Analysis of Patients with Skeletal Malocclusion Undergoing Orthognathic Surgery Along with Fixed Orthodontics in a Dental Hospital Setup

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ABSTRACT

Lately, people have become more conscious about their physical appearance. Orthodontic treatment has no doubt in providing a significant effect on facial aesthetics. Commonly treated dental and skeletal malocclusion includes class II and class III, skeletal malocclusions might need orthodontic fixed appliance, orthognathic surgery or a combination of both for its correction. The aim of this study is to analyse the prevalence percentage of patients with skeletal malocclusion undergoing orthognathic surgery along with fixed orthodontics. We reviewed and analysed the data of 86000 patients who visited a dental institutional hospital between June 2019 and March 2020. A total of 60 patients were chosen to be included in this retrospective study. They were diagnosed with either class II or class III malocclusions. Socio-demographic and clinical data of all the 60 patients were collected, such as age, gender, type of skeletal malocclusion, treatment suggested and treatment undergone were retrieved from the patient records provided by Saveetha Dental College and Hospitals. This data was tabulated in excel and analysed using SPSS software. Chi-Square test was performed, and the p-value was determined to evaluate the significance of the variables. Among the patients, 51.7% were males with the peak prevalence of reporting for skeletal malocclusion treatment at the age of 10-30 years (85%). Most predominant dental malocclusion being class II division 1 (38.3%) followed by class III(23.3%). Proclination (40%) and crowding (60%) were other common dental alignment issues in the maxillary and mandibular arches, respectively.

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INTRODUCTION

In recent years physical appearance and facial esthetics have brought an increased consciousness among people for being socially accepted. That being the reason, it isn't surprising to see an increase for orthodontic treatment requirements to a great extent driven by the desire to improve one's appearance (Nurminen, 1999; Story, 1966). Hence, numerous adults visit orthodontists or surgeons to seek help for what they discern to be a social issue.

Orthodontics is concerned with the development of

the dentition, facial growth and occlusion together with the prevention and correction of occlusal anomalies. Diagnosis and treatment planning is of utmost importance for providing a desired result for the patient. The soft-tissue examination has become a crucial segment of orthodontic diagnosis and treatment planning. Photographic assessment of an orthodontic patient is a close portrayal of the appearance of the person (Krishnan *et al.*, 2018). There are several cephalometric analyses available for different applications ascertaining the planes, lines and angles between anthropometric landmarks established by anthropologists and points selected by orthodontists. Certain drawbacks are encountered by these analyses which are based on angular measurements and linear measurements, they are caused due to growth changes and anatomical variations occurring in different reference planes and anatomical landmarks (Rubika *et al.*, 2015). Ratios to assess the dental, skeletal and soft tissue relationships by comparing one segment of the craniofacial complex with another was established to overcome these limitations of conventional analysis (Felicita *et al.*, 2012).

Orthodontic treatment involves the application of forces that are continuous in activity on required or desired areas for the movement of the dentition to the desired place with maximum comfort to the patient (Dinesh *et al.*, 2013). Orthodontic treatment has no uncertainty in providing a noteworthy impact on facial esthetics. Angle perceived that this impact could be for better or in negative ways, stating that the orthodontists "for each of his efforts, whether he realizes it or not, makes for beauty or ugliness, for harmony or disharmony, or for perfection or deformity of the face" (E, 1899). Remembering this, it is of nothing unexpected that philosophies of contemporary orthodontic treatment favour treatment plans that meet thoughts of occlusal and utilitarian amendments and furthermore enhance dental and facial esthetics.

Most commonly treated malocclusions among the population are class II and class III dental and skeletal malocclusions. There are four possible approaches to achieve correction of class II malocclusion, the esthetic and utilitarian objectives, these include treatments that incorporate growth modification, tooth movement to recompense for any jaw disparity (camouflage), combination of those initial two, or the surgical method for the repositioning of the jaws. The treatment of choice in circumstances where the disparity between the mandible and maxilla is huge, skeletal revision either by surgical procedure or by effective growth modification method have opted. Dentoalveolar camouflage treatment

is required if skeletal correction isn't accomplished or isn't reachable with these strategies referenced before alone.

Despite the fact that there is a wide scope of individual variation, such compensation for mandibular retrognathism by customary orthodontic treatment brings about the danger of an increased nasolabial angle, decreased upper lip support and increased facial convexity, these may antagonistically influence facial esthetics (Lo and Hunter, 1982; McNeill and West, 1977).

Several types of research have been reported with concern to growth modifying functional appliance, and facial esthetics has included the appraisal of profile changes, with the presumption that profile changes associated with esthetic improvement (Vargervik and Harvold, 1985). Commonly divulged changes with effective growth modification treatment includes an increased facial height, reduced soft tissue profile convexity, furtherance of all dental, skeletal and soft tissue mandibular structures, and an uncurling of the lower lip, bringing about a reduction in the labiomental angle (Jain *et al.*, 2014; Lange *et al.*, 1995). Despite the functional appliance utilized, these profile changes appeared to be the standard, although considerable individual fluctuation in profile changes is perceived (Pancherz and Anehus-Pancherz, 1994). Based on discoveries from various other studies, asserts that the use of appliances bring about a dramatic improvement in the esthetics of the entire lower face and in an increasingly alluring profile would appear to be justified. Nevertheless, there is minuscule quantitative corroboration to support these asserts (Looi and Mills, 1986). (Heydecke *et al.*, 2005), found that the treatment of class II division 1 malocclusions with functional appliances uncertainly leads to increasingly alluring profiles.

Objectives of orthodontic treatment can be isolated into five categories: dental esthetics, facial esthetics, functional occlusion, periodontal health and stability (Roth, 1992). In conditions where skeletal deformation exists in non-developing adolescents and adults with noteworthy skeletal jaw disparity, the objectives of treatment are frequently difficult to accomplish by orthodontics alone, so both orthodontics and surgery are required to address the dental malposition and therefore the skeletal disharmony. Orthognathic surgeries are used to exact a wide range of minor and major skeletal abnormalities and also dental anomalies, including the jaw and teeth misalignment, which in turn can improve mastication, speech and breathing. It usually takes 18-24 months to complete the combined

orthodontic and surgical treatment (Jamilian *et al.*, 2015).

Mandible deficiency and facial proportions tend to become balanced with combined surgical orthodontic correction of mandibular deficiency (Schendel *et al.*, 1978). This line of thought appears to be reinforced by the certitude that in most cases, facial esthetics are improved after surgical corrections of a skeletal class II malocclusion (Baker and Woods, 2001).

Reports on comparisons of camouflage treatment with functional appliance treatment are still arduous to find. In a study, Battagel et al. (Battagel, 1989), demonstrated that non-extraction functional appliance treatment in general leads to a more commendatory lateral facial profile than does camouflage treatment, while the effect of this profile change on overall facial esthetics was unfortunately not assessed, there appears to be little, if any, information in the literature dealing with orthodontic surgery and fixed appliance playing a combined role in the amendment of skeletal malocclusions. Previously our team had conducted numerous clinical trials (Felicita, 2017a; Jain *et al.*, 2014; Samantha *et al.*, 2017), in-vitro studies (Kamisetty *et al.*, 2015), comparative studies (Kumar *et al.*, 2011; Sivamurthy and Sundari, 2016), case reports (Felicita, 2017b, 2018) and reviews (Krishnan and Pandian, 2015; Vikram *et al.*, 2017; Viswanath *et al.*, 2015) over the past many years. Now we are focusing on epidemiological studies. The idea for this study stemmed from the current interest in our community. With this in mind, this study was aimed to analyse the prevalence of skeletal malocclusion patients undergoing orthodontic surgery along with fixed orthodontics.

MATERIALS AND METHODS

This retrospective study was conducted under a University setting at Saveetha Dental College and Hospitals. The advantage of conducting this study was the ease of Data Collection containing similar ethnicity with the involvement of both the genders. Ethical approval for conducting the study was acquired from the Institutional Scientific Review Board, Saveetha Dental College and Hospitals.

Data collected for this study was from the patients who had visited the institutional dental hospital for treatment between June 2019 and March 2020. A total of 60 patients' details who were diagnosed with skeletal or dental malocclusion were collected. Sampling bias for the study was minimised by including all the required data. Data was gathered from the patient records maintained by the hospital and was then tabulated in excel and then imported into SPSS

software. Incomplete data was verified with the concerned department or patient or excluded from the study.

The collected data included age, gender, skeletal malocclusion, treatment suggestion and treatment done.

A statistical test was done using a chi-square test with SPSS by IBM. Independent variables included age and gender of the participants, whereas the dependent variables included the patients undergoing fixed appliance treatment, skeletal malocclusion cases, patient undergoing orthognathic surgery, patient undergoing both orthognathic and fixed appliance treatment. All of these were analysed using correlation and association.

RESULTS AND DISCUSSION

During the study period, 60 patients whose age ranged from 10 years to 50 years were examined. There was a higher prevalence among males 31 (51.7%) than females 29 (48.3%). The peak age for the prevalence of occurrence of a skeletal malocclusion and its correction was done in the age group of 10-30 years (85%) followed by the 30-50 years age group (15%), (Table 1).

Dental malocclusion was reported highest among the age group of 10-30 years with the predominant being class II division 1 with 38.3% followed by class III (23.53%) whereas among 30-50 yrs class I and class II division 1 subdivision was the most predominant with 33.33% (Graph 1). Proclination (40%) was the most predominant maxillary dental alignment among the dental malocclusion of the participants (Graph 2). Whereas crowding was the most common dental alignment in the mandibular arch with 60% (Graph 3). 23.3% of the population had crossbite, followed by scissor bite (18.3%) as their interact relation (Graph 4). However, 61.7% of the entire population has not undergone treatment for now. Fixed appliance was the most opted treatment by the patients with a prevalence of 25% followed by a combination of fixed appliance and orthognathic surgery (6.6%), and 5% had undergone orthognathic surgery alone (Graph 5).

The patients in this study sample were chosen based on their skeletal and dental malocclusion and also based on the treatment required. Study by (Shell and Woods, 2003), had taken 60 patients having class II division 1 and similarly, in our study the highest predominance was of class II division 1. But on the contrary (Hurtado *et al.*, 2016), showed a higher proportion of class III being predominant. (ICh *et al.*, 2016), also reported a higher preva-

**Table 1: Table representing the gender among the age group of patients involved in the study**

| Age	Gender		
	Female	Male	Total
10-30	24	27	51
30-50	5	4	9
Total	29	31	60
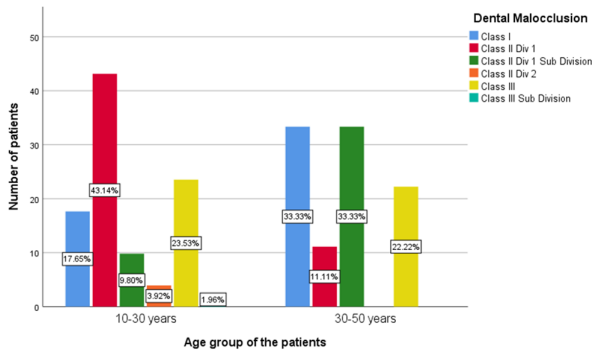
Graph 1: Bar chart represents the correlation of dental malocclusion based on the age group of the study population
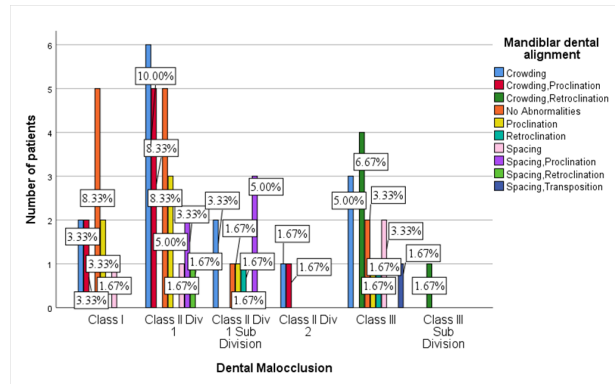
Graph 3: Bar chart correlates the association of mandibular dental alignment based on the dental malocclusion of the study population
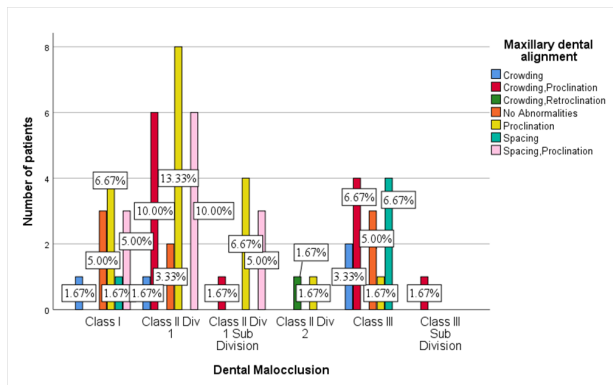
Graph 2: Bar chart correlates the association of maxillary dental alignment based on the dental malocclusion of the study population
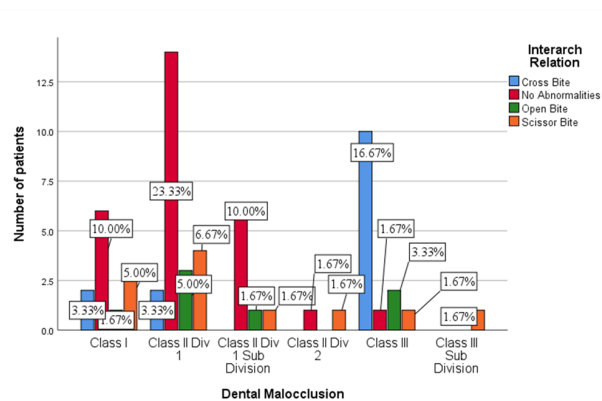

Graph 4: Bar chart correlates the association of interarch relation based on the dental malocclusion of the study population

lence of class II malocclusion among patients, hence supporting our current study.

In the present study, proclination of the dentition was most common among the patients in the maxillary arch, whereas crowding was seen predominantly in the mandibular arch. This statement was supported by an article by (Jamilian *et al.*, 2015), who reported proclination of maxillary dentition and crowding in the mandibular dentition being the highly frequent findings on clinical examination of the patients.

The current study showed 25% of the patients undergoing fixed appliances as a treatment plan.
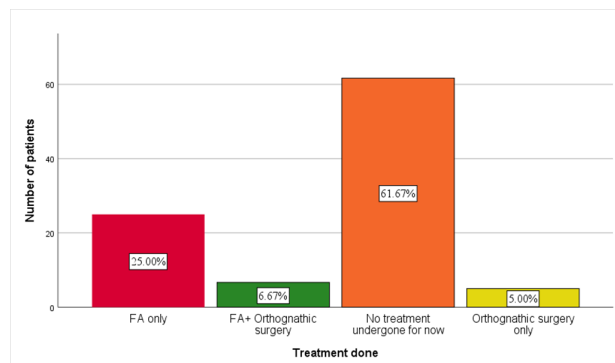
Graph 5: Bar chart represents the distribution of the type of treatment done

This was contradicted by (Hurtado *et al.*, 2016), and (ICh *et al.*, 2016), showing the highest prevalence of treatment being a combination of orthognathic surgery and fixed appliance.

The limitation of the study conducted is the unavailability of location-specific data. Hence, the results of this study must be interpreted with the limitations of this study, and further cohort studies must be done, including a larger sample size. Such a study should also include the patients' economic status, treatment duration, etc.

Graph 1 shows X-axis represents the dental malocclusion based on the age group of the population, and Y-axis represents the number of patients in terms of percentage. The peak incidence of dental malocclusion was among the age group of 10-30 years (85%) and class II division 1 (red) being the most predominant among them with 43.14% followed by 23.53% of class lll (yellow) whereas class I (blue) and Class II division 1 subdivision (green) with 33.33% were the most predominant among the age group of 30-50 years. The prevalence of class II division 1 was most predominant among the age group of 10-30 yrs whereas among 30-50 yrs class I and class II division 1 subdivision was the most predominant. However, the association of dental malocclusion based on the age group of the population was not statistically significant with a p-value >0.05. Pearson Chi-square value= 6.700, df= 5, p value= 0.244 (>0.05).

Graph 2 shows X-axis represents dental malocclusion, and Y-axis represents the number of patients based on the maxillary dental alignment. Based on the dental malocclusion of the patients participated, the most frequent maxillary dental alignment noticed among the participants was proclination (yellow) with 13.33% among class II division 1, class I (6.67%) and class II division 1 subdivision (6.67%) followed by spacing along with proclination (pink) among class II division 1 (10%), class I (5%) and class II division 1 subdivision (5%). The prevalence of proclination was highest among the study population with 40%, however the association was statistically significant with p-value <0.05. Pearson Chi-square value= 61.311, df= 30, p value= 0.001 (<0.05).

Graph 3 shows X-axis represents dental malocclusion, and Y-axis represents the number of patients based on mandibular dental alignment. Based on the dental malocclusion of the patients participated, the most frequent mandibular dental alignment noticed among the participants was crowding (blue) with 10% among class II division 1 followed by class III (5%), whereas crowding with retroclina-

tion (green) was predominant among class III with 6.67%. The prevalence of crowding was highest among the study population with 60%. However, the association was not statistically significant with a p-value >0.05. Pearson Chi-square value= 54.279, df= 45, p value= 0.162 (>0.05).

Graph 4 shows X-axis represents dental malocclusion, and Y-axis represents the number of patients based on interact relation. Based on the dental malocclusion of the patients participated, the most frequent interarch relationship noticed among the participants was of no abnormalities (red) followed by crossbite (blue) among class III and scissor bite (orange) among class II division 1 (6.67%), class I (5%) followed by other dental malocclusions with 1.67%. The prevalence of cross bite was most predominant among the study population, with 23.3% followed by scissor bite (18.3%). However, the association was statistically significant with a p-value <0.05. Pearson Chi-square value= 33.070, df= 15, p value= 0.005 (<0.05).

Graph 5 shows X-axis represents the type of treatment done, and Y-axis represents the number of patients. Majority of patients 61.7% did not undergo any treatment (orange), whereas 25% underwent fixed appliance only (red), 5% patients underwent Orthognathic surgery alone (yellow) and 6.7% underwent a combination therapy including both Orthognathic surgery and fixed appliance (green).

CONCLUSION

The broad term malocclusion includes all types of dental and skeletal malocclusions. Skeletal malocclusions include maxillary and mandibular linear discrepancies, dental malalignment most frequently is also a component of skeletal malocclusions. Skeletal malocclusion in adults usually requires Orthognathic surgery along with pre and post-surgical Orthodontics for correction of the jaw discrepancies. In this study, we observed that the majority of the patients with skeletal malocclusions (67.7%) did not opt for any treatment, or they needed more time to convince themselves for treatment. 25% of the population chose fixed appliances alone for camouflage as their treatment option avoiding Orthognathic surgery because they either feared to go through the surgery or their economic status did not allow them to choose both. 6.7% of the patients went through both Orthodontic and Orthognathic procedures as recommended by their Dentists. Surprisingly 5% of the patients opted for Orthognathic surgery alone as their treatment choice because they did not want to spend the time that was required for fixed appliance therapy which usually

goes for over 18 months. Within the limits of this study, we noticed that the highest population that reported with dental malocclusion belonged to the age group 10-30 years with a male predominance.

Conflict of interest

The authors declare that they have no conflict of interest for this study.

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REFERENCES

Baker, B. W., Woods, M. G. 2001. The role of the divine proportion in the esthetic improvement of patients undergoing combined orthodontic/orthognathic surgical treatment. *The International Journal of adult orthodontics and orthognathic surgery*, 16:108–120.

Battagel, J. M. 1989. Profile changes in Class II, division 1 malocclusions: a comparison of the effects of Edgewise and Frankel appliance therapy. *European Journal of Orthodontics*, 11(3):243–253.

Dinesh, S. S., Arun, A. V., Sundari, K. S., Samantha, C., Ambika, K. 2013. An Indigenously Designed Apparatus for Measuring Orthodontic Force. *Journal of clinical and diagnostic research*, 7(11):2623–2626.

E, A. 1899. Classification of malocclusion. dental Cosmos. St. Louis. 8:248–264.

Felicita, A., Shanthasundari, K. K., Chandrasekar, S. 2012. Determination of craniofacial relation among the subethnic Indian population: A modified approach - (Sagittal relation). *Indian Journal of Dental Research*, 23(3):305–305.

Felicita, A. S. 2017a. Orthodontic management of a dilacerated central incisor and partially impacted canine with unilateral extraction – A case report. *The Saudi Dental Journal*, 29(4):185–193.

Felicita, A. S. 2017b. Quantification of intrusive/retraction force and moment generated during en-masse retraction of maxillary anterior teeth using mini-implants: A conceptual approach. *Dental Press Journal of Orthodontics*, 22(5):47–55.

Felicita, A. S. 2018. Orthodontic extrusion of Ellis Class VIII fracture of maxillary lateral incisor – The sling shot method. *The Saudi Dental Journal*, 30:265–269.

Heydecke, G., Thomason, J. M., Lund, J. P., Feine, J. S. 2005. The impact of conventional and implant supported prostheses on social and sexual activities in edentulous adults. *Journal of Dentistry*, 33(8):649–657.

Hurtado, R. M., Valdivia, I. G., Cedeño, M. O., Herrera, Ó. M. 2016. Surgical-orthodontic treatment for skeletal class III correction. Case report. *Revista Mexicana de Ortodoncia*, 4(4):e258–e268.

ICh, I., R, F., M, S., T, D. 2016. Correction of Severe Orofacial Malformation with a Combination of Orthodontics and Orthognathic Surgery. *Journal of Dentistry and Orofacial Surgery*, 01(04).

Jain, R. K., Kumar, S. P., Manjula, W. S. 2014. Comparison of intrusion effects on maxillary incisors among mini-implant anchorage, j-hook headgear and utility arch. *Journal of clinical and diagnostic research*, 8(7):21–25.

Jamilian, A., Darnahal, A., Perillo, L. 2015. Orthodontic Preparation for Orthognathic Surgery. *A Textbook of Advanced Oral and Maxillofacial Surgery*.

Kamisetty, S. K., Verma, J. K., Arun, S. S., Chandrasekhar, S., Kumar, A. 2015. SBS vs In-house Recycling Methods-An Invitro Evaluation. *Journal of clinical and diagnostic research*, 9(9):4–8.

Krishnan, S., Pandian, A. K. S. S. 2015. Effect of bisphosphonates on orthodontic tooth movement-an update. *Journal of clinical and diagnostic research: JCDR*, 9(4):1–5.

Krishnan, S., Pandian, K., Kumar, S. A. 2018. Angular photogrammetric analysis of the soft-tissue facial profile of Indian adults. *Indian Journal of Dental Research*, 29(2):137–137.

Kumar, K. R. R., Sundari, K. K. S., Venkatesan, A., Chandrasekar, S. 2011. Depth of resin penetration into enamel with 3 types of enamel conditioning methods: A confocal microscopic study. *American Journal of Orthodontics and Dentofacial Orthopedics*, 140(4):479–485.

Lange, D. W., Kalra, V., Broadbent, B. H., Powers, M., Nelson, S. 1995. Changes in soft tissue profile following treatment with the bionator. *The Angle Orthodontist*, 65(6):423–430.

Lo, F. D., Hunter, W. S. 1982. Changes in nasolabial angle related to maxillary incisor retraction. *American Journal of Orthodontics*, 82(5):384–391.

Looi, L. K., Mills, J. R. E. 1986. The effect of two contrasting forms of orthodontic treatment on the facial profile. *American Journal of Orthodontics*, 89(6):507–517.

McNeill, R. W., West, R. A. 1977. Severe mandibular retrognathism: Orthodontic versus surgical orthodontic treatment. *American Journal of Orthodontics*, 72(2):176–182.

Nurminen, L. 1999. Motivation for and satisfaction with orthodontic-surgical treatment: a retrospective study of 28 patients. *The European Journal of*

Orthodontics, 21(1):79–87.

Pancherz, H., Anehus-Pancherz, M. 1994. Facial profile changes during and after Herbst appliance treatment. *The European Journal of Orthodontics*, 16(4):275–286.

Roth, R. 1992. Roundtable: Diagnosis and treatment planning. *J Clin Orthod*, 26:585–585.

Rubika, J., Felicita, A. S., Sivambiga, V. 2015. Gonial Angle as an Indicator for the Prediction of Growth Pattern. *World Journal of Dentistry*, 6(3):161–163.

Samantha, C., Sundari, S., Chandrasekhar, S., Sivamurty, G., Dinesh, S. 2017. Comparative evaluation of two Bis-GMA based orthodontic bonding adhesives-A randomized clinical trial. *Journal of Clinical and Diagnostic Research: JCDR*, 11(4):40–44.

Schendel, S. A., Wolford, L. M., Epker, B. N. 1978. Mandibular deficiency syndrome: III. Surgical advancement of the deficient mandible in growing children: Treatment results in twelve patients. Oral Surgery, Oral Medicine. *Oral Pathology*, 45(3):364–377.

Shell, T. L., Woods, M. G. 2003. Perception of facial esthetics: a comparison of similar class II cases treated with attempted growth modification or later orthognathic surgery. *The Angle Orthodontist*, 73(4):365–373.

Sivamurthy, G., Sundari, S. 2016. Stress distribution patterns at mini-implant site during retraction and intrusion—a three-dimensional finite element study. *Progress in Orthodontics*, 17(1).

Story, R. I. 1966. Psychological issues in orthodontic practice. *American Journal of Orthodontics*, 52(8):584–598.

Vargervik, K., Harvold, E. P. 1985. Response to activator treatment in Class II malocclusions. *American Journal of Orthodontics*, 88(3):242–251.

Vikram, N. R., Prabhakar, R., Kumar, S. A., Karthikeyan, M. K., Saravanan, R. 2017. Ball Headed Mini Implant. *Journal of clinical and diagnostic research*, 11(1):2–3.

Viswanath, A., Ramamurthy, J., Dinesh, S. P. S., Srinivas, A. 2015. Obstructive sleep apnea: awakening the hidden truth. *Nigerian journal of clinical practice*, 18(1):1–7.