish population found to be in the range of 17 to 53 per cent in various age groups.

The prevalence of bimaxillary protrusion and bimaxillary proclination in Trinidad and Tobago school children was 64.4% and 68.8% respectively with 46.6% of the total sample having Class I incisor relationship (17). A study in Nigeria concluded that the prevalence of bimaxillary proclination in their population was found to be 20% with a Class I skeletal antero-posterior jaw relationship being the majority of these patients (8).

As for our study, we found that the prevalence of bimaxillary protrusion in general among UiTM orthodontic patients ranging from 31 per cent to 37 per cent. This value is much higher compared to the study by Isiekwe in 1990 who had relied upon cephalometric value of interincisal angle of or less than 108˚. This difference might be attributed by the different ways of assessing bimaxillary protrusion features. Assessing profile photographs of patients are more subjective compared to looking at the cephalometric values. Assessors might be overestimate bimaxillary protrusive features just by looking at the photographs while at the same time measuring the values on the cephalography might otherwise showing a normal range.

The kappa score between 5 panels in scoring a Class I skeletal and dental bimaxillary protrusion/ proclination showed a fair agreement for both components (0.40 and 0.32 respectively) in the first sitting and a very good and good agreement (0.83 and 0.73 respectively) in the second sitting. During the first sitting of the colour slide photographs assessment, each of the 5 panels assessed the photographs blindly according to own interpretation before any consensus was made. Thus, only fair inter-reliability agreement was reached.

Hence, we have agreed upon consensus on the ways of assessing the photographs to improve our interpretation of the photographs evaluation. The following steps should be undertaken accordingly while assessing patient's photographs in profile view:

1) First step: compare the lower third of the facial convexity to the rest of facial third in order to assess patients profile.

2) Second step: if any difficulty was encountered during the assessment in the first step, close the upper and middle third of the face to allow only the assessment of the lower facial third. Assess the relationship of the soft tissue A and B point and the lips.

Upon taking these steps, thus the improvement of inter-reliability agreement in the second sitting of assessment has been shown.

Conclusion

- The prevalence of bimaxillary protrusion in general among UiTM orthodontic patients was found to range from 31 per cent to 37 per cent.
- The prevalence of skeletal and dental Class I bimax ranging from 28-33 per cent and 38-40 per cent respectively.

Acknowledgement

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