



Previously our team had conducted numerous studies which include in vitro studies, [6] review, [7,8] survey [9-12] and clinical trials. [13-20] Now, we are focusing on retrospective studies. Previously our team has a rich experience in working on various research projects across multiple disciplines. [21-35]

Now the growing trend in this area motivated us to pursue this project. In this study, the prevalence of anterior maxillary osteotomy procedure amongst the patients with skeletal class II malocclusion and its correlation with age and gender is focused.

## Methodology

### Study setting

This retrospective study was conducted among patients reporting to the Outpatient Dental Department of Oral Surgery Clinic at Saveetha Dental College, Chennai during the period between June 2019 to May 2020 and was approved by the Institutional Research Board (SDC/SIHEC/2020/DIASDATA/0619-0320).

### Data collection

A total of 86000 patient records were reviewed and analyzed. All the cases of skeletal class II malocclusion from June 2019 to May 2020 were screened. Patients who had undergone treatment for skeletal class II malocclusion were included in the study.

There was no specific inclusion or exclusion criteria for the age and the sex. Patients were divided according to their treatment into the groups 'AMO' and other treatment among

patients with skeletal class II malocclusion. The participants were divided into age groups that included 16-20 years, 21-25 years, 26-30 years, 31-35 years, 35-40 years, 41-45 years and 46-50 years. Also the subgroups were divided according to gender (males and females). All data was gathered and tabulated using Microsoft Excel.

### Statistical analysis

Descriptive statistics was performed to find the prevalence of anterior maxillary osteotomy procedure for the treatment of skeletal class II malocclusion according to age and the sex. Chi-square test was performed to determine the association between the type of treatment done with age and gender of the patients with skeletal class II malocclusion and statistical significance. SPSS software used to perform the statistical tests. The associations was considered to be statistically significant if the probability value was less than 0.05 ( $p < 0.05$ ).

## Results and Discussion

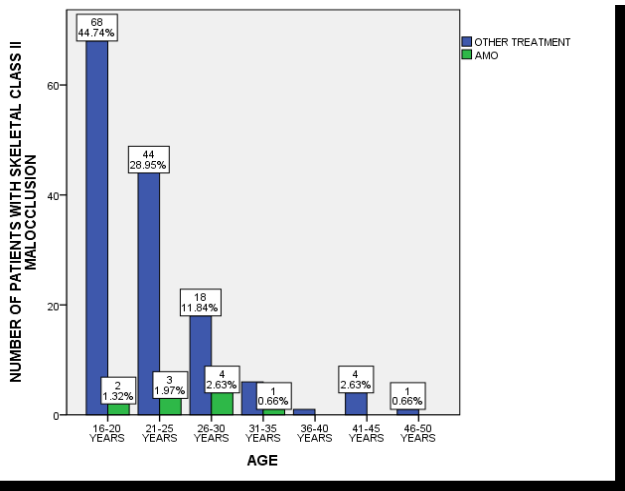
Total 152 cases were included in this study. There were 71 (46.4%) males and 81 (58.6%) females with. Age group 16-20 years had 46.4 % of patients, group 21-25 had 30.3%, group 26-30 had 15.1% of patients, age group 36-40 years and 46-50 years had 7% of patients, 3.9% and 2.6% of the patients were present in the age group 31-35 years and 41-45 years respectively. Out of 152 patients 10 (6.6%) patients had undergone AMO procedure and 142 (93.4%) patients underwent other surgical and orthodontic procedures during the specific period of time. The maximum number of AMO procedures were done during the age group 26-30 years. Total 4 (40%) males and 6 (60%) underwent the AMO procedure for skeletal class II malocclusion. The association between age and treatment did not show statistical significance ( $p < 0.06$ ). Also the association between gender and treatment showed no statistical significance ( $p < 0.67$ ) [Table 1, Table 2, Graph 1].

**Table 1: Represents the frequency distribution of patients with skeletal class II malocclusion according to the age groups. Highest number of patients were observed in the age group between 16-25 years (46.6%); followed by age group 21-25 years (30.3%); age group 26-30 years (15.1%); age group 31-35 years (3.9%); 36-40 years (0.7%); age group 41-45 years (2.6%); 46-50 years (0.7%).**

Age groups	Frequency	Percentage
Age grp 16-20	70	46.1
Age grp 21-25	46	30.3
Age grp 26-30	23	15.1
Age grp 31-35	7	3.9
Age grp 36-40	1	0.7
Age grp 41-45	4	2.6
Age grp 46-50	1	0.7
Total	152	100

**Table 2: Represents the frequency distribution of patients with skeletal class II malocclusion according to the gender. Number of female patients (53.6%) involved in the study were more than the male patients (46.6%).**

Gender	Frequency	Percentage
Male	71	46.4
Female	81	53.6
Total	152	100



**Graph 1:** Bar graph reveals the association of type of treatment done for skeletal class II malocclusion with age of the patients. X-axis denotes age groups of the individuals. Y-axis denotes the number of patients with skeletal class II malocclusion. AMO procedures done are more in the age group of 26-30 years (Green) when compared to other age groups. The association between age and treatment did not show statistical significance  $p=0.06$  ( $p<0.05$ ).

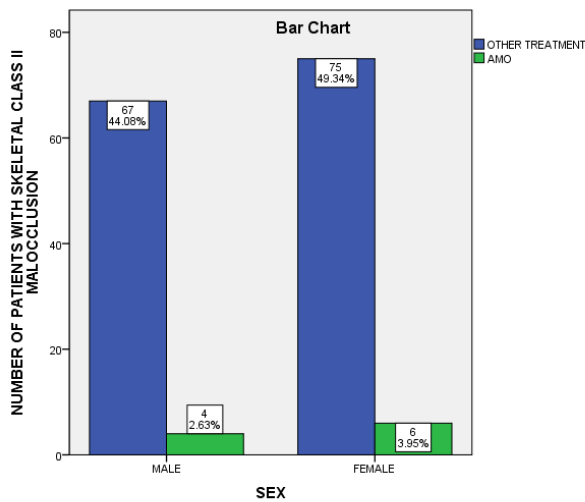
Skeletal class II malocclusions are presented with maxillomandibular skeletal disharmony with underdeveloped mandibular growth and/ or maxillary excess which leads to convex profile. [36] Treatment of Class II malocclusions should ideally focus first on improving the skeletal discrepancy using functional appliances during the active growth phase of an individual. [37] Dentoalveolar compensations, reduced overjet and the severity of the Class II malocclusion, are still the major effect of functional appliances. In adults, the maxillomandibular position in relation to cranial base can be adjusted with orthognathic surgery to improve the facial esthetics. However, part of the Class II malocclusion can be treated with dentoalveolar compensation alone and also other methods have been advocated in the literature. Our institution is passionate about high quality evidence based research and has excelled in various fields. [38-44] Anterior maxillary

osteotomy is a simple and reliable procedure in the management of dentofacial deformities. However, there is very little information available in the literature about this procedure. Due to the recent advancements in orthodontic-orthognathic treatments and the associated complications, the necessity of anterior maxillary osteotomy is declined. [45] The complications observed in AMO perioperatively are similar to that reported in Le fort I osteotomies and vary from minor complications like dental hypersensitivity to the loss of osteotomy segment due to avascular necrosis. [46] Some of the complications in anterior maxillary osteotomy are completely different from those which are encountered during a Le fort I osteotomy. Difficulty in the planning with the movement of the segment with desired vascularity is the main concern. [47] Apart from this complications like airway disturbances, undesirable occlusion, increased interdental spacing also soft tissue and vascularity related complications like palatal tear, palatal hematoma, partial necrosis of the segment and butthole defect are advocated in the literature.

The anterior maxillary osteotomy was used very commonly in earlier times of the orthognathic surgery; however, it is slowly getting phased out due to advancement in the orthodontic-orthognathic surgical treatment planning, and improved in the results using planned full jaw procedures. Some surgeons still prefer to perform the anterior maxillary osteotomy over other orthodontic-orthognathic surgical procedures. This study has been done to evaluate the prevalence of the anterior maxillary osteotomy procedures amongst other orthodontic and orthognathic surgical procedures. In this study it was observed that 10 (6.6%) patients had undergone AMO procedure while 142 (93.4%) patients underwent other orthodontic and surgical procedures. The number of patients treated with surgical procedures were less than the patient treated with orthodontic treatment. The limitations of the study includes, less sample size and the duration of the study. The association between age and treatment did not show statistical significance ( $p<0.06$ ). Also the association between gender and treatment showed no statistical significance ( $p<0.67$ ) maybe because of the inadequate sample size [Table 3, Graph 2].

**Table 3: Represents the frequency distribution of patients with skeletal class II malocclusion according to the type of treatment done. Number of female patients (53.6%) involved in the study were more than the male patients (46.6%).**

Type of treatment	Frequency	Percentage
Other treatment	142	93.4
AMO	10	6.6
Total	152	100



**Graph 2:** Bar graph represents association between gender and the type of treatment done for skeletal class II malocclusion with age of the patients. X-axis represents the gender of the patients and Y-axis denotes the number of individuals within skeletal class II malocclusion. AMO procedures done are more in the females compared to males. There is no significant difference in the prevalence of AMO according to the gender  $p=0.67$  ( $p<0.05$ ).

## Conclusion

Within the limit of this study we can conclude that the prevalence of the anterior maxillary osteotomy procedure is less as compared to the other orthognathic and orthodontic procedures. The prevalence of AMO procedure was maximum in the age group between 26-30 years. No significant difference was seen between the prevalence of the procedure in males and females. Awareness about surgical treatment and presurgical counselling should be done for patients with dento-skeletal deformities.

## References

- Kannan VS, Narayanan GRS, Ahamed AS, Velaven K, Elavarasi E, Danavel C. Anterior maxillary osteotomy: A technical note for superior repositioning: A bird wing segment. *J Pharm Bioallied Sci.* 2014;6(S1):S107-9.
- Steinhauser EW. Historical development of orthognathic surgery. *J Craniomaxillofac Surg.* 1996;24(4):195-204.
- Thyne GM, Ferguson JW, Pilditch FD. Endotracheal tube damage during orthognathic surgery. *Int J Oral Maxillofac Surg.* 1992;21(2):80.
- Nout E. On the Le Fort III osteotomy. 2010.
- Noma H, Kakizawa T, Kukimoto Y, Tanabe K, Omori K. New method of anterior maxillary osteotomy. *Jap J Oral Maxillofac Surg.* 1981;27:1158-63.
- Marimuthu M, Andiappan M, Wahab A, Muthusekhar MR, Balakrishnan A, Shanmugam S. Canonical Wnt pathway gene

expression and their clinical correlation in oral squamous cell carcinoma. *Indian J Dent Res.* 2018;29(3):291-7.

- Packiri S, Gurunathan D, Selvarasu K. Management of paediatric oral ranula: A systematic review. *J Clin Diagn Res.* 2017;11(9):ZE06-9.
- Mp SK. The emerging role of botulinum toxin in the treatment of orofacial disorders: Literature update. *Asian J Pharm Clin Res.* 2017;10(9):21-29.
- Mp SK, Rahman R. Knowledge, awareness, and practices regarding biomedical waste management among undergraduate dental students. *Asian J Pharm Clin Res.* 2017;10(8):341-5.
- Kumar S, Sneha S. Knowledge and awareness regarding antibiotic prophylaxis for infective endocarditis among undergraduate dental students. *Asian J Pharm Clin Res.* 2016;9(2):154-159.
- Rahman R, Mp SK. Knowledge, attitude and awareness of dental undergraduate students regarding human immunodeficiency virus/acquired immunodeficiency syndrome patients. *Asian J Pharm Clin Res.* 2017;10(5):175-80.
- Patturaja K, Pradeep D. Awareness of basic dental procedure among general population. *Res J Pharma Tech.* 2016;9(9):1349-51.
- Jesudasan JS, Wahab PUA, Sekhar MRM. Effectiveness of 0.2% chlorhexidine gel and a eugenol-based paste on postoperative alveolar osteitis in patients having third molars extracted: A randomised controlled clinical trial. *Br J Oral Maxillofac Surg.* 2015;53(9):826-30.
- Patil SB, Durairaj D, Suresh Kumar G, Karthikeyan D, Pradeep D. Comparison of extended nasolabial flap versus buccal fat pad graft in the surgical management of oral submucous fibrosis: A prospective pilot study. *J Maxillofac Oral Surg.* 2017;16(3):312-21.
- Christabel A, Anantanarayanan P, Subash P, Soh CL, Ramanathan M, Muthusekhar MR, et al. Comparison of pterygomaxillary dysjunction with tuberosity separation in isolated Le Fort I osteotomies: A prospective, multi-centre, triple-blind, randomized controlled trial. *Int J Oral Maxillofac Surg.* 2016;45(2):180-5.
- Mp SK. Relationship between dental anxiety and pain experience during dental extractions. *Asian J Pharm Clin Res.* 2017;10(3):458-61.
- Rao TD, Kumar MP. Analgesic efficacy of paracetamol vs. ketorolac after dental extractions. *Res J Pharma Tech.* 2018;11(8):3375-9.
- Abhinav RP, Selvarasu K, Maheswari GU, Taltia AA. The patterns and etiology of maxillofacial trauma in South India. *Ann Maxillofac Surg.* 2019;9(1):114-7.
- Sweta VR, Abhinav RP, Ramesh A. Role of virtual reality in pain perception of patients following the administration of local anesthesia. *Ann Maxillofac Surg.* 2019;9(1):110-3.
- Jain SV, Jain VS, Muthusekhar MR, Baig MF, Senthilnathan P, Loganathan S, et al. Evaluation of three-dimensional changes in pharyngeal airway following isolated lefort one osteotomy for the correction of vertical maxillary excess: A prospective study. *J Maxillofac Oral Surg.* 2019;18(1):139-146.
- Ponnulakshmi R, Shyamaladevi B, Vijayalakshmi P, Selvaraj J. In silico and in vivo analysis to identify the antidiabetic activity of beta sitosterol in adipose tissue of high fat diet and sucrose induced type-2 diabetic experimental rats. *Toxicol Mech Methods.* 2019;29(4):276-90.

22. Mathew MG, Samuel SR, Soni AJ, Roopa KB. Evaluation of adhesion of Streptococcus mutans, plaque accumulation on zirconia and stainless steel crowns, and surrounding gingival inflammation in primary molars: randomized controlled trial. *Clin Oral Investig*. 2020;24(9):3275-80.
23. Subramaniam N, Muthukrishnan A. Oral mucositis and microbial colonization in oral cancer patients undergoing radiotherapy and chemotherapy: A prospective analysis in a tertiary care dental hospital. *J Investig Clin Dent*. 2019;10(4):e12454.
24. Girija ASS, Shankar EM, Larsson M. Could SARS-CoV-2-induced hyperinflammation magnify the severity of Coronavirus Disease (CoViD-19) leading to acute respiratory distress syndrome? *Front Immunol*. 2020;11:1206.
25. Dinesh S, Kumaran P, Mohanamurugan S, Vijay R, Singaravelu DL, Vinod A, et al. Influence of wood dust fillers on the mechanical, thermal, water absorption and biodegradation characteristics of jute fiber epoxy composites. *J Polym Res*. 2020;27(1).
26. Thanikodi S, Singaravelu D Kumar, Devarajan C, Venkatraman V, Rathinavelu V. Teaching learning optimization and neural network for the effective prediction of heat transfer rates in tube heat exchangers. *Therm Sci*. 2020;24(1 Part B):575-81.
27. Murugan MA, Jayaseelan V, Jayabalakrishnan D, Maridurai T, Kumar SS, Ramesh G, et al. Low velocity impact and mechanical behaviour of shot blasted SiC wire-mesh and silane-treated aloevera/hemp/flax-reinforced SiC whisker modified epoxy resin composites. *Silicon Chem*. 2020;12(8):1847-56.
28. Vadivel JK, Govindarajan M, Somasundaram E, Muthukrishnan A. Mast cell expression in oral lichen planus: A systematic review. *J Investig Clin Dent*. 2019;10(4):e12457.
29. Chen F, Tang Y, Sun Y, Veeraraghavan VP, Mohan SK, Cui C. 6-shogaol, an active constituents of ginger prevents UVB radiation mediated inflammation and oxidative stress through modulating NrF2 signaling in human epidermal keratinocytes (HaCaT cells). *J Photochem Photobiol B*. 2019;197:111518.
30. Manickam A, Devarasan E, Manogaran G, Priyan MK, Varatharajan R, Hsu C-H, et al. Score level based latent fingerprint enhancement and matching using SIFT feature. *Multimed Tools Appl*. 2019;78(3):3065-85.
31. Wu F, Zhu J, Li G, Wang J, Veeraraghavan VP, Krishna Mohan S, et al. Biologically synthesized green gold nanoparticles from induce growth-inhibitory effect on melanoma cells (B16). *Artif Cells Nanomed Biotechnol*. 2019;47(1):3297-305.
32. Ma Y, Karunakaran T, Veeraraghavan VP, Mohan SK, Li S. Sesame inhibits cell proliferation and induces apoptosis through inhibition of STAT-3 translocation in thyroid cancer cell lines (FTC-133). *Biotechnol Bioprocess Eng*. 2019;24(4):646-52.
33. Ponnaniakamideen M, Rajeshkumar S, Vanaja M, Annadurai G. In vivo type 2 diabetes and wound-healing effects of antioxidant gold nanoparticles synthesized using the insulin plant *Chamaecostus cuspidatus* in albino rats. *Can J Diabetes*. 2019;43(2):82-9.e6.
34. Vairavel M, Devaraj E, Shanmugam R. An eco-friendly synthesis of Enterococcus sp.-mediated gold nanoparticle induces cytotoxicity in human colorectal cancer cells. *Environ Sci Pollut Res Int*. 2020;27(8):8166-75.
35. Paramasivam A, Priyadharsini VJ, kumar RS. N6-adenosine methylation (m6A): a promising new molecular target in hypertension and cardiovascular diseases. *Hypertens Res*. 2020;43(2):153-4.
36. Papadopoulos MA. Skeletal anchorage in orthodontic treatment of class II malocclusion: Contemporary applications of orthodontic implants, miniscrew implants and miniplates. Mosby. 2014;312.
37. Papadopoulos MA. Skeletal anchorage in orthodontic treatment of class II malocclusion e-book: Contemporary applications of orthodontic implants, miniscrew implants and mini plates. Elsevier Health Sciences. 2014;416.
38. Vijayashree PJ. In silico validation of the non-antibiotic drugs acetaminophen and ibuprofen as antibacterial agents against red complex pathogens. *J Periodontol*. 2019;90(12):1441-8.
39. Ezhilarasan D, Apoorva VS, Ashok Vardhan N. Syzygium cumini extract induced reactive oxygen species-mediated apoptosis in human oral squamous carcinoma cells. *J Oral Pathol Med*. 2019;48(2):115-21.
40. Ramesh A, Varghese S, Jayakumar ND, Malaiappan S. Comparative estimation of sulfiredoxin levels between chronic periodontitis and healthy patients - A case-control study. *J Periodontol*. 2018;89(10):1241-8.
41. Mathew MG, Samuel SR, Soni AJ, Roopa KB. Evaluation of adhesion of Streptococcus mutans, plaque accumulation on zirconia and stainless steel crowns, and surrounding gingival inflammation in primary molars: randomized controlled trial. *Clin Oral Investig*. 2020;24(9):3275-3280.
42. Sridharan G, Ramani P, Patankar S, Vijayaraghavan R. Evaluation of salivary metabolomics in oral leukoplakia and oral squamous cell carcinoma. *J Oral Pathol Med*. 2019;48(4):299-306.
43. Pc J, Marimuthu T, Devadoss P. Prevalence and measurement of anterior loop of the mandibular canal using CBCT: A cross sectional study. *Clin Implant Dent Relat Res*. 2018;20(4):531-534.
44. Ramadurai N, Gurunathan D, Samuel AV, Subramanian E, Rodrigues SJL. Effectiveness of 2% Articaine as an anesthetic agent in children: Randomized controlled trial. *Clin Oral Investig*. 2019;23(9):3543-50.
45. Gunaseelan R, Anantanarayanan P, Veerabahu M, Vikraman B, Sripral R. Intraoperative and perioperative complications in anterior maxillary osteotomy: A retrospective evaluation of 103 patients. *J Oral Maxillofac Surg*. 2009;67(6):1269-73.
46. Kramer F-J, Baethge C, Swennen G, Teltzrow T, Schulze A, Berten J, et al. Intra- and perioperative complications of the LeFort I osteotomy: A prospective evaluation of 1000 patients. *J Craniofac Surg*. 2004;15(6):971-7.
47. Rosenquist B. Anterior segmental maxillary osteotomy. A 24-month follow-up. *Int J Oral Maxillofac Surg*. 1993;22(4):210-3.