ORIGINAL ARTICLE

Amount of Local Anesthetic Solution Used in Mandibular Third Molar Surgery - A Retrospective Analysis

Dyna Albert, Muthusekhar MR, Kathiravan Selvarasu[*]

Department of Oral and Maxillofacial Surgery, Saveetha Dental College, Saveetha Institute of Medical and Technical Science, Saveetha University, Chennai, Tamil Nadu, India

ABSTRACT

Mandibular third molar is the most commonly impacted teeth and surgical removal of them is the most common minor oral surgical procedure done under local anesthesia in the outpatient department. For a comfortable patient experience and best surgical results, emphasis should be made on a pain-free procedure. In this study, we aim to analyse retrospectively the amount of local anesthetic solution used during surgical removal of impacted mandibular third molar and to find if any association between the amount of local anesthesia used and Pederson's difficulty Index (PDI) of the impacted teeth. Retrospective observational study conducted among patients reporting to the Department of Oral and Maxillofacial Surgery, Chennai for the surgical removal of impacted mandibular third molar between the study period June 2019 to March 2020. 658 patients who fulfilled the inclusion and exclusion criteria were included in the study. Data regarding patients demography, site of impaction, Pederson Difficulty Index of impacted teeth, amount of local anesthesia used were rewarded. The data were statistically analysed using descriptive statistics in IBM SPSS version 20 software. Study population included 58.4% males and 41.6% females, majority of them in the 3rd decade of life. (53.6%) with mean age 29.1 years. Of 658 impacted teeth analysed 54.4% were moderately difficult followed by minimally difficult 38.4% and very difficult 7.1% according to PDI. A significant association was found between the amount of local anesthesia used and PDI score of impacted teeth. In 64.7% cases 2ml of local anesthesia was sufficient to achieve anesthesia during the procedure. 2ml of local anesthesia is sufficient to achieve adequate anesthetic effect in surgical removal of impacted molar. As PDI increased, the amount of local anesthesia used also increased.

[*]Corresponding Author

Name: Kathiravan Selvarasu
Phone:
Email: kathiravan.sdc@saveetha.com

INTRODUCTION

Archer in 1975 defined an impacted tooth as a tooth that is completely or partially unerupted and is positioned against another tooth, bone or soft tissue so that its further eruption is unlikely (Santosh, 2015). Literature from around the world states mandibular third molars to be the most commonly impacted tooth (Kruger *et al.*, 2001; Gisakis *et al.*, 2011; Alsadat-Hashemipour *et al.*, 2013). This can be due to discrepancy in jaw and tooth size which can be attributed in part to evolution, aberrant position of third molar in the arch due to dense external

oblique ridge or due to retarded maturation of third molar because of lag in dental development when compared to skeletal development (Carter and Worthington, 2016; Padhye *et al.*, 2013; Kumar *et al.*, 2017; Msagati *et al.*, 2013).

These impacted teeth also give rise to various pathologies of odontogenic origin making (Celikoglu *et al.*, 2010; Jesudasan *et al.*, 2015; Nagappan *et al.*, 2016; James *et al.*, 2018) the prophylactic removal of third molars more common in recent times (Ravikumar and Narayanan, 2018; Shoshani-Dror *et al.*, 1985; Muralidharan *et al.*, 2019). Surgical removal of mandibular third molar is a routine and the most common minor oral surgical procedure done in the outpatient department under local anesthesia (Rashid *et al.*, 2018). The prime factor that provides for the best surgical outcome and patient satisfaction/experience is a pain-free procedure (Sekhar *et al.*, 2001; Jerjes *et al.*, 2009; Danda *et al.*, 2010). No amount of emphasis made can fully substantiate the importance of a pain-free procedure that is done on a conscious patient (Pacey, 2014; Shanmugaavel *et al.*, 2016). Hence, achieving adequate anesthesia of the surgical site is the first and the most important step in the surgical removal of third molars (James and Maheshwari, 2017; Kumar, 2017; James and Nazar, 2018). Various nerve block techniques have been proposed over the years for the same, popularly, the conventional inferior alveolar nerve block technique, Vazirani Akinosi technique, Gow-Gates mandibular nerve block technique (Malamed, 2020).

Though the nerve block technique used to anesthetize the surgical site is an independent decision of the surgeon, the most commonly used technique is the Conventional Inferior Alveolar Nerve Block (IANB) technique. This can be due to the fact that this is where the surgical training of an oral and maxillofacial surgeon begins and is a foundation upon which the surgeon builds his skills (Okamoto *et al.*, 2000; Thangavelu *et al.*, 2012; Christopher *et al.*, 2018).

As much as the anesthesia technique, the amount of anesthetic solution and the type of anesthetic solution used are also of clinical importance. The composition of anesthetic solutions has evolved drastically since the introduction of novocaine (Kumar, 2015; Bahl, 2004; Deepa and Thirrunavukkarasu, 2010; Ogle and Mahjoubi, 2012). Nowadays, longer acting and more potent local anesthetic solutions with potentially lesser complications have been introduced (Srisakthi, 2014; Hariharan *et al.*, 2014; Jain and Nazar, 2018; Ramadurai *et al.*, 2019). Nonetheless, the gold standard still continues to 2%

lignocaine. Adrenaline in concentrations 1:80,000, 1:1,00,000 or 1:2,00,000 is used along with lignocaine for its vasoconstrictor property. This provides more visibility, increases the concentration of the drug and reduces systemic absorption of lignocaine (Malamed, 2020; Okamoto *et al.*, 2000). With respect to the amount of local anesthetic solution used, the maximum recommended dose (MRD) of 2% lignocaine with adrenaline is 7mg/kg up to 500mg. The MRD of plain 2% lignocaine is 4.4mg/kg up to 300mg. Hence, the amount of local anesthesia used in mandibular third molar surgery is crucial and while aiming to provide a pain-free comfortable experience, the overzealous use should be cautioned against (Defosse, 1999; Becker and Reed, 2012; Ogle and Mahjoubi, 2011).

In this study, we aim to retrospectively assess the amount of local anesthesia being used in surgical removal of impacted mandibular third molar.

METHODOLOGY

The retrospective observational study was conducted among the patients reporting to the Department of Oral and Maxillofacial surgery at Saveetha Dental College and hospital, Chennai during the time period June 2019 to March 2020.

The approval for the study was given by the "Institutional Ethical committee, SIMATS Review Board".

The inclusion criteria for the study were patients of any age and gender undergoing surgical extraction of impacted mandibular third molar under local anesthesia.

The exclusion criteria for the study were patients undergoing closed extraction of mandibular third molar either in local or general anesthesia and open extraction of mandibular third associated with any pathologies, patients with a history of debilitating systemic diseases and mentally or physically challenged patients.

Diagnostic Criteria

The diagnosis of impacted mandibular third molar was made with clinical findings and radiographic interpretations using intra-oral periapical radiograph (IOPA) and orthopantomogram (OPG). Based on their interpretations, the difficulty of extraction was predicted using Pederson's Difficulty Index (PDI) as minimally difficult, moderately difficult and very difficult.

Data Collection

The patient demographic details and data pertaining to study parameters were retrieved from "DIAS-Dental Information Archive System" provided by the

institution.

A total of 782 patients had reported to the department of oral and maxillofacial surgery at Saveetha Dental College, Chennai for surgical extraction of mandibular third molar under local anesthesia between the study duration (June 2019 to March 2020). Of the 782 patients, only 658 fulfilled the inclusion criteria and exclusion criteria and were included in the study. The sample size of the population studied is 658.

Study Parameters

From DIAS, the following data were extracted for the purpose of the study:

1. Demographic details (age, gender)

2. Nomenclature of the impacted tooth to be surgically removed (38 or 48)

3. Pederson's Difficulty Index (PDI) for the tooth.

4. Amount of local anesthetic used during the procedure in millilitre (ml)

Surgical Procedure

All the surgical removal of impacted teeth were carried out by residents (postgraduate students) of oral and maxillofacial surgery in their final year of training. For standardization, only cases which used 2% lignocaine with 1:2,00,000 adrenaline and employed conventional inferior alveolar nerve blocking (IANB) technique were included in the study. And in all the cases either wards or modified wards incision was used to gain access to the surgical site. Closure was done using 3-0 silk suture.

Statistical Analysis

The data obtained was subsequently tabulated in an excel spreadsheet and was exported to IBM SPSS version 20.0 for statistical analysis. The data was analysed descriptively measuring mean, standard deviation, percentage and frequency. The association between different study parameters were analysed using Pearson Chi-square test at 95% confidence interval. The output was generated as tabular or graphical representation.

RESULTS AND DISCUSSION

Analysis of the demographic data of the study population revealed that a majority of them were in their 3rd decade of life (53.6%) with mean age 29.1 years when they underwent surgical removal of lower third molar (Figure 1). Gender distribution did not show much significance with 58.4% being males and 41.6% being females (Figure 2).
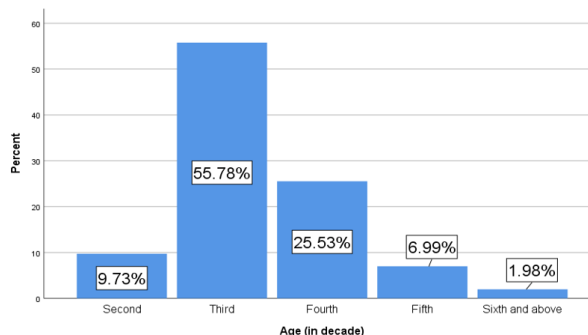

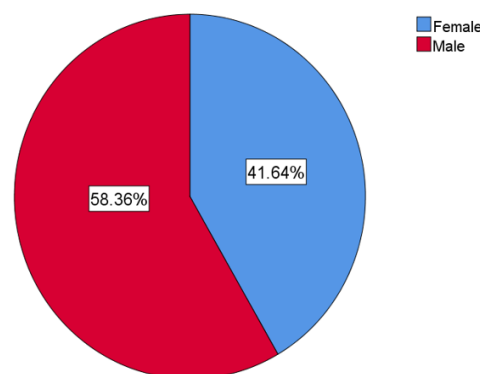**Figure 1: Simple bar showing age distribution of study population**

Figure 2: Pie chart showing the distribution of gender of study population; impacted mandibular third molars were more common in males (56.36%) than females (41.64%)
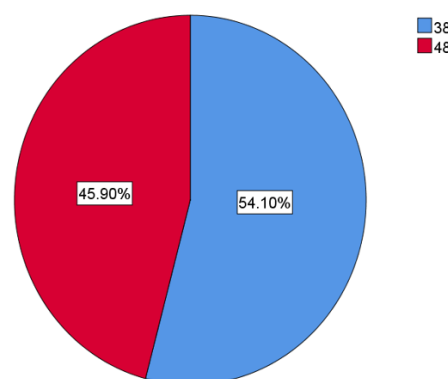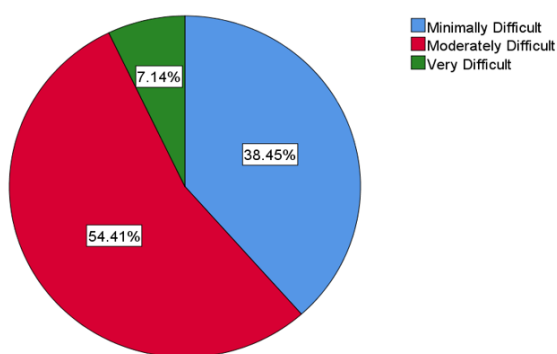

Figure 3: Pie chart showing the distribution of impacted mandibular third molar teeth among the study population; 38 (54.10%) was more commonly impacted than 48 (45.90%)

The study population underwent surgical removal of 38 (54.1%) more than 48 (45.9%), though not statistically significant (Figure 3). Of the 658 impacted teeth included in the study, 54.4% were moderately difficult, 38.4% were minimally difficult and 7.1% were very difficult as per Pederson's Difficulty Index (PDI) (Figure 4). Distribution of the amount of local anesthesia used during the procedure revealed that 2ml was sufficient to achieve adequate anesthetic

Table 1: Cross-tab showing association between PDI of impacted mandibular third molar and amount of LA used during its surgical removal at CI 95%

PDI	Amount Of Local Anesthetic Solution Used (in ml)							Total
	2.00	3.00	4.00	5.00	6.00	8.00	10.00	
Minimally difficult count	172	32	41	6	2	0	0	253
Expected count	163.8	36.9	43.4	4.6	3.5	0.4	0.4	253.0
Moderately difficult count	235	56	58	3	6	0	0	358
Expected count	231.8	52.2	61.5	6.5	4.9	0.5	0.5	358.0
Very difficult count	19	8	14	3	1	1	1	47
Expected count	30.4	6.9	8.1	0.9	0.6	0.1	0.1	47
Total count	426	96	113	12	9	1	1	658
Expected count	426	96	113	12	9	1	1	658

Figure 4: Pie chart showing distribution impacted mandibular third molar based on Pederson's Difficulty Index (PDI) among the study population
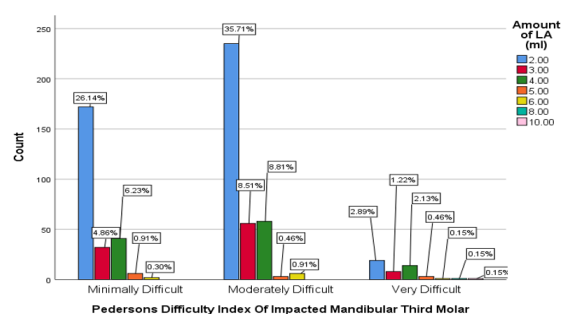
Figure 6: Grouped bar graph showing association between Pederson's Difficulty Index (PDI) of impacted mandibular third molar and amount of LA used during its surgical removal at CI 95%
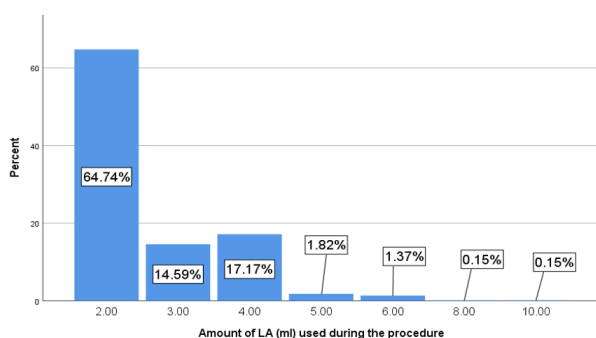
Figure 5: Bar graph shows the distribution of amount of LA (in ml) used during open extraction of mandibular third molar in the study population

effect in 64.7% cases. This was followed by 4ml (17.2%), 3ml (14.6%), 5ml (1.8%), 6ml (1.4%), 8ml and 10ml (0.2%) (Figure 5). Association between PDI of impacted mandibular molar and amount of local anesthesia used was statistically significant with p < 0.01 at confidence interval 95% (Figure 6) (Table 1).

Al-Dajani et al. in 2017 studied the patterns of mandibular third molar impaction in Saudi population and concluded that it was more prevalent in the second and third decade of life with a mean age of 33.5 years (Al-Dajani *et al.*, 2017). A similar study conducted by Mitra et al. in 2016 in Indian population of Ranchi revealed mandibular third molar impaction to be more common in males of age group 21-25 years (Mitra, 2016).

The demographic data of our study population revealed similar results where the majority of patients who underwent mandibular third molar impaction surgery were in their 3rd decade of life (53.6%) with a mean age of 29.1 years. The distribution of gender did not reveal any significant difference (male – 58.4%, female – 41.6%) though it refuted the recent results from Ravikumar *et al.* (2018); Enabulele and Obuekwe (2017); Al-Dajani *et al.* (2017); Dubey *et al.* (2019). This can be due to our stringent inclusion and exclusion criteria (Al-Dajani *et al.*, 2017; Enabulele and Obuekwe, 2017; Ravikumar *et al.*, 2018; Dubey *et al.*, 2019).

Mahdey et al. in 2015 retrospectively analysed the Pederson's Difficulty Index (PDI) of impacted mandibular third molar in Malaysian population using 1249 orthopantomograms (OPGs). They concluded that the majority of impacted mandibular third molars were "very difficult" as per PDI (Mahdey, 2015). In our study however, we found that "moderately difficult" mandibular third molars were more subject to surgical removal (54.4%).

An innovative evaluation in our study was that of the amount of local anesthetic solution used during the duration of surgical removal of mandibular third molar. We observed that in 64.7% cases only 2ml local anesthetic solution was used. The largest amount of local anesthetic solution used in this study was 10ml in 0.2% of cases corresponding to the "very difficult" category of PDI. Malamed in his "Handbook of local anesthesia" recommends the amount of local anesthesia solution (with adrenaline) required to anesthetize each nerve. For inferior alveolar nerve blocks following the conventional technique he recommends the following: Inferior alveolar nerve-1.5ml, lingual nerve-0.2ml, long buccal nerve-0.3ml. Hence, 2 ml of local anesthetic solution containing adrenaline is sufficient to provide adequate anesthesia in conventional IANB technique (Malamed, 2020). Our finding is consistent with Malamed's statement. Association between PDI of impacted mandibular third molar and amount of local anesthesia used was statistically significant with $p < 0.01$ at confidence interval 95%.

In Figure 1, X-axis represents age in decade and Y-axis represents the percentage; patients with impacted mandibular third molars underwent open extraction of the impacted tooth more commonly in the third decade of life (55.78%). In Figure 4, the most commonly impacted mandibular third molars were moderately difficult (54.41%) as per the PDI. In Figure 5, X-axis represents the amount of LA used during the procedure (in ml) and Y-axis represents the percentage; 2ml (64.74%) of LA solution was used the maximum while 8ml (0.15%) and 10ml (0.15%) were used the minimum. In Figure 6, X-axis represents the PDI of impacted mandibular third molar and Y-axis represents the amount of LA used in percentage and count; Chi-square test: $p < 0.01$ shows significant association i.e. as the PDI score increased, the amount of LA used also increased.

Limitations

In this retrospective observational study, the popularly used classification of mandibular third molar impaction viz. Winters, Pell and Gregory classification were not considered individually even though

Pederson's Difficulty Index is based on these classifications. Also, this retrospective analysis is restricted to a single study niche reporting to a dental college within a narrow study duration.

CONCLUSION

Within the limits of our study, we found that 2ml of 2% lignocaine with adrenaline (1:1,00,000 or 1:2,00,000) is sufficient in achieving adequate anesthesia during surgical removal of the third molar in most cases and the amount of local anesthetic solution used may increase with increased PDI score.

Conflict of Interest

The authors declare that there is no conflict of interest for this study.

Funding Support

REFERENCES

Al-Dajani, M., Abouonq, A. O., Almohammadi, T. A., Alruwaili, M. K., Alswilem, R. O., Alzoubi, I. A. 2017. A Cohort Study of the Patterns of Third Molar Impaction in Panoramic Radiographs in Saudi Population. *The Open Dentistry Journal*, 11(1):648–660.

Alsadat-Hashemipour, M., Tahmasbi-Arashlow, M., Fahimi-Hanzaei, F. 2013. Incidence of impacted mandibular and maxillary third molars-a radiographic study in a Southeast Iran population. *Medicina Oral Patología Oral y Cirugia Bucal*, 18(1):e140–e145.

Bahl, R. 2004. Local anesthesia in dentistry. *Anesthesia progress*, 51(4):138–142.

Becker, D. E., Reed, K. L. 2012. Local Anesthetics: Review of Pharmacological Considerations. *Anesthesia Progress*, 59(2):90–102.

Carter, K., Worthington, S. 2016. Predictors of Third Molar Impaction: A Systematic Review and Meta-analysis. *Journal of Dental Research*, 95(3):267–276.

Celikoglu, M., Miloglu, O., Kazanci, F. 2010. Frequency of Agenesis, Impaction, Angulation, and Related Pathologic Changes of Third Molar Teeth in Orthodontic Patients. *Journal of Oral and Maxillofacial Surgery*, 68(5):990–995.

Christopher, J. P., Marimuthu, T., Krithika, C., Devadoss, P., Kumar, M. S. 2018. Prevalence and measurement of anterior loop of the mandibular canal using CBCT: A cross sectional study. *Clinical Implant Dentistry and Related Research*,

20(4):531–534.

Danda, A. K., Wahab, A., Narayanan, V., Siddareddi, A. 2010. Single-Dose Versus Single-Day Antibiotic Prophylaxis for Orthognathic Surgery: A Prospective, Randomized, Double-Blind Clinical Study. *Journal of Oral and Maxillofacial Surgery*, 68(2):344–346.

Deepa, T., Thirrunavukkarasu, N. 2010. Saliva as a potential diagnostic tool. *Indian Journal of Medical Sciences*, 64(7):293.

Defosse, O. 1999. Local anesthesia with and without vasoconstrictors: indications, contra-indications and complications in relation to the health of the patient. *Revue Belge de Medecine Dentaire*, 54(4):242–258.

Dubey, M., Passi, D., Singh, G., Dutta, S., Srivastava, D., Chandra, L., Mishra, S., Srivastava, A. 2019. Study of pattern and prevalence of mandibular impacted third molar among Delhi-National Capital Region population with newer proposed classification of mandibular impacted third molar: A retrospective study. *National Journal of Maxillofacial Surgery*, 10(1):59.

Enabulele, J., Obuekwe, O. N. 2017. Gender Variation in Pattern of Mandibular Third Molar Impaction. *Journal of Dentistry, Oral Disorders and Therapy*, 5(2):1–4.

Gisakis, I. G., Palamidakis, F. D., Farmakis, E.-T. R., Kamberos, G., Kamberos, S. 2011. Prevalence of impacted teeth in a Greek population. *Journal of Investigative and Clinical Dentistry*, 2(2):102–109.

Hariharan, S., Narayanan, V., Soh, C. L. 2014. Split-mouth comparison of Physics forceps and extraction forceps in orthodontic extraction of upper premolars. *British Journal of Oral and Maxillofacial Surgery*, 52(10):e137–e140.

Jain, M., Nazar, N. 2018. Comparative Evaluation of the Efficacy of Intraligamentary and Supraperiosteal Injections in the Extraction of Maxillary Teeth: A Randomized Controlled Clinical Trial. *The Journal of Contemporary Dental Practice*, 19(9):1117–1121.

James, D., Maheshwari, G. U. 2017. Efficacy of cyanoacrylate and black braided silk for the closure of incision after surgical removal of impacted third molars: A Systematic Review. *Annals of Applied Bio-Sciences*, 4(4):38–46.

James, D., Nazar, N. 2018. Role of Anti-anxiety Drugs in Patient Cooperation during Minor Surgical Procedure. *Research Journal of Pharmacy and Technology*, 11(8):3389.

James, D., Srinivas, M. R., Muthusekhar, M. R. 2018. Knowledge, Attitude and Practice on post exposure prophylaxis of Hepatitis among Dental undergraduates and Post-Graduates students at Saveetha Dental College and Hospital, Chennai– A Questionnaire Survey. *Research Journal of Pharmacy and Technology*, 11(8):3320.

Jerjes, W., Upile, T., Kafas, P., Abbas, S., Rob, J., McCarthy, E., McCarthy, P., Hopper, C. 2009. Third molar surgery: the patient's and the clinician's perspective. *International Archives of Medicine*, 2(1):32.

Jesudasan, J. S., Wahab, P. A., Sekhar, M. M. 2015. 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. *British Journal of Oral and Maxillofacial Surgery*, 53(9):826–830.

Kruger, E., Thomson, W. M., Konthasinghe, P. 2001. Third molar outcomes from age 18 to 26: Findings from a population-based New Zealand longitudinal study. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*, 92(2):150–155.

Kumar, M. S. 2015. Newer delivery systems for local anesthesia in dentistry. *J Pharm Sci Res*, 7(5):252–255.

Kumar, M. S. 2017. Relationship Between Dental Anxiety And Pain Experience During Dental Extractions. *Asian Journal of Pharmaceutical and Clinical Research*, 10(3):458.

Kumar, V. R., Yadav, P., Kahsu, E., Girkar, F., Chakraborty, R. 2017. Prevalence and Pattern of Mandibular Third Molar Impaction in Eritrean Population: A Retrospective Study. *The Journal of Contemporary Dental Practice*, 18(2):100–106.

Mahdey, H. M. 2015. Prevalence and Difficulty Index Associated with the 3 rd Mandibular Molar Impaction among Malaysian Ethnicities: A Clinico-Radiographic Study. *Journal of Clinical and Diagnostic Research*, 9(9):65–68.

Malamed, S. 2020. Handbook of Local Anesthesia - 7th Edition. page 31. Elsevier, ISBN: 9780323582094.

Mitra, R. 2016. Prevalence of Mandibular Third Molar Impaction. *IJCMR*, 3(9):2625–2626.

Msagati, F., Simon, E. N., Owibingire, S. 2013. Pattern of occurrence and treatment of impacted teeth at the Muhimbili National Hospital, Dar es Salaam, Tanzania. *BMC Oral Health*, 13(1).

Muralidharan, N. P., Kritivasan, S., nazar, N. 2019. Microbial Analysis of Dento Alveolar bone Immediately after Extraction. *Indian Journal of Public Health Research & Development*, 10(5):109.

Nagappan, J., Gopinath, N. M., Elango, S. K., Pillai, D. D. M., Mani, M. 2016. Antimicrobial Effectiveness of Herbal and 0.2% Chlorhexidine Mouthrinse against Streptococcus mutans: An In-vitroStudy. *Journal of International Oral Health*, 8(6):683–686.

Ogle, O. E., Mahjoubi, G. 2011. Advances in Local Anesthesia in Dentistry. *Dental Clinics of North America*, 55(3):481–499.

Ogle, O. E., Mahjoubi, G. 2012. Local Anesthesia: Agents, Techniques, and Complications. *Dental Clinics of North America*, 56(1):133–148.

Okamoto, Y., Takasugi, Y., Moriya, K., Furuya, H. 2000. Inferior alveolar nerve block by injection into the pterygomandibular space anterior to the mandibular foramen: radiographic study of local anesthetic spread in the pterygomandibular space. *Anesthesia Progress*, 47(4):130–133.

Pacey, L. 2014. A patient's view: Third molar surgery. *British Dental Journal*, 216(9):490.

Padhye, M. N., Dabir, A. V., Girotra, C. S., Pandhi, V. H. 2013. Pattern of mandibular third molar impaction in the Indian population: a retrospective clinico-radiographic survey. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology*, 116(3):e161–e166.

Ramadurai, N., Gurunathan, D., Samuel, A. V., Subramanian, E., Rodrigues, S. J. L. 2019. Effectiveness of 2% Articaine as an anesthetic agent in children: randomized controlled trial. *Clinical Oral Investigations*, 23(9):3543–3550.

Rashid, H., Hussain, A., Sheikh, A. H., Azam, K., Malik, S., Amin, M. 2018. Measure Of Frequency Of Alveolar Osteitis Using Two Different Methods Of Osteotomy In Mandibular Third Molar Impactions: A Double-Blind Randomized Clinical Trial. *Journal of Ayub Medical College, Abbottabad : JAMC*, 30(1):103–106.

Ravikumar, K. K., Jamal, B. T., Ageel, R., Binaffif, A. A., Ageel, B., Karkashan, L., Natto, Z. 2018. Prevalence of impacted teeth and their associated pathologies on panoramic films in the Saudi Population. *International Journal of Social Rehabilitation*, 3(2):40.

Ravikumar, K. K., Narayanan, V. 2018. Prediction of postoperative outcome in mandibular third molar surgery based on preoperative variables: A Prospective clinical study. *International Journal of Social Rehabilitation*, 3(1).

Santosh, P. 2015. Impacted mandibular third molars: Review of literature and a proposal of a combined clinical and radiological classification. *Annals of Medical and Health Sciences Research*, 5(4):229.

Sekhar, C. H., Narayanan, V., Baig, M. F. 2001. Role of antimicrobials in third molar surgery: prospective, double blind,randomized, placebo-controlled clinical study. *British Journal of Oral and Maxillofacial Surgery*, 39(2):134–137.

Shanmugaavel, A. K., Asokan, S., John, J. B., Priya, P. R. G., Raaja, M. T. 2016. Comparison of Drug Acceptance and Anxiety Between Intranasal and Sublingual Midazolam Sedation. *Pediatric Dentistry*, 38(2):106–111.

Shoshani-Dror, D., Shilo, D., Ginini, J. G., Emodi, O., Rachmiel, A. 1985. Controversy regarding the need for prophylactic removal of impacted third molars: An overview. *Quintessence International*, 49(8):653–662.

Srisakthi, D. 2014. Hyperbaric Oxygen Therapy – Can It Be the New Era in Dentistry? *Journal of Clinical and Diagnostic Research*, 8(2):263–265.

Thangavelu, K., Kannan, R., Kumar, N. 2012. Inferior alveolar nerve block: Alternative technique. *Anesthesia: Essays and Researches*, 6(1):53.