INCIDENCE OF INFRA ORBITAL NERVE INJURY FOLLOWING MAXILLARY ORTHOGNATHIC SURGICAL PROCEDURES

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Abstract

Objectives: The orthognathic surgeries done in the maxilla to some extent affect the infra orbital nerve and are usually caused by anterior maxillary osteotomy (AMO) and le fort 1 osteotomy. Hence these 2 surgeries and the incidence of nerve injury in them is assessed. The most common nerve injuries of the maxilla are the infra orbital nerve (ION). The aim of this study was to assess the incidence of nerve injuries following orthognathic surgical procedures done in the face. Infraorbital nerve (branch of maxillary branch of Trigeminal nerve) was the nerve taken for assessment.

Materials and Methods: In this retrospective study, the data was collected from the hospital database and further analysis was done and the results were tabulated. A statistical analysis of the collected data regarding the variance among the different nerves injured in different mid facial fractures were assessed.

Results: Of the 88 participants, 49 were female and 39 were male. Of the participants, 5.7% had an incidence of infraorbital nerve injury while 94.3 % did not experience any incidence of infraorbital nerve injury.

Conclusion: The incidence of infraorbital nerve injury is present in about 6% of cases where orthognathic surgery has been performed in the maxilla. There is a significant association between infraorbital nerve injury and orthognathic surgery of the maxilla.

Keywords: orthognathic surgery, maxilla, le fort 1 osteotomy, anterior maxillary osteotomy.

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1. Introduction

In the late 1800s, the first surgical procedures for treating anterior mandibular open bite were described; however, it wasn't until the middle of the 20th century that these procedures were widely accepted. (1) For a successful procedure, careful planning is necessary. The course of treatment includes following a precise treatment plan, using the appropriate instruments for a given procedure, performing a thorough surgical routine, and adhering to the rules for each routine. Although identical orthognathic surgical methods are employed, there are a number of significant variations for each osteotomy. (2) To deliver efficient and secure surgical care to the patient with facial deformities, the surgeon must be aware of these distinctions. Numerous criteria, such as the reason for the osteotomy, affect the choice of the best osteotomy technique. The best osteotomy technique to use depends on a number of variables, including the reason for treatment, the therapy's objective, the patient's profile, underlying medical issues, and the scope of the operation. (3,4)

The maxilla's skeletal abnormalities can be fixed with a maxillary surgical procedure or a modified version of it. The maxilla can be independently moved in three dimensions using current surgical methods. (5) When done under direct view, segmenting the maxilla also makes it possible to rearrange certain parts in various three-dimensional planes. The lips, cheeks, and nose's soft tissues change as a result of the maxilla's shifting posture. With the exception of nasal breadth, changes in the nasal complex following orthognathic surgery are complex and unpredictable. The authors emphasize that there should be no dogma about the order of maxillary or mandibular surgery after providing a comprehensive overview. Any surgical choice must be chosen after careful consideration, planning, and flexibility. (6)

Maxillofacial surgeons perform the LeFort 1 osteotomy to treat a variety of dentofacial abnormalities. It is being used for a variety of purposes due to its popularity and simplicity. If the proper preoperative and intraoperative procedures are followed, the osteotomy can be carried out swiftly and effectively. This procedure's complication profile is well known, thus it should be known before it is carried out. (7) The accuracy of maxillary motions in relation to long-term stability and relapse has been the subject of recent studies. Overall, the LeFort 1 osteotomy is a common, safe, and predictable orthognathic procedure with consistent long-term outcomes. A common procedure for treating maxillary protrusion is anterior maxillary osteotomy. In those years, various operational fields had changes or improvements to prevent various issues.

Complications were more likely to occur in patients with severe anatomical anomalies, like cleft lip and palate. Nearly half of the problems were experienced by these patients, who made up 11.5% of the total. (8,9) Patients were also more likely to experience problems if they had segmental LeFort 1 osteotomies or anterior motions larger than 9 mm. In these particular circumstances, careful prior preparation and adequate preoperative consulting should be used. It is advised to make an effort to limit maxillary movement, such as with surgery of both jaws. (10) Our team has extensive knowledge and research experience that has translate into high quality publications[1–10]. The aim of this study was to assess the incidence of nerve injuries following orthognathic surgical procedures done in the face. Infraorbital nerve (branch of maxillary branch of Trigeminal nerve) was the nerve taken for assessment.

2. Materials and Methods

This retrospective study examined the records of patients from 01 June 2020 to 01 January 2022 who visited university dental hospital. The study population included patients that have undergone orthognathic surgery. The study sample included both male and female gender, predominantly south indians. The study population was 157 patients who had undergone orthognathic surgery and was further reduced to 88 since only that number of people underwent orthognathic surgery in the maxilla, specifically AMO and le fort 1 osteotomies among those who visited the university hospital. Sample size was incurred from these patients which was 88 patients. The necessary data such as gender, the nerve injuries, the type of surgery was recorded. Incomplete patient records were excluded. Data were recorded in Microsoft Excel and exported to the statistical package of social science for windows (SPSS) and subjected to statistical analysis. Chi square tests are used for comparison of groups.

3. Results

According to Figure 1, on the basis of gender distribution 44.32% of males and 55.68% of females were considered for the study. According to Figure 2, incidence of nerve injuries is taken into consideration. 5.67% represents the participants in whom nerve injuries occurred while 94.32% represents the ones in whom there was no occurrence of nerve injuries. According to Figure 3, the type of orthognathic surgery performed for each patient is considered of which 50% of the patients have undergone AMO, 35.23% have undergone Le fort 1 osteotomy and 14.77% have undergone both simultaneously. According to Figure 4, the association between the type of

surgery performed and the gender is taken into consideration. The nerve injuries occurring in maxillary orthognathic surgery is 2.27% in females and 3.41% in males while the ones that have not incurred any nerve injuries are 53.41% in females and 40.91% in males. According to Figure 5, the association between the type of surgery performed and the incidence of nerve injury is taken into consideration. The nerve injuries occurring in AMO type of surgery and is 1.14% while nerve injuries don't occur in 48.86% of cases, the ones occurring in Le fort 1 type of surgery and the incidence 2.27% while no nerve injuries are seen in 32.95% of cases. When both surgeries are performed the incidence is 2.27% while no nerve injury was seen in 12.50% of cases.

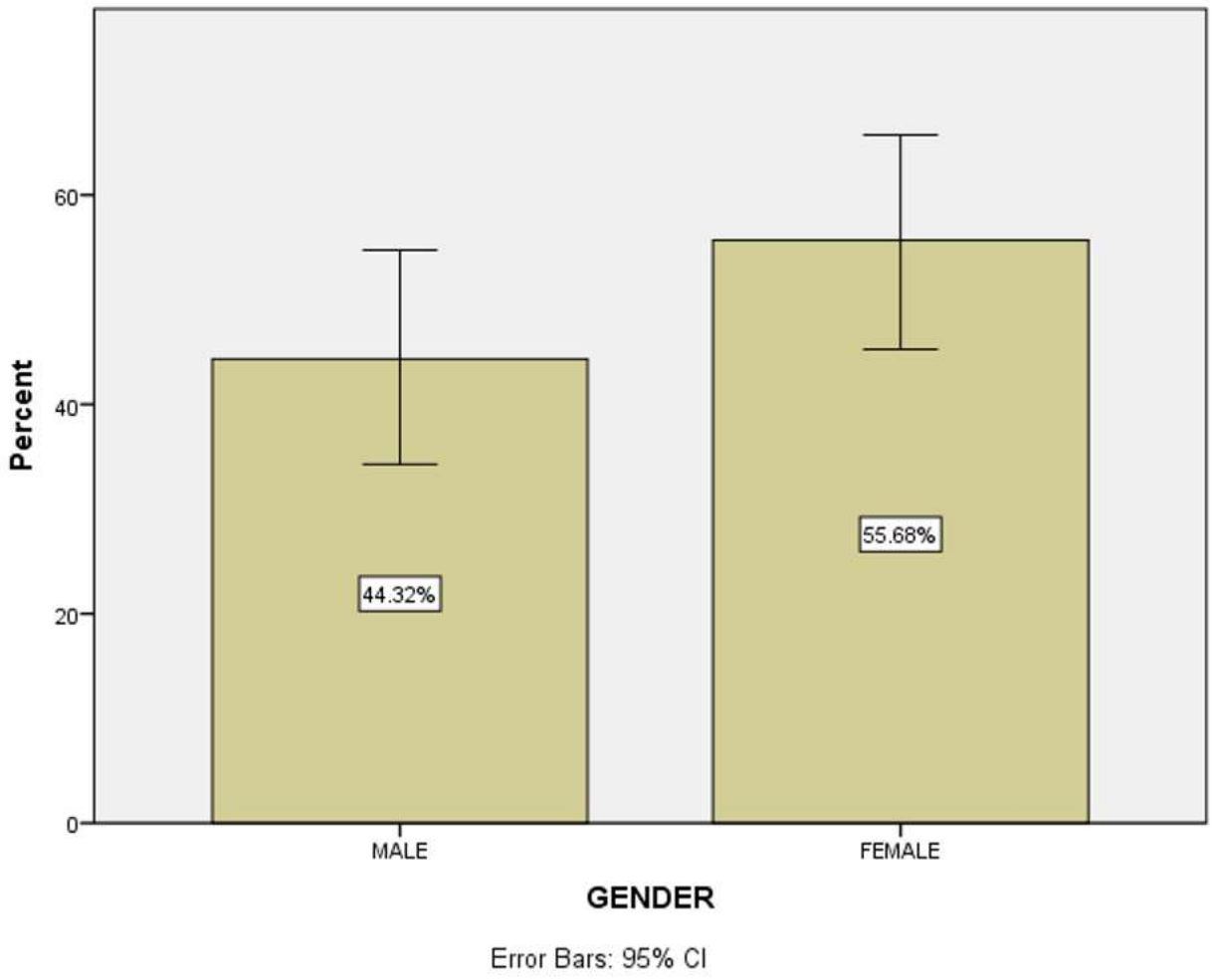

Figure 1: Graph representing the gender distribution.
44.32% were males and 55.68% were females in this study.

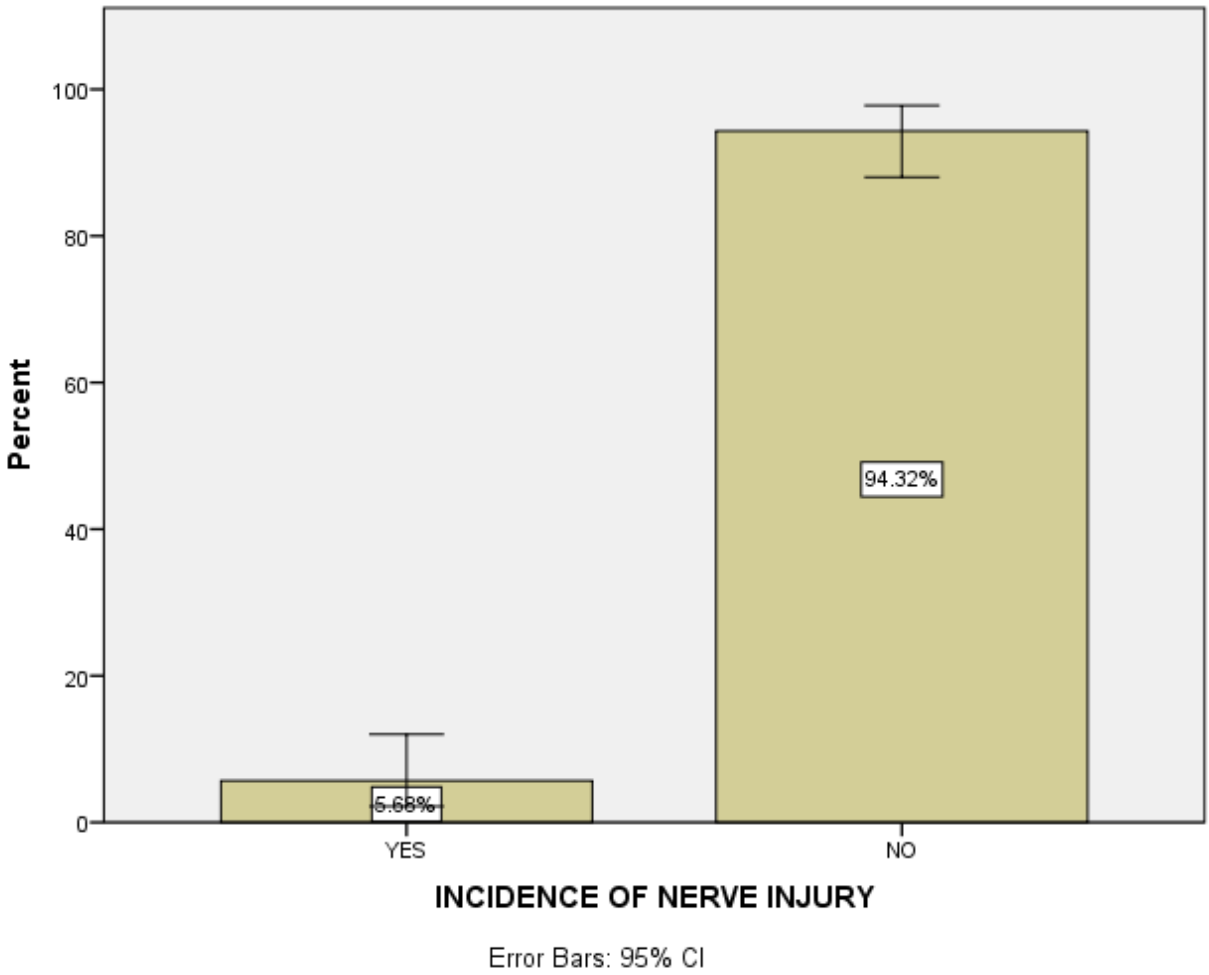

Figure 2: Graph representing incidence of nerve injuries.
5.67% represents the participants in whom nerve injuries occurred while 94.32% represents the ones in whom there was no occurrence of nerve injuries.

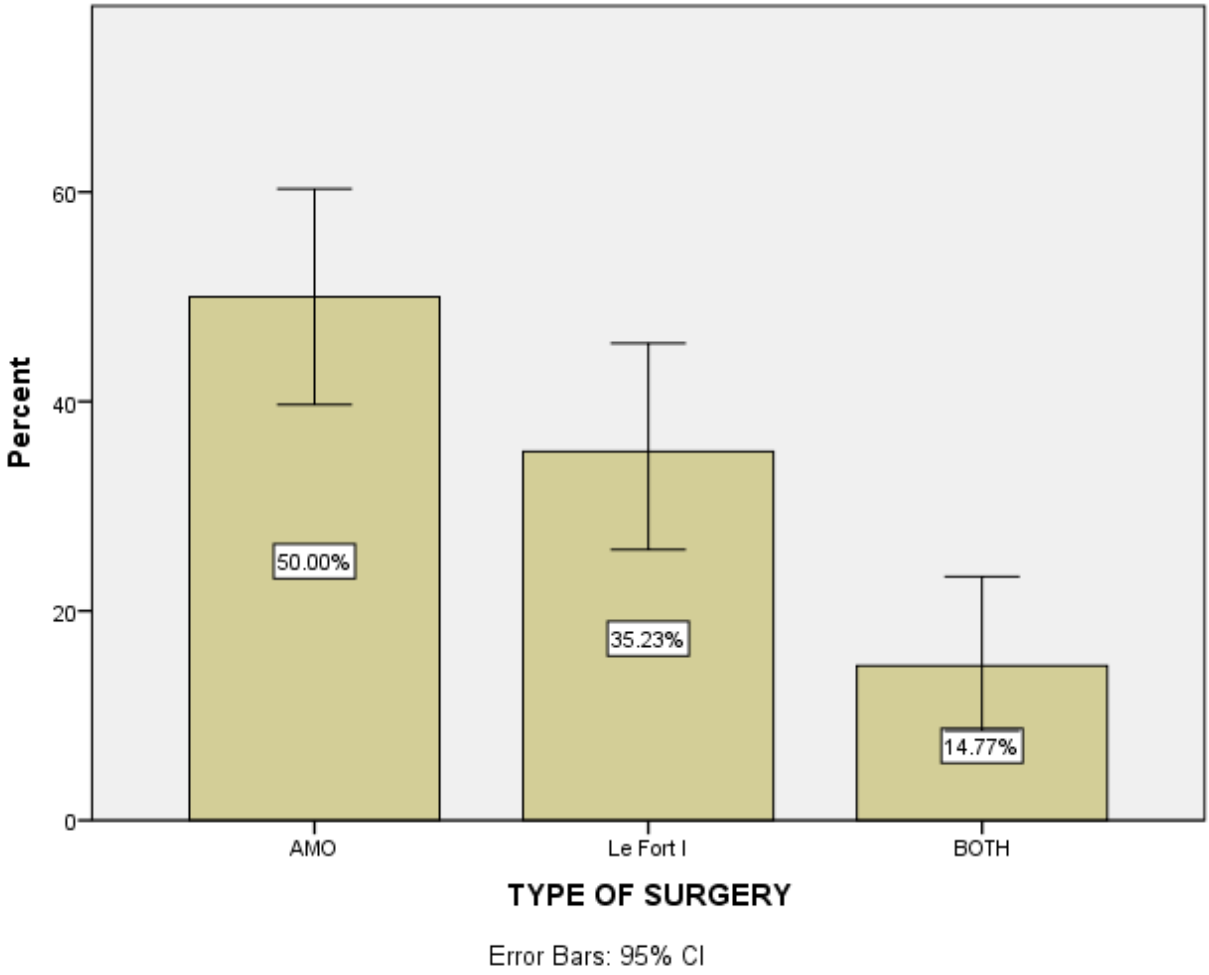

Figure 3: Graph representing the type of orthognathic surgery performed for each patient.
50% of the patients have undergone AMO, 35.23% have undergone Le fort 1 osteotomy and 14.77% have undergone both simultaneously

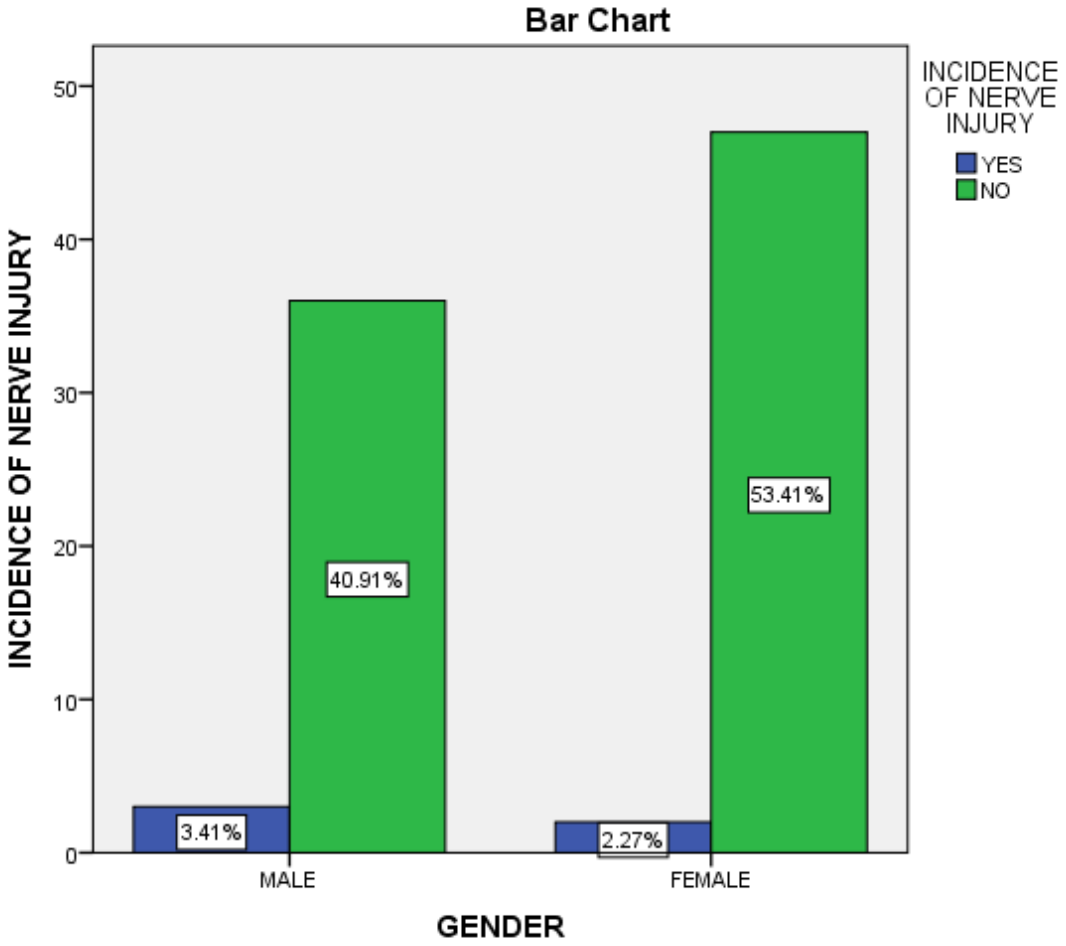

Figure 4: Graph representing the association between the type of surgery performed and the gender. The nerve injuries occurring in maxillary orthognathic surgery is 2.27% in females and 3.41% in males while the ones that have not incurred any nerve injuries are 53.41% in females and 40.91% in males. Chi square test was done and the association was found to be statistically significant ($p<0.05$). This shows that the results are statistically significant in the incidence of nerve injury incurred due to different osteotomies.

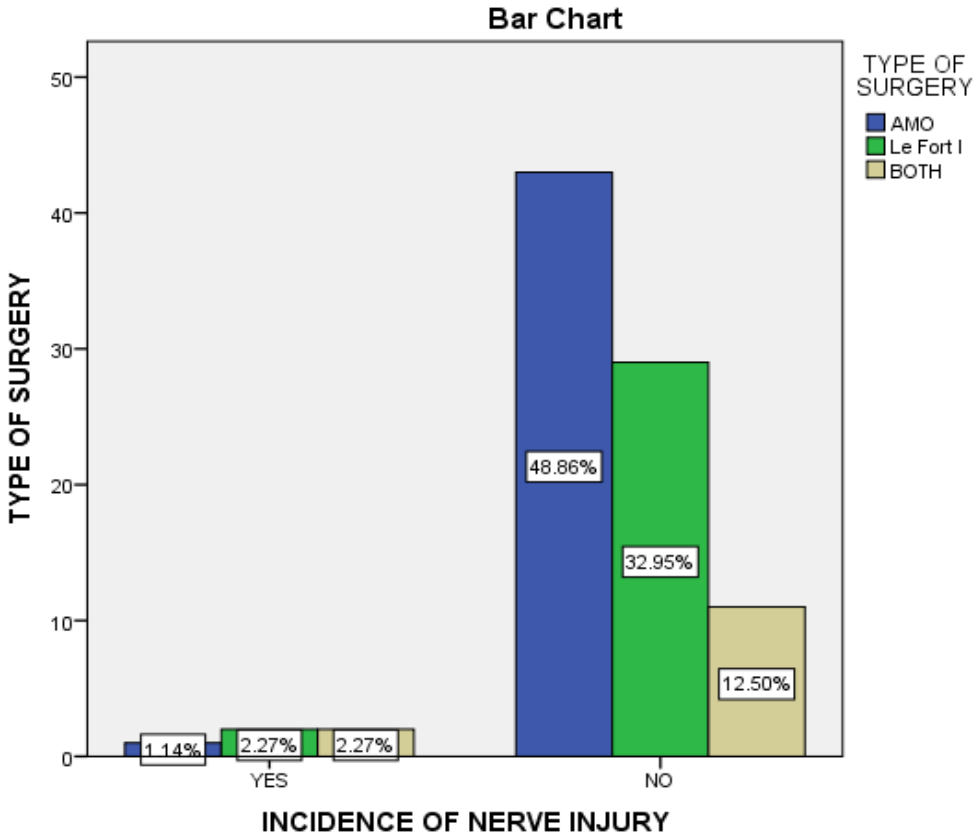

Figure 5: Graph representing the association between the type of surgery performed and the incidence of nerve injury.

Blue represents the nerve injuries occurring in AMO type of surgery and is 1.14% while nerve injuries don't occur in 48.86% of cases. Green represents the ones occurring in Le fort 1 type of surgery and the incidence 2.27% while no nerve injuries are seen in 32.95% of cases. Beige represents the incidence when both surgeries are performed and the incidence is 2.27% while no nerve injury was seen in 12.50% of cases. Chi square test was done and the association was found to be statistically significant ($p<0.05$). This shows that the results are statistically significant in the incidence of nerve injury incurred due to different osteotomies.

4. Discussion

The primary purpose of orthognathic surgery is to treat skeletal abnormalities of the mouth, jaw, and face that are either acquired or developmental (OMSDs). Significant improvements in surgical osteotomy methods and instrumentation have been created and applied in orthognathic surgery over the past three decades. (11) The fundamentals of surgery, however, have largely remained the same. Various surgical methods have also been created, improved upon, and employed by surgeons in the field of oral and maxillofacial surgery. (12)

The primary purpose of the anterior maxillary osteotomy (AMO) is to move the anterior dento-osseous segment posteriorly. It can also be used to move the section in the given superior or inferior directions. The first documented anterior segmental maxillary osteotomy was carried out in 1921 by Cohn-Stock, who used an elastic force to retract the anterior maxillary segment after removing a wedge of palatal bone through a transverse palatal incision. Numerous techniques for treating AMO have been proposed, including those developed by Wassmund in 1927, Wundere in 1963, and Cupar in 1954. (13,14) However, Wassmund's procedure, which allows for bone removal under direct sight via the nasal floor, is the one that most surgeons prefer. Up until the premaxilla segment is positioned in a preset position as indicated by a prefabricated splint, the bone from the lateral, superior, and posterior palatal surfaces is removed in slices. This trial-and-error approach of bone removal maneuvering lengthens the procedure and causes prolonged kinking of the palatal pedicle, which compromises the vascularity of the anterior section.

Previous clinical and animal research have demonstrated that nerve injury and inflammation generate hypoalgesia and hyperalgesic responses to electrical stimulation, respectively. According to a

study, decompression of the infraorbital canal was used in conjunction with orthognathic surgery to treat potential pressure, ischaemia, and physical damage of ION. (15) Clinical findings made during surgical decompression surgery supported the existence of ION damage: once the thin superior wall of the infraorbital canal was removed, the oedematous infraorbital neurovascular bundle was dragged out of the constrained canal space by intracanal pressure. Otherwise, the study's definition of the rationale for infraorbital canal decompression is fairly precise. (16) This is because some experts contend that it is unclear if and how much the sensitivity problems are caused by tissue manipulation during open surgery or by trauma alone.

Subperiosteal dissection can unintentionally compress, retract, or transect the infraorbital nerve. Damage to the infraorbital nerve may have been caused by improper separation during the disimpaction process. (17,18) Following a LeFort I treatment, there was no post-operative sensitivity, according to a study that used both objective and subjective measures. As was seen in bimaxillary operations, the data revealed a higher incidence of insensitivity in the area above the top lip, followed by the lower lip and the chin. (19) Studies have shown that normally, neurosensory changes are noticeable right away in the post-operative period. (20-24) They arise from direct trauma to the anterior, medial, and posterior superior alveolar nerves, the nasopalatine nerve, and the descending palatal nerve, as well as from traction of the infraorbital nerve. (25-29)

5. Conclusion

Within the limits of the study, it was found that the incidence of nerve injuries following orthognathic surgery in the maxilla is very less. In the association between the type of surgery and the incidence of nerve injury, it was maximum in le fort 1 and in cases where both AMO and le fort 1 were performed together. The p value was less than 0.05 and this result was analyzed and was found to be statistically significant. Hence the result that infra orbital nerve injuries occur more in le fort 1 osteotomy especially in a combination with AMO is significant. The association between gender and the type of fracture is not statistically significant as it has a p value more than 0.05. Further advancements and long-term clinical trials would provide a better prognosis and greater outlook post-surgery.

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Nishanthana Murali contributed to data collection, analysis and interpretation and drafting of the article. Dr. M. P. Santosh Kumar contributed to the critical revision of the article.
Conflict of Interest:
No potential conflict of interest relevant to this article was reported.
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6. References

Gayathri MM. Knowledge and awareness among patients about dental implants. Journal of Pharmaceutical Sciences and Research. 2016 May 1;8(5):351.

Mommaerts MY, Abeloos JV, De Clercq CA, Neyt LF. The effect of the subspinal Le Fort I-type osteotomy on interalar rim width. Int J Adult OrthodonOrthognath Surg. 1997;12:95–100

Betts NJ, Vig KW, Vig P, Spalding P, Fonseca RJ. Changes in the nasal and labial soft tissues after surgical repositioning of the maxilla. Int J Adult OrthodOrthognath Surg. 1993;8:7–23.

Lanigan DT, Guest P. Alternative approaches to pterygomaxillary separation. Int J Oral Maxillofac Surg. 1993;22:131–8.

Renick BM, Symington JM. Postoperative computed tomography study of pterygomaxillary separation during the Le Fort I osteotomy. J Oral Maxillofac Surg. 1991;49:1061–5.

Robinson PP, Hendy CW. Pterygoid plate fractures caused by the Le Fort I osteotomy. Br J Oral Maxillofac Surg. 1986;24:198–202

O'Regan B, Bharadwaj G. Prospective study of the incidence of serious posterior maxillary haemorrhage during a tuberosity osteotomy in low level Le Fort I operations. Br J Oral Maxillofac Surg. 2007;45:538–42.

SK M. Knowledge, attitude, and practices regarding infection control among undergraduate dental students. Asian J Pharm Clin Res. 2016;9(1):220-4.

Robinson RC, Holm RL. Orthognathic surgery for patients with maxillofacial deformities. Assoc PeriopRegistNurs. 2010;92:28–52.

Hoffman GR, Islam S. The difficult Le Fort I osteotomy and downfracture: a review with consideration given to an atypical maxillary morphology. J PlastReconstrAesthet Surg. 2008;61:1029–33.

Kendell BD, Fonseca RJ, Lee M. Postoperative nutritional supplementation for the orthognathic surgery patient. J Oral Maxillofac Surg. 1982;40:205–13.

Balaji R, Duraisamy R, Kumar MP. Complications of diabetes mellitus: A review. Drug Invention Today. 2019 Jan 15;12(1).

Olejko TD, Fonseca RJ. Preoperative nutritional supplementation for the orthognathic surgery patient. J Oral Maxillofac Surg. 1984;42:573–7.

Chidyllo SA, Chidyllo R. Nutritional evaluation prior to oral and maxillofacial surgery. N Y State Dent J. 1989;55:38–40.

Santhosh K. Knowledge, attitude and practices regarding needlestick injuries among dental students. Asian J Pharm Clin Res. 2016;9(4):312-5.

Fearon KC, Luff R. The nutritional management of surgical patients: enhanced recovery after surgery. Proc Nutr Soc. 2003;62:807–11.

Younis J, Salerno G, Fanto D, Hadjipavlou M, Chellar D, Trickett JP. Focused preoperative patient stoma education, prior to ileostomy formation after anterior resection, contributes to a reduction in delayed discharge within the enhanced recovery programme. Int J Colorect Dis. 2011;27:43–7.

Aarts MA, Okrainec A, Glicksman A, Pearsall E, Victor JC, McLeod RS. Adoption of enhanced recovery after surgery (ERAS) strategies for colorectal surgery at academic teaching hospitals and impact on total length of hospital stay. Surg Endosc. 2012;26:442–50.

Larsson J, Akerlind I, Permerth J, Hornvist JO. The relation between nutritional state and quality of life in surgical patients. Eur J Surg. 1994;160:329–34

Ramesh A, Varghese S, Jayakumar ND, et al. Comparative estimation of sulfiredoxin levels between chronic periodontitis and healthy patients - A case-control study. *J Periodontol* 2018; 89: 1241–1248.

Vijayashree Priyadharsini J. In silico validation of the non-antibiotic drugs acetaminophen and ibuprofen as antibacterial agents against red complex pathogens. *J Periodontol* 2019; 90: 1441–1448.

Priyadharsini JV, Vijayashree Priyadharsini J, Smiline Girija AS, et al. In silico analysis of virulence genes in an emerging dental pathogen A. baumannii and related species. *Archives of Oral Biology* 2018; 94: 93–98.

Teja KV, Ramesh S, Priya V. Regulation of matrix metalloproteinase-3 gene expression in inflammation: A molecular study. *J Conserv Dent* 2018; 21: 592–596.

Manohar MP, Sharma S. A survey of the knowledge, attitude, and awareness about the principal choice of intracanal medicaments among the general dental practitioners and nonendodontic specialists. *Indian J Dent Res* 2018; 29: 716–720.

Nandakumar M, Nasim I. Comparative evaluation of grape seed and cranberry extracts in preventing enamel erosion: An optical emission spectrometric analysis. *J Conserv Dent* 2018; 21: 516–520.

Varghese SS, Ramesh A, Veeraiyan DN. Blended Module-Based Teaching in Biostatistics and Research Methodology: A Retrospective Study with Postgraduate Dental Students. *J Dent Educ* 2019; 83: 445–450.

Panchal V, Jeevanandan G, Subramanian E. Comparison of instrumentation time and obturation quality between hand K-file, H-files, and rotary Kedo-S in root canal treatment of primary teeth: A randomized controlled trial. *J Indian Soc Pedod Prev Dent* 2019; 37: 75–79.

Nair M, Jeevanandan G, Vignesh R. Comparative evaluation of post-operative pain after pulpectomy with k-files, kedo-s files and mtwo files in deciduous molars-a randomized clinical trial. *Braz Dent J*, https://bds.ict.unesp.br/index.php/cob/article/view/1617 (2018).

Deena, S. R., Kumar, G., Vickram, A. S., Singhaniam, R. R., Dong, C. D., Rohini, K., ... & Ponnusamy, V. K. (2022). Efficiency of various biofilm carriers and microbial interactions with substrate in moving bed-biofilm reactor for wastewater treatment: A review. Bioresource Technology, 127421.

Felicita AS. Orthodontic extrusion of Ellis Class VIII fracture of maxillary lateral incisor - The sling shot method. *Saudi Dent J* 2018; 30: 265–269.