
Association of Vertical Growth Pattern with Various Malocclusions Among Subjects Reporting to An Institutional Set Up

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Abstract: Facial vertical growth pattern plays an important role in achieving facial balance as well as response to orthodontic treatment. Variation in growth pattern, function of soft tissue and jaw musculature has an impact on dentoalveolar tissues thus influencing the pattern of malocclusion. The present study aims to identify the vertical growth patterns and its association with different malocclusion. A retrospective study was conducted using the case records of patients in a private University hospital between June 2019 to March 2020. The sample size consisted of a total of 225 patients based on malocclusion (class I -75, class II - 75, Class III -75) whose data on age, gender, skeletal growth pattern were recorded. Frequency distribution and chi-square tests were applied for statistical analysis in SPSS 20.0. The study results showed that there is a statistically significant association between type of malocclusion and vertical growth pattern ($p=0.026$) vertical growth pattern was common in class II malocclusion. Also there was no statistically significant difference between vertical growth pattern and age ($p= 0.524$), gender ($p=0.178$). Hence it can be concluded that vertical growth pattern is not associated with age, gender but in subjects with class II malocclusion vertical growth pattern is more common than in other malocclusions.

Keywords: Malocclusion, Orthodontics, Treatment plan, Vertical growth pattern., innovation

INTRODUCTION

Vertical growth patterns have certain implications in orthodontic treatment. Different malocclusions are present in the growth pattern (Janson, Metaxas and Woodside, 1994). The vertical growth of the facial sutures and alveolar process is greater than the condylar growth, mandible rotates back clockwise resulting in anterior greater facial height (Broadbent and Bolton, 1975; Rubika, Felicita and Sivambiga, 2015). Growth pattern excess in vertical dimension results in long face, incompetent lips, gingival smile (Schendel *et al.*, 1976). Contrary, in short face over closure of lips may occur due to deficiency of vertical growth (Opdebeeck and Bell, 1978).

The craniofacial growth pattern and malocclusion are important in assessment of effect induced mechanotherapy during growth. For success of any orthodontic treatment, proper diagnosis and treatment planning is required (Pandian, Krishnan and Kumar, 2018). Growth pattern influences the use of functional appliances and growing patience during orthodontic treatment (Bishara and Jakobsen, 1998). Investigation on craniofacial vertical growth pattern and timing of skeleton maturation helps to prevent the chances of relapse in orthodontic patients (Janson *et al.*, 1998).

Orthodontic treatment uses a certain amount of forces on tooth and supporting tissues to bring desirable movement (Felicita and Sumathi Felicita, 2018), this includes correction of rotation, crowding, intrusion, extrusion (Jain, Kumar and Manjula, 2014; Felicita, 2017). Orthodontic tooth movement mainly uses components such as bonded brackets, wires, elastics (Ramesh Kumar *et al.*, 2011; Kamisetty *et al.*, 2015; Samantha *et al.*, 2017). Additional support for orthodontic movement is obtained from extraoral structures, intraoral use of mini screws, implants (Sivamurthy and Sundari, 2016; Felicita and Sumathi Felicita, 2017; Vikram *et al.*, 2017). The Indigenous apparatus can be used in measuring tensile force generated by orthodontic auxiliaries (Dinesh *et al.*, 2013). Various external physiological

factors such as use of drugs, systemic health conditions can affect the orthodontic tooth movement (Krishnan, Pandian and Kumar S, 2015; Viswanath *et al.*, 2015).

Our department is passionate about research we have published numerous high quality articles in this domain over the past years (Kavitha *et al.*, 2014) , (Praveen *et al.*, 2001),(Devi and Gnanavel, 2014), (Putchala *et al.*, 2013), (Vijayakumar *et al.*, 2010), (Lekha *et al.*, 2014a, 2014b) (Danda, 2010) (Danda, 2010) (Parthasarathy *et al.*, 2016) (Gopalakannan, Senthilvelan and Ranganathan, 2012), (Rajendran *et al.*, 2019), (Govindaraju, Neelakantan and Gutmann, 2017), (P. Neelakantan *et al.*, 2015), (PradeepKumar *et al.*, 2016), (Sajan *et al.*, 2011), (Lekha *et al.*, 2014a), (Neelakantan, Grotra and Sharma, 2013), (Patil *et al.*, 2017), (Jeevanandan and Govindaraju, 2018), (Abdul Wahab *et al.*, 2017), (Eapen, Baig and Avinash, 2017), (Menon *et al.*, 2018), (Wahab *et al.*, 2018), (Vishnu Prasad *et al.*, 2018), (Uthrakumar *et al.*, 2010), (Ashok, Ajith and Sivanesan, 2017), (Prasanna Neelakantan *et al.*, 2015). Up to date, there are only very few literature studies available to find the correlation between the malocclusion and growth pattern. The present study aims to assess the association of vertical growth pattern with age, gender and the type of malocclusion.

MATERIALS AND METHODS

Study design and setting

A retrospective study was conducted to find out the prevalence and association of vertical growth pattern among different malocclusion. Case records of 41435 patients with malocclusion who reported to Saveetha dental college were reviewed and the study subjects were selected. Patients from 13 to 40 years of age with vertical growth pattern were selected who reported for treatment of malocclusion were retrieved from June 2019-March 2020.

Ethical approval

Prior permission to utilize the data for study and analysis was obtained from the Institutional Research Committee of the University and was approved under ethical approval number SDC/SIHEC/2020/DIASDATA/0619-0320.

Data Collection

The study included a total of 225 records divided into three groups with 75 pts in each group. Group 1- 75 class I malocclusion cases with vertical growth pattern, group 2- 75 vertical growers with class 2 malocclusion cases with vertical growth pattern, group 3 - 75 vertical growers with class III malocclusion cases with vertical growth pattern were selected. The data was collected based on pre-treatment orthodontic diagnostic case summary. Cross verification of data was done with available radiographs and photographs. For convenience of data analysis the age of the patients were categorised into 2 groups as adolescents 13-20 years and adults 21-40 years.

Statistical analysis

Data on patients' age, gender, vertical growth pattern and type of malocclusion were collected and tabulated in Microsoft Excel and imported to SPSS statistical analysis of version 23.0. Descriptive statistics were used to present the incidence of vertical growth pattern and chi-square association test was done to find the association between age, gender, vertical growth pattern and type of malocclusion. A statistical significance p value <0.05 was considered.

RESULTS AND DISCUSSION

The sample consists of a total of 225 subjects from the three groups. Figure 1 shows age distribution of the patients. Frequency distribution of age group 13-20 years (59.56%), 21-40 years (40.44%). Figure 2 shows gender distribution of the patients, 46.7% of males and 53.3% of females. Figure 3 shows association between vertical growth pattern and type of malocclusion. Class II malocclusion (11.56%) had higher prevalence of vertical growth pattern; there was a statistically significant association between malocclusion and vertical growth pattern $p=0.026$ (Table 1).

Figure 4 shows association between gender and vertical growth pattern. The prevalence of presence of vertical growth pattern was seen higher among males 13.33% compared to females 11.11%; there was no statistical significance between gender and vertical growth pattern $p=0.178$ (Table 2). Figure 5 shows association between age and vertical growth pattern. The prevalence of vertical growth pattern present was highest in the age group of 13-20 years (13.33%) followed by 21-40 years (11.11%); there was no statistically significant association between age and vertical growth pattern $p=0.524$ (Table 3).

The results of the present study shows that there is no association between gender and vertical growth pattern. Blanchette *et al.*, in his longitudinal study found that boys had higher prevalence of vertical growth patterns than girls which could be attributed to the growth spurt (Blanchette *et al.*, 1996), but the drawback is type of malocclusion was not considered in the study.

The results of the present study shows that there is no association between age and vertical growth pattern. Jacob et al , reported the vertical growth changes are taking place maximum at the adolescent age (Jacob and Buschang, 2011) . The factors that could affect the results of our study could be the use of a wide range of age group study participants.

In the present study a significant association of vertical growth pattern and malocclusion was found. It was also seen that the most prevalent type of malocclusion associated with vertical growth pattern was class II. Similar to our present findings, Grippaudo et al. found significant association between upper dental arch and vertical facial pattern in class II malocclusion (Grippaudo *et al.*, 2013). The finding was in support to the present study finding .

In a present study, the prevalence of vertical growth patterns was about 24%. De Almeida et al, in his epidemiological study found the prevalence of vertical growth patterns in Brazilian population was found to be 34.9% (de Almeida Cardoso *et al.*, 2011). Another study by Shaikh et al compared the facial height of Causians and Pakistani population and found a significant difference between the cephalometric values (Shaikh and Alvi, 2009; Felicita, Chandrasekar and Shanthasundari, 2012) . From these inferences, it could be said that different subtypes of populations have differences in facial growth patterns . Since our study subjects were limited to the South Indian population the growth tendencies could vary .

There are very few literature studies available for comparison or association of growth pattern with malocclusion. Large scale study should be done to find out the epidemiology of growth pattern, this could help in ruling out the most prevalent malocclusion associated with growth pattern and will serve as a guide for correct treatment planning in young age group.

CONCLUSION

Within the limits of the present study it can be concluded that vertical growth pattern was highly associated with class II malocclusion and more number of males presented with vertical growth pattern. The association of vertical growth pattern with age groups and gender was not statistically significant.

Authors Contribution

First author (Kiruthika Patturaja) performed the analysis , interpretation and wrote the manuscript. Second author (Ravindra Kumar Jain) contributed to conception, data design , analysis , interpretation and critically revised the manuscript . Third author (Iffat Nasim) participated in the study and revised the manuscript. All the three authors have discussed the results and contributed to the final manuscript .

Conflicts of Interest

Nil

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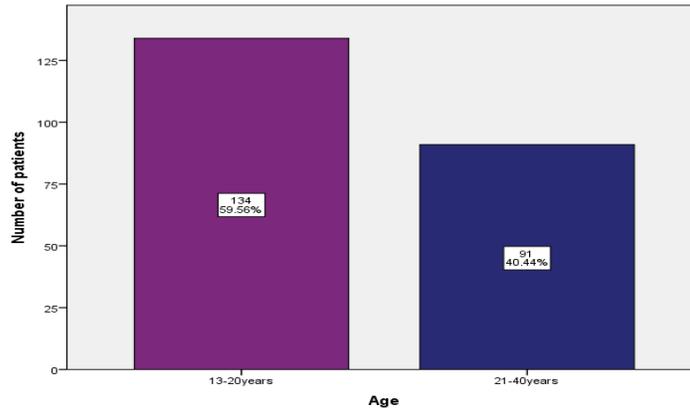


Fig.1: Bar graph shows distribution of different age groups in patients with malocclusion. X axis represents the age group. Y axis represents the number of patients with malocclusion .Frequency distribution of patients with different malocclusion is more prevalent in the age group of 13-20 years.

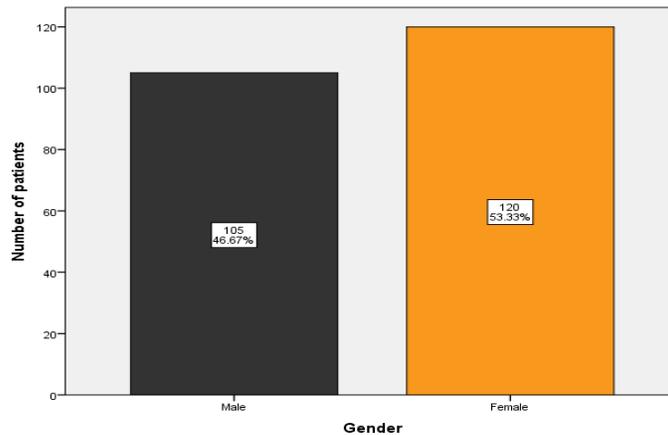


Fig.2: Bar graph shows distribution of gender in patients with different malocclusion. X-axis represents the gender distribution females (orange), males (black). Y axis represents the number of patients with different malocclusion. Frequency distribution of males -46.67% and females -53.33%. Higher incidence of females with different malocclusion.

Table 1 : Chi- square test shows association between malocclusion and vertical growth pattern among patients. There was statistically significant association between malocclusion and vertical growth pattern ($p = 0.026, p < 0.05$)

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.267 ^a	2	.026
Likelihood Ratio	7.230	2	.027
Linear-by-Linear Association	.898	1	.343

N of Valid Cases	225		
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 18.33.			

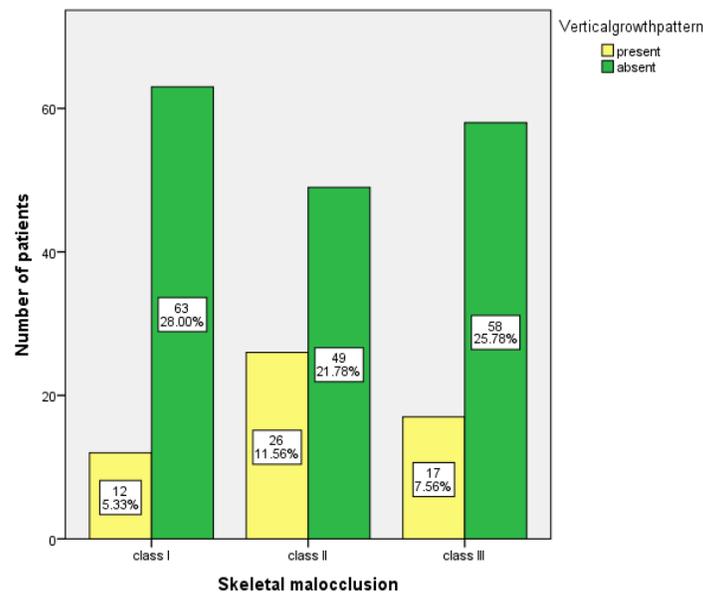


Fig.3 : Bar graph showing association of vertical growth pattern with malocclusion . X axis represents the skeletal malocclusion. Y axis represents the number of patients with vertical growth pattern. Subjects with vertical growth pattern were highest in class II malocclusion. Chi square association test was done and found to be significant (Chi square value =7.267, p = 0.026(<0.05))statistically significant proving vertical growth pattern was more common in class II malocclusion.

Table 2 : Chi- square test shows the association of gender and vertical growth pattern among patients. There was no statistical significance between gender and vertical growth pattern (p = 0.178, p>0.05)

Chi-Square Tests						
	Value	df	Asymp. Sig. (2-sided)	Sig.	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.816 ^a	1	.178			
Continuity Correction ^b	1.421	1	.233			
Likelihood Ratio	1.813	1	.178			
Fisher's Exact Test					.214	.117
Linear-by-Linear Association	1.807	1	.179			
N of Valid Cases	225					

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 25.67.

b. Computed only for a 2x2 table

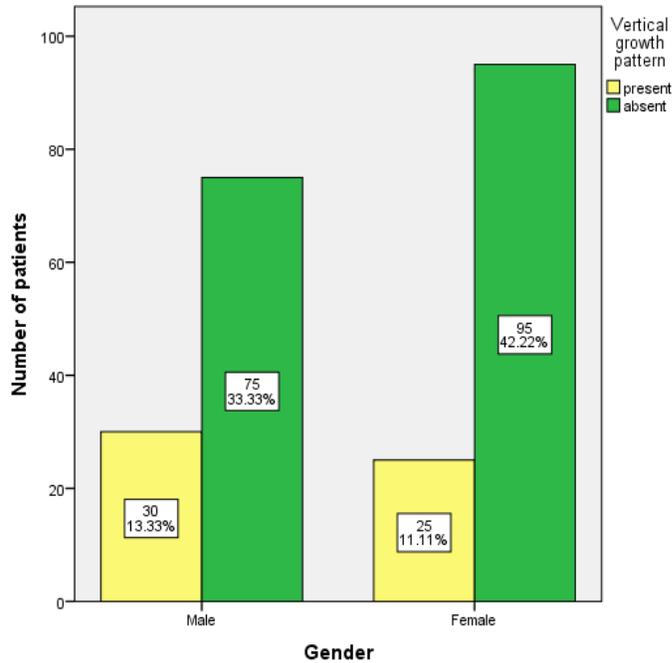


Fig.4 : Bar graph showing association of vertical growth pattern with gender. X axis represents the gender Y axis represents the number of patients with vertical growth pattern present or absent. Vertical growth pattern is more common in males than females. Chi square association test was done and found to be non significant (Chi square value = 1.816, $p = 0.178 (>0.05)$).

Table 3: Chi- square test shows the association between age and vertical growth pattern among patients. There was no statistical significance between age and vertical growth pattern ($p=0.524$. $p>0.05$).

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.294 ^a	2	.524
Likelihood Ratio	1.226	2	.542
Linear-by-Linear Association	1.146	1	.284
N of Valid Cases	225		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 2.69.

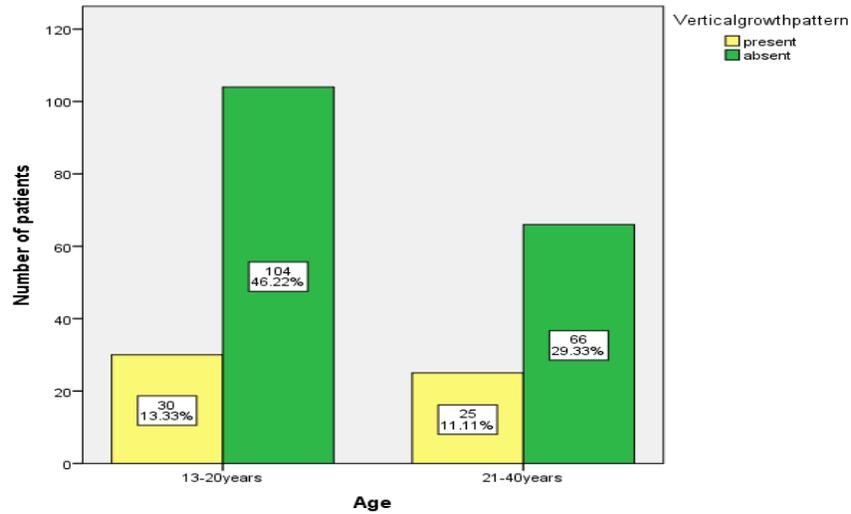


Fig.5 : Bar graph showing association of vertical growth pattern with age. X axis represents the age. Y axis represents the number of patients with vertical growth pattern present or absent . More number subjects in the age group of 13-20 years had a vertical growth pattern. Chi square association test was done and found to be non significant (Chi square value = 1.294, p = 0.524 (>0.05)).`