Impact of Suturing Techniques on the Periodontal Health Status of Mandibular Second Molar after Extraction of Impacted Third Molars - A Randomised Control Trial

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ABBREVIATIONS

gm	Gram
mm	Millimeter
VAS	Visual Analogue Scale
i.e.	that is
CI	Confidence interval
PPD	Probing pocket depth
CAL	Clinical attachment level
Vs	Verses
Cap.	Capsule
Tab.	Tablet
SD	Standard deviation
ANOVA	Analysis of variance
HS	Highly significant
NS	Non-significant
S	Significant

Introduction

Last teeth to erupt in the dental arch are the third molars and are the most frequently impacted tooth in human dentition. Third molar is considered impacted when its eruption into normal functional occlusion has been interfered by other teeth, overlying bone, or soft tissue and it is not fully erupted. [1] Impacted teeth were seldom a problem in Neolithic man. Consumption of high abrasive diet caused attrition of teeth resulting in reduction of mesio- distal distance of the dentition. This provides an adequate space for the mesial migration and proper eruption pathway for the third molar. With the arrival of refined food and consequential reduction in masticatory functional load, today, the rate of impaction of third molars shows a significant increase.[2] Frequency of occurrence of impacted third molar is generally reported to be from 18% to 32%.[3]

The etiology of impacted third molar is multifactorial and it is probably the result of both genetic and environmental factors. Several long term clinical studies have proved that lack of space in mandibular third molar region, angulation, ectopic position, obstruction of eruption pathway, early physical maturity and late mandibular third molar mineralisation are the major etiological factors for the third molar impaction.[4] Preventive removal of third molar has been indicated in case of horizontal teeth, root ends growing close to the nerve and partially erupted vertical teeth whereas the obvious indications for removal of third molars are dental caries, tooth displacement and pathology.[5]

Third molar impaction is invariably associated with variety of complication such as pericoronitis, root resorption of adjacent tooth, cystic and neoplastic changes, prosthetic, orthodontic problems and even temporomandibular joint symptoms.[6, 7] Complications are inevitable when the tooth is associated with pathological process and must be removed. Extraction of third molar teeth is the most common surgical procedure performed in the oral cavity.

Surgical procedures in the removal of third molars pose a constant challenge for surgeons. A significant correlation has been found between the levels of difficulty for surgical removal of third molars and its post-operative complications.[8]

Variables influencing level of surgical difficulty in removal of third molar includes depth of impaction, orientation of impaction, root morphology and number of roots, proximity of alveolar nerve and angulation of third molar.[9]

A deeper impaction requires larger amount of bone removal for the delivery of third molar and is more likely to cause damage to adjacent vital structures like inferior alveolar nerve during the operative procedure. According to Pell & Gregory deviation from the vertical alignment of the tooth increases the surgical difficulty.[10] Morphological variations in roots of third molar like divergent roots or dilacerated roots may require sectioning and can prove more difficult to remove.

Difficulty level increases with the increase in angulation of tooth. Tooth angulation can be the precise indicator for the prophylactic removal of partially erupted mandibular third molars.[11]

An important but often overlooked issue to address in treatment of third molar impaction is the risk of developing periodontal defects on the distal aspect of mandibular second molar

Impacted third molars showed close proximity to the adjacent second molars. Proximity and closeness between the second and third molar make surgery more difficult. The removal of mandibular third molar appears to significantly influence the periodontal status on the distal root of the second molar.[12] Removal of third molar can either create or exacerbate periodontal problems on the distal aspect of lower second molar. Postoperative periodontal defects have been a frequent occurrence at the distal aspect of mandibular second molar after surgical removal of impacted third molar.[13]

Studies have shown increase in probing depths after the removal of third molars. Pocket formation or worsening of periodontal status cannot always be prevented. This complication may necessitate modification in surgical procedure.[14]

The mainstream surgical attention has preferably remained focussed around the prevention of delayed wound healing and associated surgical complications after third molar extraction. Besides this the optimal management of the impacted third molar should include the periodontal consideration.

Researchers have demonstrated inclination of mandibular third molar, age of the subject, large contact area and poor oral hygiene as the risk factors for increasing second molar periodontal pocket, loss of attachment and bone resorption.[15]

Localised periodontal lesions may remain symptomless until the severity of attachment loss is in advanced stage and may easily escape detection by an attending surgeon. This creates a threat to the second molar. Surgical procedure should be directed to control the periodontal disease or improve the periodontal healing after the removal of impacted mandibular third molar.

Modification in the surgical technique by using different incisions and flap techniques are being continuously investigated to overcome the problems after the surgical removal of mandibular third molar and there effect in reduction of postoperative discomfort and mentioned periodontal problems on the distal aspect of mandibular second molar.[16]

However studies have revealed conflicting results. One of the factors closely linked to the intensity of postoperative pain and swelling depends on the type of healing of the surgical wound.

It has also been shown that primary closure of the flap avoids suture dehiscence and facilitates improved wound healing.[16]

In secondary healing, the socket remains in communication with the oral cavity and in primary healing the socket is covered and sealed hermetically by a mucosa flap. Widely used suturing technique usually preferred by surgeons is a simple loop suture. The modification of suturing technique can be the alternative technique to improve the post-operative periodontal status of mandibular second molar after removal of impacted mandibular third molar. Anchor suture is another technique used in suturing the flap located in an edentulous area mesial or distal to a tooth.[17]

Advantage of this suturing lies in the fact that this suture closes the facial and lingual flap and helps in tight adaptation against the tooth. This provides the basis for the hypothesis that anchor suture might facilitate primary healing and might provide better periodontal health of the adjacent second molar after removal of impacted third molar. There are limited studies evaluating the comparative effect of suturing technique on periodontal status of adjacent second molar after removal of impacted third molar. So the present study was conducted to evaluate and compare the effect of suturing technique on the periodontal health status on distal aspect of mandibular second molar after surgical removal of impacted third molars.

Aim and Objectives

Aim of the Study

The aim of the present study is to evaluate and compare the impact of two suturing techniques: simple loop suture and open anchor suture on the periodontal health status on the distal aspect of the adjacent mandibular second molar after surgical removal of impacted third molar.

Objectives of the Study

1. To evaluate the impact of simple loop suture technique on periodontal health status of mandibular second molar.

2. To evaluate the impact of open anchor suture technique on periodontal health status of mandibular second molar.

3. To compare the impact of simple loop and open anchor suture technique for better periodontal health status on the distal aspect of second molar after surgical removal of the adjacent impacted mandibular third molar.

4. To evaluate the effect of simple loop and open anchor suture technique on wound dehiscence after surgical removal of impacted mandibular third molar.

Review of Literature

"An outlook into future is only possible when considering the past"

Ash M et al in 1962[18] conducted a study to determine the effect of the extraction of third molars on the periodontal structures distal to the second molars. 225 mandibular and maxillary third molars adjacent to second molars were selected for extraction. The third molars were classified as completely covered, partially erupted, or fully erupted. The status of the periodontal structures of the second molar was evaluated pre-operatively, immediate post-operatively, at 2 weeks, at 6 months, and one year after extraction of adjacent third molars. No cases with cystic lesions, or other intraosseous lesions involving the second and third molars were included in this study. In the group of completely covered third molars there were 21 cases of

periodontal pockets and/or root exposure prior to extraction and 55 cases after extraction. In the partially covered group there were 28 cases prior to extraction and 68 cases after extraction. Within the limits of the study authors concluded that the presence and/or extraction of completely and partially covered third molars results in a high incidence of periodontal pocket formation on the distal of second molars.

Gröndahl HG and Lekholm U in 1973[19] conducted a prospective study to compare the periodontal health distal to the third molars before and after the surgical removal of third molars. Periodontal health distal to the third molar was assessed in 33 patients by measuring the amount of plaque, severity of gingival inflammation and depth of periodontal pocket in the periodontal structures distal to third molar. The periodontal assessment was carried out once prior to the third molar surgery and secondly 3 months after the surgery by clinical examination and probing. In the study it was found that there was no significant difference in the alveolar height after the third molar removal. However it was also found that there was significant reduction in the depth of the gingival pocket distal to the third molar three months after surgery. Authors concluded that the removal of third molars led to the improvement of the hygienic condition of the periodontal structures distal to the third molars.

Osborne WH et al in 1982[20] evaluated the effect of root planing and curettage on the crevicular depth and periodontal attachment at the distal surface of mandibular second molars following removal of adjacent impacted or partially erupted third molars. It was evaluated in 18 patients, between the ages of 18 and 25, presenting with similar bilateral impactions. There was no significant difference demonstrated in the crevicular depths and attachment levels between the curetted, root planed side, and

the untreated controls. Thus, any benefits derived by root planing and curettage of mandibular second molars immediately following removal of adjacent impacted third molars are minimal. Authors suggested that removal of mandibular third molars in their early stages of development is the best means of preventing or minimizing loss of attachment on mandibular second molars.

Stephen RJ et al in1983[21] compared envelope flap and a modified envelope flap with releasing vertical incision in 15 patients for their influence on the post-operative periodontal health of second molars after third molar removal. The envelope flap described by Szmyd was used on one side and the modified envelope flap with a vertical releasing incision extending up to the mucogingival line was used on the other side. Post-operative clinical evaluation for periodontal health was carried out on 1st, 2nd, 6th and 12th week after the third molar surgery. After the analysis of data in both groups, the results showed an actual improvement in the health status around mandibular second molars at 12 weeks compared to the pre-operative readings. There was no significant difference between the two flap designs examined. The authors of the study concluded that when a problem involving the soft tissues around the mandibular second molars occurs after the 12th week, it is not due to the surgery or the technique.

Kugelberg CF et al in 1985[22] in a retrospective study evaluated the effect of lower third molar surgery on periodontal tissues, due to impaction or semi-impaction in 215 cases. The post-operative examination was done 2 years after the surgical treatment and included both clinical and radiographic variables. Clinical registrations included the amount of plaque, presence of gingivitis and periodontal pockets. The results

showed a higher incidence of plaque, gingivitis and pockets on the distal surface of the second molar than on other surfaces. The alveolar bone level distal to the second molar was registered by radiographic examination with a periodontal probe as indicator. 2 years post-operatively, 43.3% of the cases exhibited pocket depths exceeding 7 mm and 32.1% showed intrabony defects exceeding 4 mm.

Quee TA et al in 1985[23] evaluated the influence of flap design on the periodontal status of second molar after third molar surgery in a prospective comparative split mouth study. In the study, the authors examined 30 patients who underwent bilateral surgical removal of their similarly impacted mandibular third molars. A split-mouth experimental design was used in patients, with each patient acting as his/her own control. In each patient, one side of the mandible was randomly allocated to one of the two flap design groups, i.e. the vertical flap described by Thoma or the envelope flap (the variation of Thoma's vertical flap) described by Kruger. After the comparison of periodontal pocket depths of the second molar in both groups, the authors found that although there was some loss of attachment on the distal surface of the second molar after surgery in both the groups. However, it was found that there was no difference between the 2 flap designs at end of 6 months of follow up. The study concluded that the choice of flap design by the operator in third molar surgery had no influence on the periodontal status of the second molar.

Marmary Y et al in 1986[24] evaluated 83 preoperative and postoperative radiographs following extraction of impacted mandibular third molars and measured bone regeneration. The patient sample was divided into two age groups, Group I consists of patient with age group between 20 to 29 years and Group II with age group between

30 to 50 years. Postoperatively, there was an average net gain of 2.15 mm in bone level. Authors concluded that the degree of bone healing is affected primarily by age and, to a lesser extent, by the presence of generalized inflammation.

Kugelberg CF et al in 1990[25] investigated the long-term effects on periodontal tissues of impacted lower 3rd molar surgery in 51 patients with comparative retrospective study design. The postoperative examinations were done 2 years and 4 years after the surgical treatment and included both clinical and radiographic variables. Assessments were made regarding the oral hygiene status, gingival condition and periodontal tissue breakdown in terms of increased probing depths and intra-bony defects. Comparing the results of the two examinations, no significant changes of the incidence of plaque and gingivitis were seen on the distal surface of the second molar, nor any significant change concerning the probing depth were noted. The proximal bone level distal to the second molar was recorded by radiographic examination with a cut-off periodontal probe as indicator. Two years postoperatively, 16.7% of the cases aged less than 25 years showed intrabony defects exceeding 4 mm, compared with 40.7% in the age group greater than 26 years. At the 4-year re-examination, the corresponding figures were 4.2% and 44.4%, respectively. The improvement concerning the alveolar bone level was mainly seen in individuals under 25 years. The results emphasized the importance of the age of the patient at the time of surgery, as all cases where the intra-bony defects deteriorated were 26 years or older. The authors of the study concluded that when the need for extraction can be foreseen, an early removal of the impacted third molar might have a beneficial effect on the periodontal health of the adjacent second molar.

Knutsson K et al. in 1996[7] measured the prevalence of disease of mandibular third molars referred for removal and estimated the risk for development of pathoses. The prevalence of different diseases and the patient's age, angular position, and degree of impaction of the molars were registered. Odds ratio for molars with different positions and impaction states were estimated. Pericoronitis was found in 64% of cases, caries in the third molar in 31%, periodontitis in association with 8%, caries in the second molar in 5%, and root resorption of the second molar with 1% of the molars with pathoses. Odds ratio was highest for distoangular molars (5.8) and for molars partially covered by soft tissue (6.7). Authors concluded that the odds ratio is about 22 and 34 times higher for molars partially covered by soft tissue than for molars completely covered by soft or bone tissue. For distoangular molars the odds ratio is 5 to 12 times higher than for molars in other positions.

Rakprasitkul S et al in 1997[26] in a prospective comparative study, comparison was done between the primary wound closure with the insertion of a small surgical tube drain (drain group) and a simple primary wound closure (no drain group) after removal of impacted third molars. The surgery was performed on 23 patients in a randomized cross over fashion. In the postoperative period, the patients received identical analgesic drugs (Acetaminophen 1 gm every 4 hours daily), and they were also given a sheet with post-operative instructions. The patients were examined by the same person immediately post-operatively, and on the third and seventh post-operative days. The second surgery was performed two months after the first surgery. Data was collected on duration of surgery (minutes), facial swelling (percentage), and mouth opening (mm). The facial swelling was determined by measuring the distance from the corner of the mouth to the attachment of the ear lobe following the bulge of

the cheek, and the distance from the outer canthus of the eye to the angle of the mandible. Mouth opening was measured between the edges of the central incisors. The small surgical tube drain was removed on the third post-operative day, and the sutures were removed on the seventh post-operative day. The wound healing was also assessed on the seventh post-operative day. The degree of wound breakdown was classified according to four grades. The severity of pain, the degree of edema, and the degree of bleeding were recorded by the patient. The severity of pain was recorded on a visual analogue scale (VAS) from 0 to 10. The degree of edema was recorded according to four grades. The degree of bleeding was also recorded according to four grades. In the study the operation time was found to be significantly longer and mouth opening significantly wider in the immediate post-operative period in the drain group subjects as compared to the control group. There was no significant difference in the severity of pain between the two groups. Facial swelling was found to be significantly less in the drain group subjects. Thus the study concluded that post-operative problems, in general, were less in the small surgical drain group as compared to the non-drain control group.

Peng KY et al in 2001[27] evaluated and compared the long-term effects of third molar extraction on the periodontal health of the 2 groups of mandibular second molars, with and without third molar extraction. A total of 312 sites in 57 adult patients were examined and the buccal and lingual locations of the mesial and distal root surfaces around the second molars were recorded. 232 were experimental teeth; i.e., third molars had been surgically removed more than 5 years ago, 80 sites served as control molars; i.e., congenitally missing third molars. Clinical periodontal parameters including probing depth, attachment loss, and gingival recession and

radiographic intrabony level were measured. The effects of the surgery and the examination (buccal or lingual) locations on the measurements were statistically analysed. However, significant effects of the surgical history on the probing depth were observed on the distal surfaces. Similar results of greater attachment loss and radiographic alveolar bone loss were observed only at the distal sites of the experimental group. In addition, the increased radiographic bone loss was only found at the distal sites (adjacent to the surgical location) and not at the mesial sites (distant from the surgical location) on the experimental group. Greater periodontal breakdown, including probing depth, attachment loss, and radiographic alveolar bone loss, was found at the distal sites, but not at the mesial sites, of the experimental molars where the third molar was surgically extracted compared with the control teeth (no surgery). In the experimental molars, more radiographic bone loss was found at the sites adjacent to the surgical location than at the sites distant to the surgical location. Therefore authors concluded that the surgical removal of the mandibular third molar may lead to a periodontal breakdown on the distal surface of the second molar and periodontal re-evaluation after the initial healing of third molar extraction is needed.

Jakse N et al in 2002[16] evaluated the primary wound healing of 2 different flap designs. Sixty patients with completely covered lower third molars were removed out of which in 30 cases, the classic envelope flap with a sulcular incision from the first to the second molar and a distal relieving incision to the mandibular ramus was used, whereas in 30 third molars were extracted after preparation of a modified triangular flap first similarly described by Szmyd. Wound healing was evaluated on the first post-operative day, as well as on 1 and 2 weeks after surgery. The overall result was a

total of 33% wound dehiscence. In the envelope-flap group, wound dehiscence developed in 57% of the cases which represents a relative risk ratio of 5.67, with a 95% CI from 1.852 to 12.336. With the modified triangular- flap technique, only 10% of the wounds gaped during wound healing. Authors concluded that the modified triangular flap is significantly less conducive to the development of wound dehiscence.

Rosa AL et al. in 2002[28] compared the influence of two mucoperiosteal flaps on periodontal healing of adjacent second molars after extraction of impacted mandibular third molars. In 14 patients with bilateral impaction of mandibular third molars an envelope incision with a releasing incision anterior to the second molar (3-cornered flap) was used on one side and Szmyd flap on the other side. Pocket depth, clinical attachment level, and bone level of the buccal and mesial surfaces of the second molars was measured pre-operatively, at 3 month and at 6 months post-operatively with the help of William's periodontal probe. There was no statistical significant difference found between measurements of probing depth, clinical attachment level, or bone level for the 2 types of flap used or the 2 surfaces measured but there was a statistically significant increase in all 3 measurements from the 3-month to the 6-month post-operative time. Authors concluded that the periodontal condition of the adjacent second molar worsened from 3 to 6 months, but it remained within normal values and was independent of the design of the mucoperiosteal flap used in extracting an impacted mandibular third molar.

Kan KW et al. in 2002[29] evaluated periodontal condition distal to mandibular second molar following surgical removal of impacted mandibular third molars was

done in a retrospective study. The assessment of periodontal health was done from the 6th to 36th month post-operatively following surgery. The study concluded that periodontal breakdown was initiated and established on distal surface of mandibular second molar in the vicinity of mesio-angular impacted third molar which was evidenced by pre-extraction crestal radiolucency in association with inadequate plaque control. Whereas after surgical removal of third molars, adjacent second molar was seen to be predisposed to persistent localized periodontal problems.

Suarez-Cunqueiro MM et al. in 2003[30] compared marginal and paramarginal flap designs in third molar surgery in 27 healthy patients belonging to the age group of 17-31 years in a prospective comparative study who underwent surgical removal of impacted third molars. In the split mouth study, the marginal flap was used randomly in one chosen half of the jaw, and a paramarginal flap was used in the other half. The study evaluated the influence of these flaps on wound healing, periodontal pocket depth of the adjacent second molar, pain, trismus, and swelling. The study concluded that the probing depth was similar in both marginal and paramarginal flaps at 3 months. Pain, trismus, and swelling were similar with both techniques when used in third molar surgery.

Pasqualini D et al. in 2005[31] in a prospective comparative study compared the primary and secondary closure techniques after removal of impacted third molars in terms of post-operative pain and swelling. 200 patients with impacted third molars were randomly divided into two groups of 100. Panoramic radiographs were taken to assess degree of eruption and angulation of third molars and teeth were surgically removed, in Group I the socket was closed by hermetically suturing the flap and in

Group II a 5–6 mm wedge of mucosa adjacent to the second molar was removed to achieve healing by secondary intention. Swelling and pain were evaluated for 7 days after surgery with the visual analogue scale. The post-operative pain, swelling and trismus were seen to be significantly reduced in Group II compared Group I. The study concluded that pain and swelling were less severe with secondary healing than with primary healing.

Susarla SM et al. in 2005[32] in a prospective study assessed various risk factors associated with mandibular third molar surgery. The mandibular third molars were found to be more difficult to extract than their maxillary counterparts. In winter's classification, the deviation of teeth from vertical alignment was seen to increase the operating time and distoangular impacted teeth were seen to require the maximum time for extraction. Difficulty associated with surgical removal increased from soft tissues impactions to bony impactions. Favourable tooth morphology with better root access and crown positioning was seen to be associated with decreased operating time. The number of teeth being removed, surgical experience of the operator and type of procedure also dictated the degree of difficulty and operating time. The study concluded that, with an increase in unfavourable pre-operative factors, significant extraction difficulty was associated with third molar surgery.

Krausz AA et al. in 2005[33] conducted a split mouth study and evaluated 25 patients for long term changes in periodontal health status and alveolar bone height distal to adjacent second molar clinically and radiographically following extraction of an impacted third molar. Patient who underwent extraction of one impacted third molar was labelled as test group whereas opposite tooth remained intact was labelled as

control group. Alveolar bone height was digitally measured on the distal aspect of second molar in pre-operative and current state panoramic radiographs and current state clinical measurement consisting of plaque index, gingival index, periodontal pocket depth, gingival margin position and clinical attachment level were performed in both groups. They concluded that there was significant gain in alveolar bone height on the distal aspect of the adjacent second molar on test side whereas on control side slight bone loss was noted. There was statistical significant difference in plaque index between both the groups but suggested that further follow up studies were required to understand the long term effects of third molar on periodontal health status of adjacent second molar.

Kırtıloğlu T et al. 2007[34] in bilateral split mouth study compared the effects of two different flap designs on the periodontal health status of the mandibular second molar after the extraction of the adjacent impacted third molar. In his study, he included 18 patients aged 16 to 32 years requiring removal of bilateral impacted mandibular third molar. The periodontal health status of the second molar was evaluated by measuring mean probing depth at distal and buccal sites pre-operatively and at 1 week, 2 weeks, 4 weeks, and 12 months post-operatively. There were no significant differences in pre-operative and 1 year post-operatively in mean probing depth and clinical attachment loss between the 2 flaps. Authors concluded that modified Szmyd flap, which leaves intact gingiva around the second molar, has better primary periodontal healing than the 3-cornered flap after surgical removal of the fully impacted mandibular third molar.

Chaves AJ et al. in 2008[35] evaluated the influence of two flap design on periodontal status of adjacent second molars after removal of semi-impacted mandibular third molar surgery. Periodontal probing depth were assessed in 20 patients at six sites mesio-buccal, buccal, disto-buccal, disto-lingual, lingual and mesio-lingual, around the second molar using a 'Williams'-type probe just prior to surgery and three months post-operatively. The results showed that both methods caused reduction in pocket depth ($P > 0.05$) but there were no statistically significant differences between the flap techniques ($P > 0.05$). He concluded that decision to use any of the various flap designs for access to mandibular third molars should be based on operator preference rather than on the assumption that periodontal health of the adjacent second molar will be improved.

Xavier RL et al. in 2008[36] evaluated pain, swelling and trismus in 2 groups with different suturing techniques after extraction of impacted mandibular third molars. The authors included 20 patients of both genders with an indication for the removal of bilaterally impacted lower third molars and were divided into test and control groups. Complete suture was performed on the free and attached gums in the control group and in the test group only the attached gum of the oblique vestibular incision was sutured. The results showed that the drainage of fluid through the suture was not obliterated and led to diminution of pain 48 hours after surgery. There were no statistically significant differences observed in relation to swelling, which diminished gradually in both groups. But the variable trismus, presented with a greater mouth opening throughout the evaluation in the test group which was statistically significant at 7 days. 3 months post-operatively the probing depth was found to be greater in the control group which was statistically significant. Authors concluded that the strategy

of not suturing the free gum of the oblique vestibular incision in the extraction of impacted lower third molars leads to the diminution of immediate painful symptomatology, but has no influence on the swelling.

Sanchis Bielsa JM et al. in 2008[37] compared two types of flaps in semi impacted third molar surgery and their relation to the post-operative period in twenty five patients. In 25 cases wound was sutured using a reflection flap while in the 25 contralateral cases the conventional closure was used. Authors concluded that the postoperative course after extraction of a semi-impacted third molar when healing took place by secondary intention than in case of healing by first intention.

Blakey GH et al. in 2009[38] assessed the impact of third molar removal on periodontal pathology in subjects with asymptomatic third molars. Subjects in whom at least 2 third molars were removed were a subsample of healthy young subjects enrolled with 4 asymptomatic third molars in an institutional review board-approved longitudinal study. Full-mouth periodontal PPD data, 6 sites per tooth, were obtained as a measure of periodontal status at each of 3 visits: enrolment, before removal of third molars, and after removal of third molars. The oral cavity was divided by jaw into segments: the third molar region including the third molar (12 probing sites), distal to the second molar (4 probing sites), and non-third molars (80 probing sites). A PPD $\geq$ 4 mm was considered an indicator variable for periodontal pathology. The number and percent of sites with a PPD $\geq$ 4 mm were calculated from the total number of probing sites across all subjects. The frequency of subjects with at least one PPD $\geq$ 4 mm and all third molars removed were compared with the frequency of subjects retaining at least 1 mandibular third molar using Fisher's exact test, with

significance set at 0.05. Sixty nine subjects had third molars removed: 57% were female, and 77% were Caucasian. The median age at surgery was 26.3 years. The median interval from enrolment to surgery was 2.4 years. The median follow-up after surgery was 9. All third molars were removed in 56 subjects; 13 retained at least 1 mandibular third molar. More subjects had at least 1 PPD ≥ 4 mm around their mandibular third molars before surgery compared with enrolment (52% vs 45%, respectively). Of the total possible mandibular third molar probing sites, 18% had PPD ≥ 4 mm presurgery compared with 12% at enrolment. Significantly fewer subjects who had all third molars removed had a PPD ≥ 4 mm on the distal of their mandibular second molars after surgery, compared with those retaining at least 1 mandibular third molar (20% vs 69%, respectively, *P* =.001). The number of PPDs ≥ 4 mm in the mandible was less after surgery if all third molars had been removed (1.4% vs 6.6%, respectively).

Centinkaya BO et al. in 2009[39] compared the effects of different suturing techniques (simple loop suture vs. anchor suture) on the periodontal health of the adjacent second molars after impacted mandibular third molar extraction. 15 patients with bilaterally identical impacted mandibular third molars were used. Using split mouth design, flaps were closed with either anchor suture technique or simple loop suture technique after the extraction of third molars. Post-operative examination included PPD and CAL measured at the distal surface of the second molars before surgery and 6 months after surgery. The PPD and CAL in the distal surfaces of the second molars were significantly higher after 6 months in the simple suture group (P = .001), whereas no differences were found in the anchor suture group (P > .05). Intergroup comparisons showed that the 6-month PPD and CAL values of the distal

surfaces were significantly higher in the simple suture group compared with the anchor suture group (P =.015). The authors found that anchor suture might be a better technique to use to maintain healthy periodontium and to prevent periodontal problems after the extraction of impacted third molars.

Danda AK et al. in 2010[40] in a study compared the influence of primary and secondary closure of the surgical wound on post-operative pain and swelling after removal of impacted third molars was done in a prospective comparative study. A total of 93 patients with bilaterally similar impacted third molars who underwent surgical removal were included in the study. Primary closure of the surgical site was done on one side (Group I) and secondary closure on the other side (Group II). Pain and swelling was seen to be greater in Group I than in Group II. The study concluded that the secondary closure group had a significant decrease in amount of pain and swelling post-operatively than the primary closure group.

Dicus C et al. in 2010[41] assessed the prevalence of periodontal inflammatory disease on the distal aspect of second molars after third molar removal its association with the association between presurgical, surgical variables and postsurgical periodontal outcomes. Of the 75 subjects, 52% were women. The median age at surgery was 23.6 years (interquartile range, 20.9 to 26.6 years). Gender, ethnicity, age, pre-surgical symptoms, and data estimating the extensiveness of surgery were not significantly associated with postsurgical distal to second molar periodontal outcomes. The study concluded that after third molar removal, periodontal inflammatory diseases on the distal of second molars were detected significantly less often. None of the variables examined except for pre-surgical presence of periodontal defect ≥ 4 mm distal to

second molar were significantly associated with postsurgical periodontal inflammatory diseases.

Osunde OD et al. in 2010[42] evaluated and compared the effect of single and multiple suture techniques on pain, swelling, and trismus associated with third molar surgery. Authors included 50 patients with an indication for the removal of impacted lower third molars and were divided into 2 groups. In Group I flap was closed by multiple sutures and those in the Group II by a single suture. Pain, swelling, and trismus were evaluated at 1st, 2nd, 3rd, 5th, and 7th post-operative day. Descriptive and comparative statistical analyses were performed, results are presented and significance was set at P< .05. Both groups were comparable in terms of the age distribution (multiple suture group, 26.0 ± 4.73 years; single suture group, 25.8 ± 4.28 years, P=.755), difficulty index (multiple suture group, 5.0± 1.68; single suture group, 4.9± 4.79; P = .935), duration of surgery (multiple suture group, 29. 7± 6.11 minutes; single suture group, 30.0 ±6.04 minutes; P= .835), and baseline parameters such as facial width (multiple suture group, 10.0 ± 1.32 cm; single suture group, 9.8 ± 0.37 cm; P= .115), mouth opening (multiple suture group, 4.5 ± 1.32 cm, single suture group, 4.8 ± 0.26 cm; P= .165), and pre-operative pain, which was 0 in both groups. Other comparable variables included impaction type (P= .210) and indication for surgery (P= .278). A statistically significant difference was found in the level of pain at postoperative days 1, 2, and 3 (P < .05). A similar significant difference was found in swelling and trismus (P< .05). At days 5 and 7, no significant differences were found between the 2 groups for all parameters of pain, swelling, and trismus (P > .05). There was comparable distribution of age, gender, and operative variables, such as the pattern of impaction, preoperative difficulty index, and operative time between

patients undergoing the 2 methods of closure. With that, the results showed that the single suture closure technique was better than the multiple suture technique with regard to post-operative pain, swelling, and trismus.

Bello SA et al. in 2011[43] studied the influence of suture less and multiple-suture closure of wounds on postoperative pain, swelling, trismus and periodontal health of adjacent second molar after extraction of bilaterally similar impacted mandibular third molars was assessed in a prospective comparative split mouth study. In the split mouth study involving 30 patients, each patient served as his/her own control. After the third molar surgery, on one side the flap was repositioned passively without using a suture to hold it in place (study side), and on the other side the wound was closed primarily with three sutures (control side). Recorded complications included pain, swelling, bleeding, and formation of periodontal pockets. The study concluded that patients had significantly less post-operative pain and swelling when no sutures were used. There were no signs of excessive bleeding or oozing post-operatively on either side. The study concluded that six months post-operatively, there was no significant difference in the depth of the periodontal pocket around the second molar after third molar surgery.

Montero J et al. in 2011[44] evaluated the change in the periodontal status of mandibular second molars after surgical extraction of adjacent impacted lower third molar. The study included 48 patients (20 men and 28 women). Panoramic radiographs were obtained and clinical examinations were carried out at baseline to determine the periodontal status (probing depth and dental plaque and gingival indices) both for the second molar. After surgical removal of the impacted mandibular

third molars, all patients were assessed at 3, 6, 9, and 12 months for changes in periodontal status. The periodontal health of the second molar was found to improve gradually after third molar surgery in all clinical parameters. Probing depth was gradually reduced by about 0.6 mm quarterly, until a final depth of 2.6 ± 0.8 mm was attained. The periodontal status of the four posterior sextants also improved gradually. Molar depth, according to the Pell and Gregory classes and types, seemed to be the main factor modulating both the baseline probing depth and the change in probing depth during follow-up. Authors found that the initial periodontal breakdown established on the distal surfaces of the second molars and in the periodontal health of the 4 posterior sextants can be significantly improved 1 year after surgical removal of the ipsilateral lower third molar.

Hashemi HM et al. in 2012[45] evaluated the effect of suture less and multiple suture technique on inflammatory complications following third molar surgery on post-operative pain, swelling and trismus after lower third molar surgery was assessed in a prospective comparative study. The 80 patients (48 males, 32 females, and aged 18-38 years) were randomly divided into two equal groups. In the experimental group, the flaps were replaced without suturing. In control group flaps were opposed using multiple sutures. Pain, swelling and trismus were evaluated at 24 hours, 48 hours and 1 week post-operatively in both groups. The study concluded that there was significantly less pain, swelling and trismus at 24 hours and 48 hours, in the suture-less group. However it was also found that there was no significant difference between the two treatment groups in terms of pain, swelling and trismus at 1st week post-operatively.

Kareem JJ et al. in 2012[46] evaluated and compared the effect of 4 suturing techniques: (Simple loop , Figure 8 suture, Anchor suture and Closed anchor suture) on the periodontal health status on the distal aspect of the adjacent mandibular second molar after surgical removal of lower impacted third molar. 40 patients having fully impacted mandibular third molars were divided in to 4 groups (Group A: Simple loop, Group B: Figure 8 suture, Group C: Anchor suture and Group D: Closed anchor suture), each group consisted of 10 patients. Surgical extraction of impacted third molars was carried out for them. PPD and CAL were recorded pre-operatively and 6 months after surgery. On 6 months after surgery the mean values of PPD and CAL were significantly increased on the distal surface of the adjacent mandibular second molar in simple loop & figure 8 techniques. On the other hand, no significant difference has been noticed between anchor & closed anchor techniques in comparison with preoperative values. After 6-months, PPD and CAL values of were significantly higher in the simple loop and figure 8 techniques compared to anchor and closed anchor techniques. The authors concluded that closed anchor suture & anchor suture techniques are preferable to close the flaps in surgical removal of impacted mandibular third molars to maintain a good health status on the distal side of the adjacent mandibular second molar.

Eshghpour M et al. in 2013[47] compared the condition of the periodontium six months after extraction of impacted mandibular third molars with baseline values. 50 patients with 38 females and 12 males with mesio-angular impacted mandibular third molars participated in this study and probing depth, Leo and Sillness' gingival index, and clinical attachment level in disto-buccal, mid-distal, and disto-lingual surfaces of second molar teeth were assessed pre-operatively and 6 months later. To evaluate the

changes in alveolar bone height, two parallel peri-apical radiographs obtained at the baseline and follow-up session. 28(56%) of impacted molar teeth were in the right side and 22 (44%) were in the left side. Baseline values of probing depth, clinical attachment loss, and gingival index at three points on the distal surface of the mandibular second molar tooth had no significant differences with follow-up values (P-value> 0.05). According to the radiographs, baseline alveolar bone height also had insignificant difference with follow-up height (P-value> 0.05). Authors concluded that the surgical removal of impacted mandibular third molar does not affect periodontium after 6 months.

Anighoro EO et al. in 2013[48] compared the effect of complete and partial wound closures on post-operative sequelae and complications after surgical removal of impacted mandibular third molars. 120 patients who required 121 surgical extractions of mandibular impacted third molars were included in the study and patients were randomly divided into 2 groups based on wound closure after surgery. In Group I (complete wound closure, n1 = 60) patients had their extraction sockets completely closed by mucosal flap while in Group II (partial wound closure, n2 = 60) patients had their extraction sockets partially closed. Data collected included maximum interincisal distance and facial width both pre-operatively and post-operatively and post-operative pain intensity and complications. There were 50 (41.7%) males and 70 (58.3%) females (male to female ratio of 1:1.4); age range was 18 - 40 years and the mean was 26 ± 10 years. The mean ages of patients in both groups showed no significant difference (Group I = 26.5 ± 7.2; Group II = 27.1 ± 8.1). The pain was maximal at the 1st post-operative day review and it gradually reduced in intensity towards the pre-operative values for both groups. The pain perceptions in patients in Group II were

however significantly lower than those of Group I on days 1 and 3 but not statistically different on day 7. The mean difference in the post-operative and pre-operative maximum interincisal distance was greatest on the 1st post-operative day and gradually became smaller on the subsequent follow up. Comparison of this mean difference between the two groups however showed a significant difference in the 2 groups on 7th day. Maximal swelling was noted in both groups on the 3rd post-operative day. A comparison of the mean facial width between the two groups showed no statistically significant difference on all the review days. The post-operative complication rate was 5% in both groups. The results of the study indicate that there was a comparative reduction in post-operative sequelae namely pain and trismus after impacted mandibular third molar surgery when a partial wound closure technique was done. However, there was no significant difference in the post-operative complication rate between the two groups.

Desai A et al. in 2014[49] investigated the influence of flap design on visibility and accessibility during removal of impacted third molar and hematoma formation, wound gaping and healing of flap post-operatively. In a randomized prospective comparative study authors included 30 patients with impacted mandibular third molars and 2 flap designs were used namely "envelope flap" (Koener's incision) and 'triangular flap' (Ward's incision). Status of wound, periodontal health, and progress of healing was assessed after 7 and 15 days to judge the incidence of post-operative complications in both groups. There were no statistical differences between the groups in terms of visibility, accessibility, excessive bleeding during surgery, healing of flap, sensitivity of adjacent teeth, and dry socket and statistically significant difference was observed

in wound gaping, post-operative hematoma, and distal pocket in adjacent tooth, which was significant in Ward's triangular incision group in comparison to Koeiner's envelope incision group. Authors concluded that selection of the flap design is dependent on needs of the case and preference of the operating surgeon and does not seem to have a significant influence on the health of tissues.

Rahpeyma A et al. in 2015[50] compared wound dehiscence after removal of wisdom teeth in the most prevalent mandibular impaction (mesio-angular class IB) by two different soft tissue flap designs. In a split mouth study design, partially-erupted mandibular third molars with mesio-angular class IB impaction (Pell and Gregory classification) were selected and two flap designs were compared (envelope vs. triangular transposition flap). The patients were evaluated after 1 week and after 1 month for dehiscence, infection, and dry socket formation. There were no cases of infection in either group but three cases of dry socket in the envelope group and four in the triangular transposition flap group were recorded. In the envelope group, dehiscence occurred in 43% of cases during the first week, with 67% of cases being a large dehiscence (diameters of more than 5 mm) for which extra appointments (those requested by the patient exclusively related to the problem of the hole distal to the second molar) were scheduled in 10% of cases in the envelope group. In the triangular transposition flap group, dehiscence occurred during the first week for the same impaction in 19% of cases with large dehiscence cases occurring in 65% of cases and extra appointment rate at 4.1%. According to the results authors concluded that triangular transposition flap may prevent post-operative wound dehiscence more probably than the envelope flap.

Khan MA et al. in 2015[51] evaluated the frequency of dry socket, wound dehiscence, pain and swelling; one week after removal of mandibular third molar impaction. 100 patients having mandibular third molar impaction were included in the study and extractions were done by house surgeons and trainee medical officers. Smokers, patients with systemic diseases, using medications were excluded from the study. After elevating mucoperiosteal flap, mandibular third molar removal, primary closure was done with 3-0 suture (silk or vicryl). All patients were instructed properly and prescribed antibiotics and analgesics. Age, gender and complications of surgical removal of impacted third molar were recorded at one week. Out of 100 patients, 44 (44%) were females and 56(56%) were males. The age was ranged from 18 to 45 years. The common age group was 21-25 years. The frequency of dry socket 1 week after mandibular third molar extraction was 10% and the frequency of wound dehiscence 1 week after mandibular third molar extraction was 10%. The frequency of mild pain, moderate , and severe pain 1 week after mandibular third molar extraction were 41, 10, 4% respective and the frequency of swelling 1 week after mandibular third molar extraction was 35%. Authors concluded that the third molar surgical extraction is associated with many complications which can be minimized by observing the basic principles of surgery.

Materials and Method

"It is common sense to take a method and try it. If it fails, admit it frankly and try another. But above all, try something."

Franklin D. Roosevelt (1882-1945)

An experimental study was designed to evaluate and compare the effect of simple loop suture and open anchor suture technique on periodontal health status of mandibular second molar after surgical removal of impacted third molar and also to evaluate and compare the effect of these two suturing techniques on wound dehiscence.

STUDY AREA

The study was conducted in the Department of Oral & Maxillofacial Surgery.

STUDY POPULATION

Patients requiring surgical removal of impacted mandibular third molar were included in the study

STUDY DESIGN

Randomised Control Trial

DURATION OF STUDY

The study was performed for a period of 18 months from January 2016 to June 2017.

SAMPLE SIZE

60 patients visiting Department of Oral & Maxillofacial Surgery requiring surgical removal of impacted mandibular third molar were selected for the study.

INCLUSION CRITERIA

1. Patients of either sex in the age group of 18-30 years.
2. Class II level B mesio-angularly impacted mandibular third molar requiring ostectomy and odontectomy procedure for removal of third molar.
3. Nonsmoker patients.
4. No history of relevant systemic diseases.

EXCLUSION CRITERIA

1. Grossly decayed tooth.
2. Medically compromised patients.
3. Patient with known allergy to local anesthetic agent.
4. Mentally challenged patients.

5. Pregnancy or lactating.
6. Uncooperative and unwilling patients.
7. Patient unable to give informed consent.

MATERIALS USED:

1. Mouth mirror.
2. UNC-15 Periodontal probe. (Figure 4)
3. Cheek retractor.
4. Sterile Gauze.
5. Sterile suction tube.
6. Luer lock - 2ml disposable syringes, Unolok, needle size- 0.45 X 38 mm.
7. Chlorhexidine Gluconate solution 0.2% w/v.
8. Local anaesthetic solution consisting of 2% Lignocaine hydrochloride with adrenaline 1:2,00,000.
9. Austin's retractor.
10. Straight micro motor surgical hand piece.
11. 702 stainless steel bur (SS White Company).
12. Lower third molar extraction forceps.
13. Curette.
14. Tissue holding forceps.
15. Suture from Johnson & Johnson Ltd. (3-0 black braided silk or Vicryl with 3/8 circle 22 mm reverse cutting body needle).
16. Needle holder.
17. Normal saline.
18. Suture cutting scissor.

19. Surgeon 15 number surgical blade from Gibson Sterile Surgical Blade.
20. Bard Parker handle number 3.
21. Elevators for removal of impacted mandibular third molar.

METHODOLOGY

A randomized control trial was carried out in 60 patients indicated for surgical removal of partially impacted mandibular third molar fulfilling the inclusion criteria.

SAMPLING TECHNIQUE

Patients were selected randomly by lottery method. 60 chits were made among which 30 were of Group I and 30 of Group II. Patients reporting to OPD were evaluated for inclusion criteria and those fulfilling the criteria were asked to pick one chit and were accordingly divided in to two study groups.

PREOPERATIVE PREPARATION:

A complete case history was recorded pre-operatively using a standard case history proforma (Annexure I). Case history included a systematic documentation of patient's medical history and history of allergy (particularly in relation to local anesthesia).

Clinical examination was done and intraoral peri-apical radiograph or orthopantomogram(OPG) were performed for the impacted mandibular third molar to be extracted prior to the procedure to ensure that the tooth indicated for extraction were included in the study.

Routine presurgical investigations including blood pressure, hematological assessments for complete blood count, random blood sugar levels, bleeding time, clotting time were done and in case if the values of these assessments were beyond the normal range, further assessments were carried out and such medically compromised subjects were excluded from the study.

The entire procedure, nature of study, benefits and pitfalls associated surgical procedure were explained to the patient in detail in a language understood by the patient.

Signatures/thumb impression of the patient, witness and investigator were taken thereafter on the consent forms (Annexure II).

Total 60 patients requiring surgical removal of mesioangular impacted mandibular third molars were divided into two equal Groups I and Group II according to the suturing technique used for flap closure.

- **Group I - Simple loop suturing technique** was used for closure of the flap. The needle penetrates the outer surface of the first flap, the undersurface of the opposite flap is engaged, and then the suture is brought back to the initial site where the knot is tied in the simple loop suturing technique as shown in Figure 1.[39]

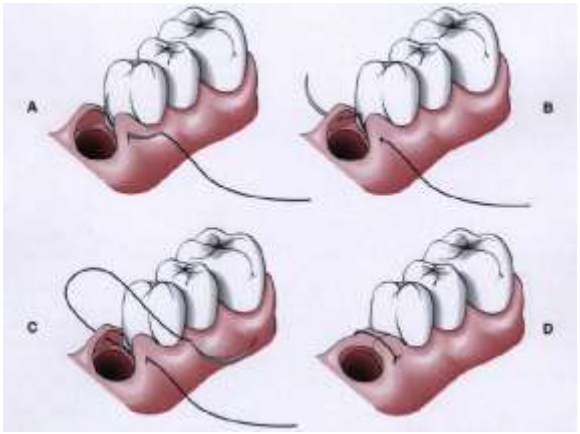

Figure 1: Simple Loop Suturing Technique

- **Group II - Open anchor suturing technique** was used for closure of the flap. The needle was placed at the line-angle area of the facial or lingual flap adjacent to the tooth, anchored around the second molar tooth, passed beneath the opposite flap, and then tied in the open anchor suturing technique as shown in Figure 2. [39]

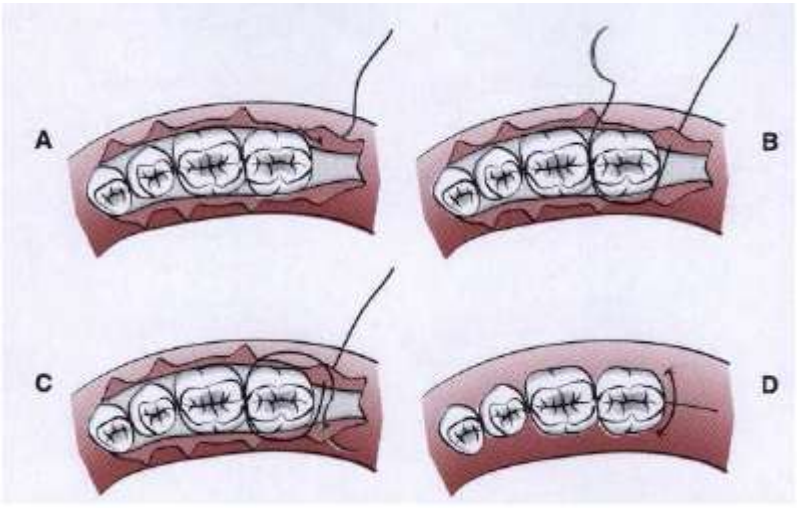

Figure 2: Open Anchor Suturing Technique

OPERATIVE PROCEDURE:

After explaining the procedure, patients were given chlorhexidine mouthwash 0.2% for mouth rinsing pre-operatively and then the surgical site was painted with 5% Povidone iodine solution and draped, the inferior alveolar nerve block was given using lignocaine 2% with adrenaline 1:200000 units (manufactured by Neon Laboratories Limited) as local anaesthetic solution. A full thickness flap was raised using Ward I incision. After flap reflection, bone removal was done with round bur and tooth sectioning was performed upon requirement. Smoothening of bone margins, irrigation of socket with normal saline was also performed. In case of Group I, the flap margins were passively repositioned by suturing at an area distal to the distal surface of second molar with the help of simple loop suturing technique. (Figure. 1) In case of Group II, the flap margins were closed by open anchor suturing technique. (Figure.2). 3-0 silk suture material was used in both the groups.

The entire procedure was done by a single operator under strict asepsis. After adequate hemostasis was achieved, all the patients were given standard post-operative instructions and were prescribed the following medications:

- Cap amoxicillin 500 mg thrice daily for 5 days. (If allergic, tab Cefixime 200mg twice a day for 5 days)
- Tab Aceclofenac 100 mg twice daily for 5 days. (If allergic, tab Paracetamol 500mg thrice a day)
- Tab. Ranitidine 150 mg twice a day, for 5 days.

Post-operatively patients were given chlorhexidine mouthwash 0.2% for mouth rinsing two times a day for 7days from the second post-operative day.

The following post extraction instructions were given:

1. Keep the gauze pack pressed in mouth for 45 minutes to 1 hour.
2. Don't spit; swallow saliva for rest of the day.
3. After removal of the gauze pack gently have something cold and start medicines.
4. Apply ice pack extra orally 3-4 times a day.
5. Eat soft and cold food only; don't take anything hot and hard for next 24 hours.
6. After 24 hours start warm saline gargles 3-4 times a day.
7. To come for follow up next day or as instructed.
8. Follow above instruction strictly.
9. In case of any complication contact immediately.

POST-OPERATIVE FOLLOWUP:

The patients were recalled for post-operative follow up on 7^{th} day after extraction for suture removal and for evaluating wound dehiscence. For assessment of periodontal pocket and clinical attachment level, patients were recalled on 15^{th} day, at 3 months and at 6 months.

CLINICAL PARAMETERS:

Various pre-operative and post-operative parameters were used to evaluate the study subjects. They were –

Pre-operative and Post-operative Assessment:

1. Probing pocket depth were measured from gingival margin to the bottom of the pocket at disto-buccal, mid-distal and disto-lingual points on the second molar pre-operatively using UNC-15 probe to compare it with post-operative probing pocket depth at 15th day, at 3 months and at 6 months.

2. Clinical attachment level were measured from cementoenamel junction (CEJ) to the bottom of the pocket at disto-buccal, mid-distal and disto-lingual points on the second molar pre-operatively using UNC-15 probe to compare it with post-operative probing pocket depth at 15th day, at 3 months and at 6 months.

3. Wound dehiscence was evaluated on 7th post-operative day. Every gaping along the entire incision line was defined as a dehiscence; particular attention was paid to the gingival margin at the distal rim of the second molar.

STATISTICAL METHODS

The demographic characteristics like age was summarised in terms of mean and standard deviation (SD) in two groups, while numbers and percentage were obtained for gender. Further, the mean and SD were obtained for both the periodontal parameters i.e. PPD and CAL, at different time points before and after treatment. Repeated measure analysis of variance was performed to determine the statistical significance of difference of mean parameter values across times for the both groups.

The pair wise analysis was performed using Tukey's post-hoc test in each group. Also, t-test for independent samples was used to determine the significance of difference of parameter means between two groups at each time point. All the analyses were performed using SPSS ver 20.0 (IBM Corp) software and statistical significance was tested at 5% level.

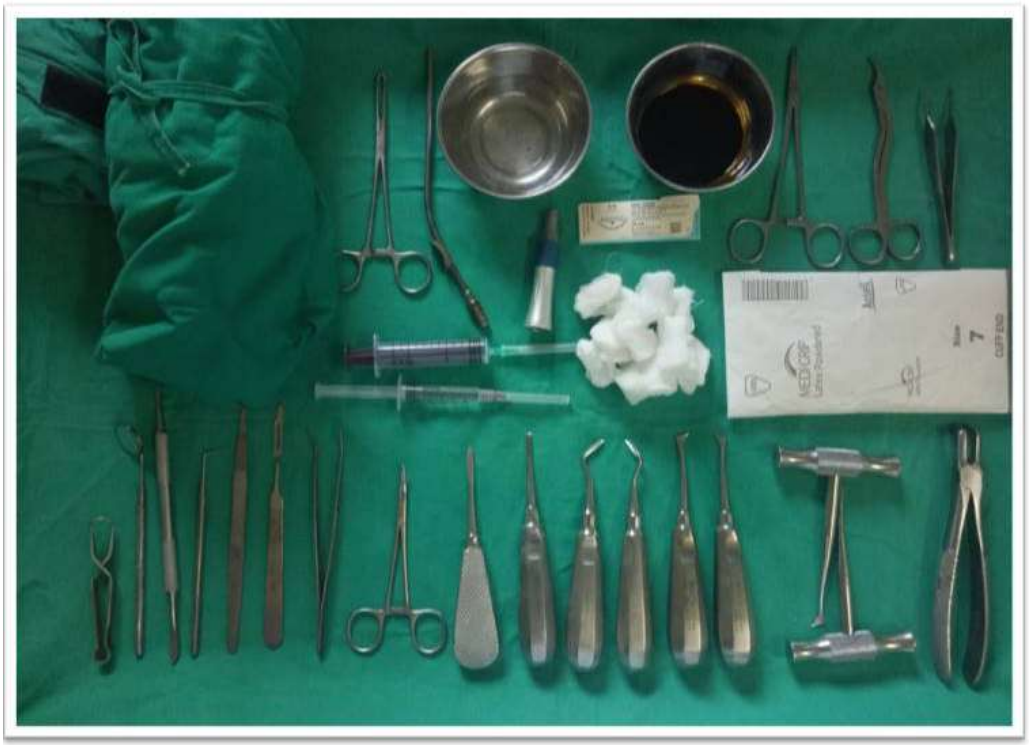

Figure 3 Armamentarium for surgical removal of impacted teeth

Figure 4 UNC-15 periodontal probe

Group I - Pre-operative measurement

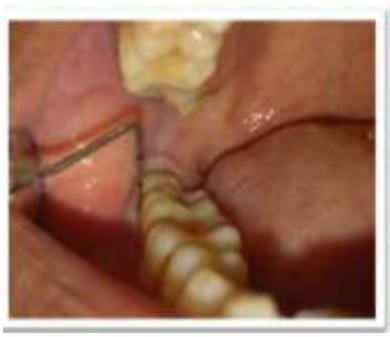

Figure 5.1 Disto-buccal

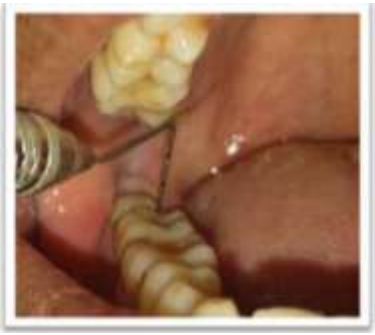

Figure 5.2 Mid-distal

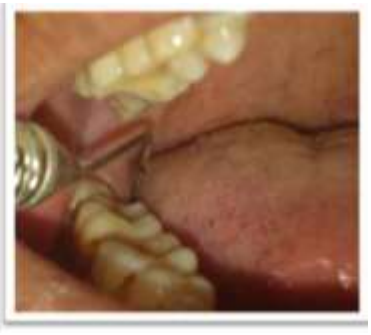

Figure 5.3 Disto-lingual

Group I - 7 days followup

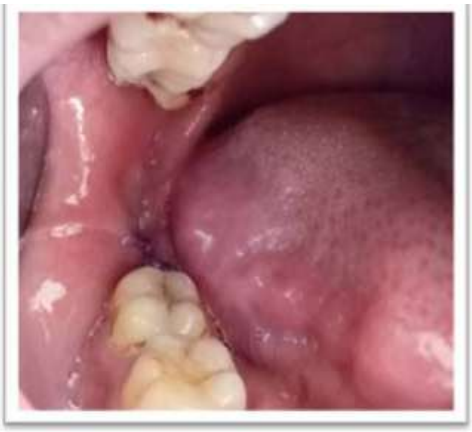

Figure 6.1 Simple loop suture in place

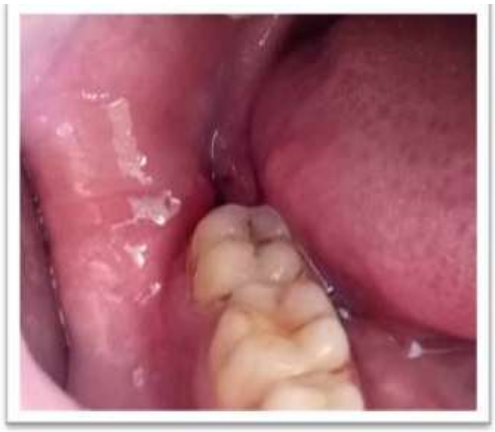

Figure 6.2 Wound after suture removal

Group I- 6 months post-operatively

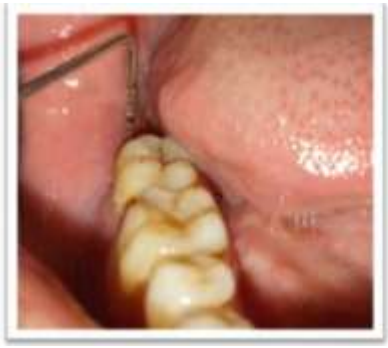

Figure 7.1 Disto-buccal

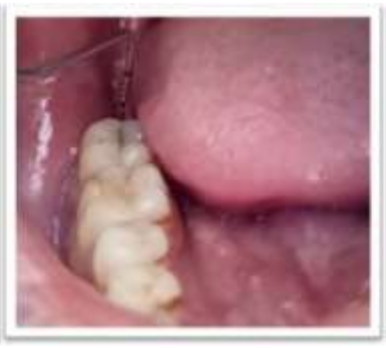

Figure 7.2 Mid-distal

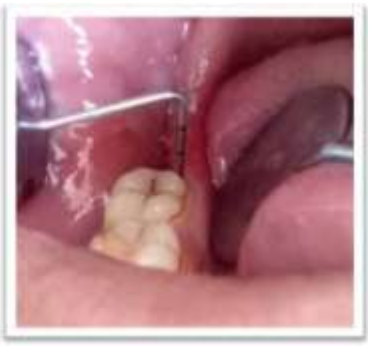

Figure 7.3 Disto-lingual

Group II - Pre-operative measurement

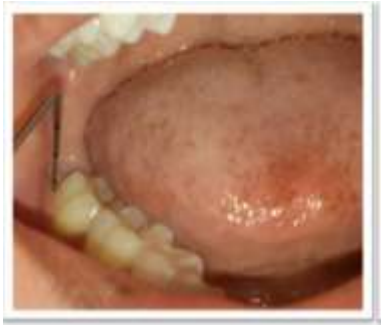

Figure 8.1 Disto-buccal

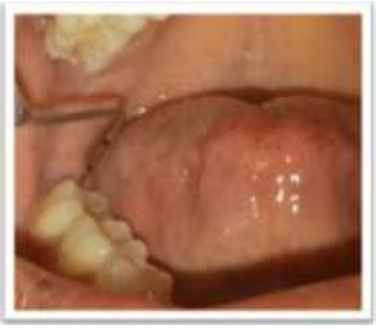

Figure 8.2 Mid-distal

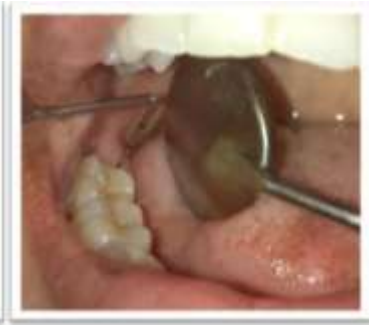

Figure 8.3 Disto-lingual

Group II - 7 days followup

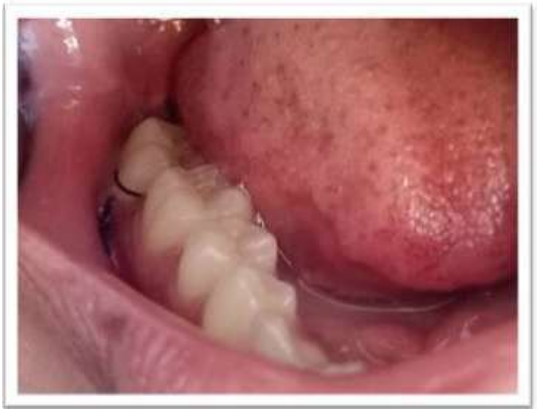

Figure 9.1 Anchor suture in place

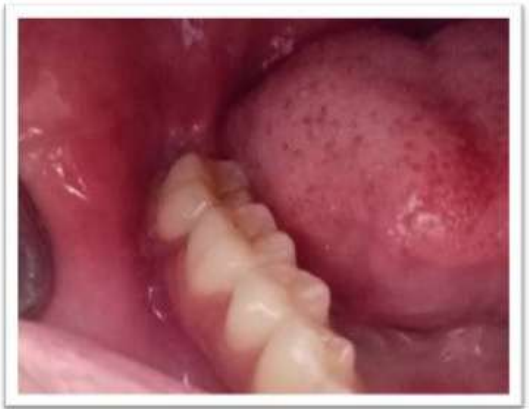

Figure 9.2 Wound after suture removal

Group II- 6 months post-operatively

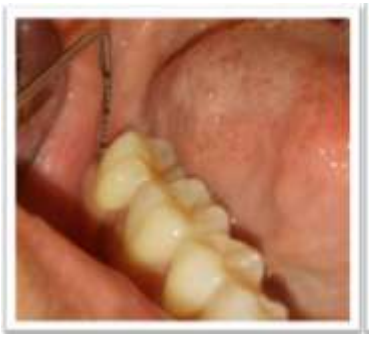

Figure 10.1 Disto-buccal

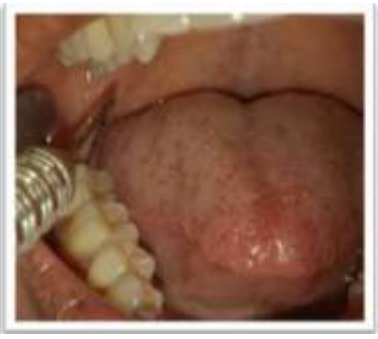

Figure 10.2 Mid-distal

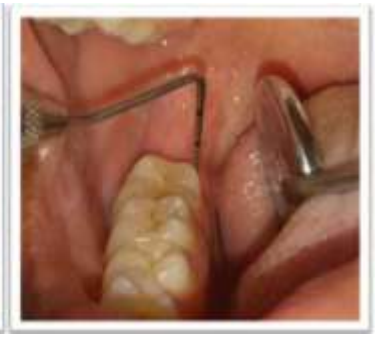

Figure 10.3 Disto-lingual

Results

This study was carried out in 60 patients undergoing surgical removal of partially impacted mandibular third molar. Patients were divided into two groups: Group I and Group II according to the suturing technique used for the closure of flap. In Group I, simple loop suture technique and in Group II open anchor suture technique was used for closure of the flap after surgical removal of partially impacted mandibular third molar. Both the techniques were evaluated and compared for their effect on periodontal health status distal to mandibular second molar by measuring PPD and CAL at disto-buccal, mid-distal and disto-lingual sites of second molar pre-operatively, 15 days, at 3 months and at 6 months.

AGE

The mean age of the study population is 23.75 ± 2.23 years.

The mean age among Group I is 24 ± 2.21 years

The mean age among Group II is 23.50 ± 2.25 years.

There was no significant difference in age between both the groups (p-value = 0.3896) suggesting comparability of both the intervention groups. (Table 1)

Graph 1 shows a bar chart distribution of age categories across the study population of both the groups.

GENDER

Table 1 shows gender distribution of the study population.

There were 14 (46.7%) female patients and 16 (53.3%) male patients in Group I. Group II comprised of 16 (53.3%) females patients and 14 (46.7%) male patients.

There was no significant difference in gender distribution between both the groups (p-value = 0.6056) suggesting comparability of both the intervention groups.

Graph 2 shows a bar chart distribution of the study population by different study groups.

With regards to gender, in Group I, there were 16 (53.3%) males and 14 (46.7%) females; while in Group II, there were 14 (46.7%) males and 16 (53.3%) females.

Baseline clinical characteristics

The mean baseline PPD for Group I was 4.28 ± 0.88 mm and for Group II it was 4.41 ± 0.86 mm. The mean baseline CAL for Group I was 4.42 ± 0.81 mm and for Group

II it was 4.59 ± 0.85 mm. At baseline, no statistically significant differences in any of the clinical parameters were observed between Group I and Group II, indicating the appropriate enrolment of study subjects in both groups and devoid of any bias. (Table 2, 6)

Clinical outcomes at 15 days, 3 months and 6 Months

Probing pocket depth (PPD)

In Group I, the mean PPD at baseline was 4.28 ± 0.88 mm and that at 15 days it was 6.09 ± 1.0 mm, at 3 month it was 2.94 ± 0.62 mm and at 6 months it was 2.82 ± 0.57 mm. In Group II the mean PPD at baseline was 4.41 ± 0.86 mm and that at 15 days it was 5.97 ± 0.84 mm, at 3 month it was 2.81 ± 0.73 mm and at 6 months it was 2.63 ± 0.57 mm.

For Group I, PPD before and after treatment across time points differed highly significantly with P-value < 0.0001, as obtained using repeated measure ANOVA. Similarly, PPD also differed highly significantly before and after treatment as in the Group II, as indicated by P-value < 0.0001, using same analysis. (Table 2)

At 15 days, the mean PPD increases by 1.81 ± 0.67 mm for Group I and for Group II mean PPD increases by1.56 ± 0.70 mm. At 3 months, the mean PPD reduction was 1.33 ± 0.76 mm for Group I and 1.60 ± 0.78 mm for Group II. There was a statistically significant reduction in PPD for Group I as well as Group II at 3 months compared to baseline ($p<0.0001$). At 6 months, the mean PPD reduction was 1.46 ± 0.79 mm for Group I and 1.78 ± 0.70 mm for Group II. There was a statistically

significant reduction in PPD for Group I as well as Group II at 3 months compared to baseline ($p<0.0001$).

The comparison of PPD difference between baseline and post-operative times for two groups was done using t-test for independent samples. PPD difference between baseline and 15 days, baseline and 3 months, as well as baseline and 6 months differed significantly across Group I and Group II with p-values 0.0135, 0.0302 and 0.0062 respectively. PPD difference between 3 months and 6 months for the two groups differed insignificantly from each other, as indicated by P-values > 0.05.

Graph 3 showing line plot of mean PPD levels at different times in two study groups

Clinical attachment level (CAL)

In Group I, the mean CAL at baseline was 4.42 ± 0.81 mm and that at 15 days it was 6.22 ± 0.93 mm, at 3 months it was 3.58 ± 0.86 mm and at 6 months it was 3.11 ± 0.64 mm. In Group II, the mean CAL at baseline was 4.59 ± 0.85 mm and that at 15 days it was 6.13 ± 0.94 mm, at 3 months it was 3.47 ± 0.66 mm and at 6 months it was 3.01 ± 0.66 mm. (Table 6).

For Group I, CAL before and after treatment across time points differed highly significantly with P-value < 0.0001, as obtained using repeated measure ANOVA. Similarly, CAL also differed highly significantly before and after treatment in Group II, as indicated by P-value < 0.0001, using same analysis.

A mean CAL loss at 15 days was 1.80 ± 0.71 mm in Group I and in Group II exhibited a mean CAL loss of 1.54 ± 0.84 mm. A mean CAL gain in Group I at 3 months was 0.93 ± 0.62 mm and in Group II it was 1.14 ± 0.73 mm. Both groups

exhibited a statistically significant increase in CAL gain at the end of 3 months when compared to baseline. ($p<0.0001$). (Table 9)

In Group I, the mean CAL at baseline was 4.42 ± 0.81 mm and that at 6 months was 1.33 ± 0.76 mm. Group II showed a mean baseline CAL of 4.59 ± 0.85 mm and at 6 months, it was 1.58 ± 0.85 mm. The mean CAL gain at 6 months in Group I was 1.33 ± 0.76 mm and in Group II was 1.58 ± 0.85 mm. There was statistically significant CAL gain for Group I and Group II at 6 months when compared to baseline ($p<0.001$). (Table 6, 7, 8)

The comparison of CAL difference between baseline and post-operative times was done using t-test for independent samples. The difference between baseline and 15 days, baseline and 3 months, as well as baseline and 6 months across Group I and Group II were statistically significant with p-values 0.0281, 0.0392 and 0.0437 respectively. CAL difference between 3 months and 6 months for the two groups differed insignificantly from each other, as indicated by P-values > 0.05. (Table 9)

Figure 4 showing line plots of mean CAL levels at different times in two groups.

The comparison of the distribution of patients as per wound dehiscence was obtained using Fisher's exact test. The difference in the proportion of cases with wound dehiscence in two groups was statistically insignificant with P-value of 0.612. (Table 10)

Discussion

The optimal management of impacted mandibular third molars is always a challenge. Several reports have focussed on various post-operative complications related to third molar surgery. Immediate post-operative tissue reactions include swelling, pain, trismus, and dysphagia. Complications, which may occur but may not necessarily follow the surgical intervention, include bleeding, dry socket, nerve injury, delayed healing and infection.[52] Another important complication which needs to be addressed is the risk of developing periodontal defects on the distal aspect of second molars after removal of impacted mandibular third molar.[53] Literature reports various modifications in surgical approach for the removal of third molars in terms of flap design and different incision techniques for the improved periodontal status of the adjacent second molar. However studies have documented conflicting results.[23, 54]

The extraction of mesio-angular impacted mandibular third molars causing periodontal damage at the distal root of the adjacent second molar has been in practice.[55] However, there is still a lack of consensus in the scientific literature concerning the clinical management of asymptomatic third molars because of the impact of surgical procedures on the periodontal status of the adjacent second molar. In the surgical removal of impacted mandibular third molars, it is important to preserve the integrity of the periodontal structures adjacent to the second molar. Factors affecting post-operative morbidity of the second molar adjacent to the impacted mandibular third molar have been a topic of extensive research. Apart from flap design and incision techniques, wound closure technique in third molar surgery is another operative factor whose effect has been associated with controversy.[35, 56] And there is a sparse literature focussing on the effect of wound closure technique in relation to the periodontal healing of second molar without any periodontal treatment.

The simple loop suture is an accepted suturing technique commonly used for wound closure by most surgeons in studies evaluating the effect of third molar removal on the periodontal health of adjacent second molar. [30, 37] However, there is literature supporting that anchor suture is one of the best technique to close a flap located in an edentulous area mesial or distal to a tooth.[17] However, there is scarce documentation regarding open anchor suture technique used for closure of flap after surgical removal of mesio-angularly impacted mandibular third molar surgery and its implication on the periodontal health of adjacent second molar. So this study was designed to evaluate and compare the impact of simple loop suture and open anchor suture technique on the periodontal health status of mandibular second molar after surgical removal of impacted third molar and also to evaluate and compare the effect of these two suturing techniques on wound dehiscence.

The present study was a randomised controlled clinical trial. 60 patients (30 males and 30 females) with a mean age of 23.75 ± 2.23 (range20-29years) requiring surgical removal of impacted mandibular third molar, who met the inclusion criteria were included and randomly assigned to each treatment sequence. In Group I, simple loop suturing technique and in Group II, open anchor suturing technique was used for closure of the flap.

In our study, patients in both Group II and Group II showed uneventful postoperative healing without any signs of infection and complication except for 3 cases in Group I and 1 case in Group II where wound dehiscence was noticed on evaluation at 7th post-operative day. Use of triangular flap design in our study could have been the reason for a minimum number of post-operative wound dehiscence which is in accordance with the findings of **Jakse et al. (2002).**[16] There is no specific data available from the literature and the decision to use any of the various flap designs for access to mandibular third molars should be based on operator preference.[35] But according to **Jakse et al. (2002)**[16] in the first phase of wound healing, wound dehiscence at the disto-facial edge of the adjacent second molar are very frequent when using the envelope flap. Such dehiscence may heal secondarily without any additional discomfort or consequences. In our study, though not significant the frequency of wound dehiscence was less in Group II compared to Group I possibly showing the beneficial effects of anchor suture technique over simple loop suture technique.

Plaque control is essential for the long term stability of clinical outcomes. Bacterial plaque is a major and important factor in the etiology of periodontal destruction and successful therapy depends upon its removal subsequent to treatment. Each subject participating in the study showed good oral hygiene and a healthy clinical gingival

condition throughout the duration of the study. This could have been the result of repeated oral hygiene instructions given to the patients throughout the study period.

The preoperative values of PPD and CAL when compared between two groups the difference was insignificant indicating the appropriate enrolment of study subjects in both groups devoid of any bias. In Group I, the mean PPD at baseline was 4.28 ± 0.88 mm, and for Group II it was 4.41 ± 0.86 mm. And there was an increase in values of PPD by 1.81 ± 0.67 mm and 1.56 ± 0.70 mm, which was significantly higher in Group I compared to Group II when evaluated at 15 days.

The PPD for Group 1 and Group 2 was increased compared to the pre-operative measurements when evaluated after 15days of removal of an impacted mandibular third molar. The reason for this can be attributed to the fact that relatively limited periodontal wound healing might not reach functional integrity until 2 weeks postsurgery. **Hiatt et al. (1968)**[57] examined the tensile strength of the tooth–gingival flap interface and found that tensile strength increases with increase in time of healing. Also the ostectomy done at the time of removal of impacted mandibular third molar jeopardizes the initial periodontal fibre attachment allowing greater penetration of the periodontal probe reflected as increased PPD at 15days.

In Group I, the mean PPD at baseline was 4.28 ± 0.88 mm, and 2.94 ± 0.62 mm, 2.82 ± 0.57 mm at 3 months and 6 months respectively. In Group II, the mean PPD at baseline was 4.41 ± 0.86 mm, and 2.81 ± 0.73 mm, 2.63 ± 0.57 mm at 3 months and 6 months respectively.

At 3 months, the mean PPD reduction was 1.33 ± 0.72 mm for the Group I and for Group II it was 1.60 ± 0.78 mm, which was significantly higher when compared to baseline. Intergroup comparison showed significantly higher reduction of PPD in

Group II at 3 months. Similarly, when evaluated at 6 month Group II showed a reduction of 1.78 ± 0.70 mm for PPD which was significantly higher when compared to Group I showing a reduction of 1.48 ± 0.75 mm.

Cetinkaya et al. (2009)[39] compared anchor suture and simple loop suture for its effect on the periodontal health of adjacent second molar after impacted mandibular third molar extraction. Authors found a statistically significant increase of distal PPD and CAL at 6 month in simple loop suture group when compared with preoperative values.

Kareem JJ et al.(2012)[46] compared the efficacies of four suturing techniques i.e. simple loop, figure of eight suture, anchor suture and closed anchor suture in maintaining the periodontal health of mandibular second molar. They found significantly increased PPD and CAL values at 6 month for simple loop and figure of eight techniques compared to the pre-operative values. **Kareem JJ et al. (2012)**[46] noted that in simple loop suture group values for PPD increased from 2.69 ± 0.67 mm to 4.10 ± 0.65 mm and CAL increased from 4.57 ± 0.62 mm to 5.81 ± 0.78 mm. Similarly, for anchor suture, PPD increased from 2.91 ± 0.63 mm to 3.27 ± 0.68 mm and CAL values increased from 4.47 ± 0.55 mm to 4.58 ± 0.64 mm, which was having a statistically non-significant difference when evaluated postoperatively at 6 month. Authors concluded that closed anchor and anchor suturing techniques is better to maintain the healthy periodontium and to prevent periodontal problem after surgical removal impacted third molar. Difference in the results in terms of increased postoperative PPD and CAL when compared to our study can be attributed to the variation in the inclusion criteria followed by **Kareem JJ et al. (2012)**[46] and **Cetinkaya et al. (2009)**[39], where authors included totally bone impacted mandibular

third molar whereas in our study, class II level B mesio-angular impacted mandibular third molar was included. Partially impacted mandibular third molar is associated with inadequate plaque control and predisposes patient to a persistent localised periodontal problem increasing PPD.[29] Similar findings have been noted by **Ash et al.(1962)**[18] that a partially impacted third molar exposed to the oral environment is more susceptible to periodontal infection, and thus to greater periodontal attachment loss.

Richardson et al. (2005)[53] studied the risk of having periodontal defects on the distal aspect of mandibular second molar and found that when PPD was more than 4mm the overall periodontal health distal to mandibular second molar improved. In our study preoperative PPD for Group I was 4.28 ± 0.88 mm and for Group II it was 4.41 ± 0.86 mm which subsequently reduced to 2.82 ± 0.57 mm for Group I and 2.63 ± 0.57 mm in Group II at 6 months.

The decrease in PPD at 3 months and 6 months in our study is similar to the observation of **Stephens et al. (1983)**[21] where authors found that there was a significant decrease in mean sulcus depth after the surgical removal of mandibular third molars. These findings can also be explained on the basis of observation of **Lindhe et al. (1984)**[58] where the author opined that all surgical procedures result in a decrease in probing pocket depths with greater reduction occurring at initially deeper sites.

In Group I, the mean CAL at baseline was 4.42 ± 0.81mm, and 6.22 ± 0.93 mm, 3.58 ± 0.86 mm, 3.11 ± 0.64 mm at 15days, 3 months and 6 months respectively. In the Group II, the mean CAL at baseline was4.59 ± 0.85mm, and 6.13 ± 0.94 mm, 3.47 ± 0.66 mm, 3.01 ± 0.66 mm at 15days, 3 months and 6 months respectively.

The difference of values of CAL at baseline and 3 months denotes the CAL gain after 3 months. Similarly, the difference of values of CAL at baseline and 6 months denotes the CAL gain at 6 months. At 3 months, the mean CAL gain was 0.93 ± 0.62 mm for the Group I and for Group II it was 1.14 ± 0.73 mm, which was highly significant when compared to baseline. Intergroup comparison showed a significantly higher gain of CAL in Group II at 3 months. Similarly, when evaluated at 6 month Group II showed a gain of 1.58 ± 0.85 mm for CAL which was significantly higher when compared to Group I showing a gain of 1.33 ± 0.76 mm.

In our study, there was a CAL gain of 0.93 ± 0.62 mm for Group I and 1.14 ± 0.73 mm for Group II at 3 months. At 6 month CAL gain of 1.33 ± 0.76 mm for Group I and 1.58 ± 0.85 mm for Group II was noted which was statistically significant when intergroup comparison was done for both the time periods. **Krausz et al (2005)**[33] in a split-mouth study found that extraction of an impacted third molar leads to a significant gain of alveolar bone height on the distal aspect of the adjacent second molar. A gain in alveolar bone height leads to gain in CAL and this could be the reason for the improvement in CAL values in both groups at 3 months and 6 months compared to pre-operative CAL values. Also our results are in accordance with findings of **Grooves and Moore (1970)**[59]**, Ash et al.(1962)**[18] **and Ziegler (1975)**[60] where authors have shown an increase in alveolar bone height distal to the second molar. **Kugelberg et al. (1985)**[22] have also shown an increase in alveolar bone height distal to the second molar after surgical extraction of impacted mandibular third molar, and mainly in younger individuals. The improvement in alveolar bone level was mainly seen in younger individuals by **Kugelberg et al (1990)**[25] and attributed the reason to the fact that young patients have better healing than older patients. In our study the mean age group was for Group I was 24 ± 2.21 years and for Group II was

23.50 ± 2.25 years indicating enrolment of younger individuals giving positive postoperative results in terms of reduction in PPD and gain in CAL.

Statistically significant CAL gain was found for Group II when the intergroup comparison was done at 3 months and 6 month which indicates that better postoperative periodontal health was achieved in Group II compared to Group I.

Reduction in PPD and CAL can be explained on the basis of regeneration and repair phenomenon related to periodontal healing after the surgical procedure. Regeneration is used in periodontal literature to describe instances where the structure and functional relationships of damaged periodontal tissues appear to be renewed. The use of term regeneration describes new attachment or formation of new cementum, alveolar bone and intervening periodontal ligament. Repair is the process wherein damaged tissues are replaced by tissues that do not duplicate the function of original tissues. Decreased probing depths after treatment of severe periodontal supra bony defects are frequently the result of connective tissue repair and the formation of a long junctional epithelium. This connective tissue repair is termed as re-attachment.[61]

Hiatt et al. (1968)[57] suggested that wound integrity during the early healing phase rests primarily on the stabilization of the gingival flaps offered by suturing. They found that optimal management of flaps by appropriate suturing techniques have a role to play in improved periodontal regeneration and repair. The rationale for using anchor suture to achieve passively repositioned closure in our study was to negate the disadvantage of delayed healing period associated with secondary closure while still achieving better post-operative outcome.[62] Open anchor suture helps to maintain the tooth flap junction at a more coronal level compared to simple loop suture during the initial periodontal healing period providing better periodontal regeneration and repair.

This improved periodontal regeneration and repair may eventually lead to a statistically significant decrease in PPD and gain in CAL for Group II compared to Group II, distal to mandibular second molar at 3 months and 6 months.

Significant reduction of PPD and gain in CAL were noted at 3 months and 6 months when compared to baseline in both the groups. When values of reduction in PPD and gain in CAL at 6 months were compared to the values at 3 months the difference was more for Group II but was not significant. This probably shows that optimal periodontal healing takes place in the initial time period and improves with time.

Our patients of both groups showed improved periodontal status distal to the second molar after surgical removal of an impacted mandibular third molar. Present clinical trial shows the beneficial effects of open anchor suturing technique over simple loop suture technique.

Summary & Conclusion

An experimental study was undertaken to evaluate and compare the effect of simple loop suture and open anchor suture technique on periodontal health status of mandibular second molar after surgical removal of impacted third molar and also to evaluate and compare the effect of these two suturing techniques on wound dehiscence.

Findings of our study showed that use of anchor suture and simple loop suture techniques had improved periodontal health status of second molar after surgical removal of partially impacted mandibular third molar irrespective of the technique used.

Significant reduction of PPD and gain in CAL were noted at 3 month and 6 month when compared to baseline in both the groups. There was a significant reduction in

PPD and gain in CAL for Group II when compared to Group I at 6 months, which indicates that open anchor suture have beneficial effects in terms of improved periodontal status distal to second molar after surgical extraction of partially impacted mandibular third molar. In our study the frequency of wound dehiscence was less though not significant in Group II compared to Group I possibly showing the beneficial effects of open anchor suture technique over simple loop.

Host response of the patient can be a significant determinant in terms of response to the surgical therapy and which is a dynamic parameter. Split mouth study design could have helped to reduce this bias, which could be one of the limitations of our study. It should be noted that the differences in healing patterns, microbial pathogens, patient population and measurement techniques make it difficult to compare clinical results.

The sample size in the present study was limited to 60 impacted third molars divided equally into two groups. A larger sample size would be desirable so as to substantiate the results. Long term analysis is needed to determine the stability of the results. The operator was the assessor in the present study and there were no blinded examinations. Therefore possibility of operator bias to some extent cannot be ruled out.

Further studies with a larger sample size should be conducted to compare the closure of flap using open anchor or simple loop suture technique and its effect on the periodontal health status of second molar adjacent to partially impacted mandibular third molar to validate the finding of our study.

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Tables and Graphs

Table 1: Demographic description of patients in two groups

Characteristics	Simple loop	Open anchor
Number of patients	30	30
Age (years)		
Mean	24.00	23.50
SD	2.213	2.255
Median	24.00	23.00
Minimum	20.00	20.00
Maximum	28.00	29.00
Gender [No. (%)]		
Male	16 (53.3)	14 (46.7)
Female	14 (46.7)	16 (53.3)

Table 2: Comparison of probing pocket depth before and after treatment in two study groups

Groups	Time: PPD (mm)				P-value*
	Before	After			
		15 days	3 months	6 months	
Simple Loop	4.28 ± 0.88	6.09 ± 1.001	2.94 ± 0.62	2.82 ± 0.57	< 0.0001 (HS)
Open Anchor	4.41 ± 0.86	5.97 ± 0.84	2.81 ± 0.73	2.63 ± 0.57	< 0.0001 (HS)

**Calculated using repeated measures ANOVA; HS: Highly Significant, S: Significant, NS: Not Significant*

Table 3: Pair wise comparison of probing pocket depth with time in Simple loop group

Time point	Absolute mean difference	P-value
Before – 15 days	1.811	< 0.0001 (HS)
Before – 3 months	1.333	< 0.0001 (HS)
Before – 6 months	1.456	< 0.0001 (HS)
3 months – 6 months	0.122	< 0.0001 (HS)

HS: Highly Significant

Table 4: Pair wise comparison of probing pocket depth with time in Open anchor group

Time point	Absolute mean difference	P-value
Before – 15 days	1.556	< 0.0001 (HS)
Before – 3 months	1.600	< 0.0001 (HS)
Before – 6 months	1.778	< 0.0001 (HS)
3 months – 6 months	0.178	< 0.0001 (HS)

HS: High Significant

Table 5: Difference of PPD between two times points and its comparison between two groups

Time points	Simple loop (n=30)	Open anchor (n=30)	P-value*
Baseline Vs 15days	1.81 ± 0.67	1.56 ± 0.704	0.0135(S)
Baseline Vs 3 month	1.33 ± 0.76	1.60 ± 0.78	0.0302 (S)
Baseline Vs 6 month	1.46 ± 0.79	1.78 ± 0.70	0.0062 (S)
3 month Vs 6 month	0.12± 0.36	0.18 ± 0.41	0.3383 (NS)

*S: Significant; NS: Not significant; *Obtained using t-test for independent samples*

Table 6: Comparison of clinical attachment level before and after treatment in two study groups

CAL	Time				P-value*
	Before	After			
		15 days	3 months	6 months	
Simple Loop	4.42 ± 0.81	6.22 ± 0.93	3.58 ± 0.86	3.11 ± 0.64	< 0.0001 (HS)
Open Anchor	4.59 ± 0.85	6.13 ± 0.94	3.47 ± 0.66	3.01 ± 0.66	< 0.0001 (HS)

**Calculated using repeated measures ANOVA; HS: Highly Significant; NS: Not significant*

Table 7: Pair wise comparison of clinical attachment level with time in Simple loop group

Time point	Absolute mean difference	P-value
Before – 15 days	1.800	< 0.0001 (HS)
Before – 3 months	0.844	< 0.0001 (HS)
Before – 6 months	1.311	< 0.0001 (HS)
3 months – 6 months	0.467	< 0.0001 (HS)

HS: Highly significant

Table 8: Pair wise comparison of clinical attachment level with time in Open anchor group

Time point	Absolute mean difference	P-value
Before – 15 days	1.554	< 0.0001 (HS)
Before – 3 months	1.122	< 0.0001 (HS)
Before – 6 months	1.578	< 0.0001 (HS)
3 months – 6 months	0.456	< 0.0001 (HS)

HS: Highly significant

Table 9: Difference of CAL between two times points and its comparison between two groups

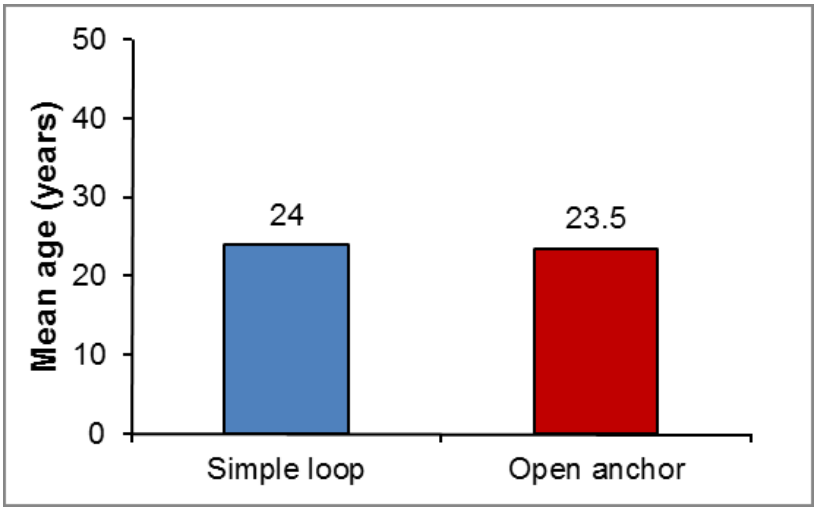
Time points	Group I	Group II	P-value*
Baseline Vs 15days	1.80 ±0.71	1.54±0.84	0.0281(S)
Baseline Vs 3 month	0.93 ± 0.62	1.14±0.73	0.0392(S)
Baseline Vs 6 month	1.33 ± 0.76	1.58 ± 0.85	0.0437 (S)
3 month Vs 6 month	0.60 ± 0.72	0.57±0.64	0.7418 (NS)

*S: Significant; NS: Not significant; *Obtained using t-test for independent samples*

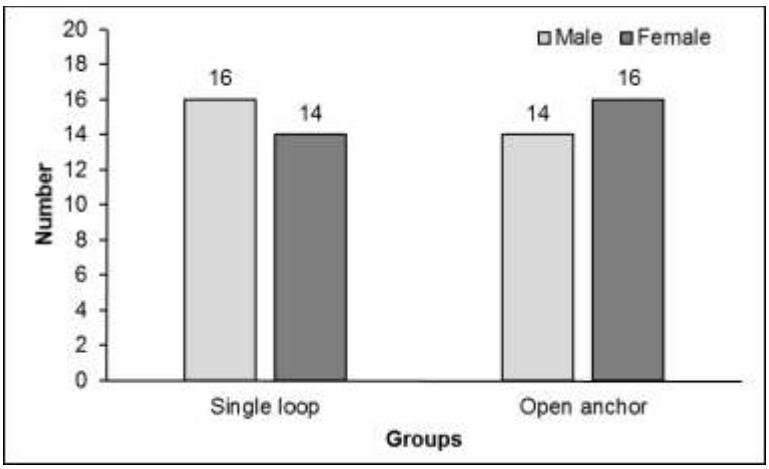
Table 10: Distribution of patients as per wound dehiscence in two groups

Status	Simple loop (n=30)	Open anchor (n=30)	P-value*
Present	3	1	0.612 (NS)
Absent	27	29	

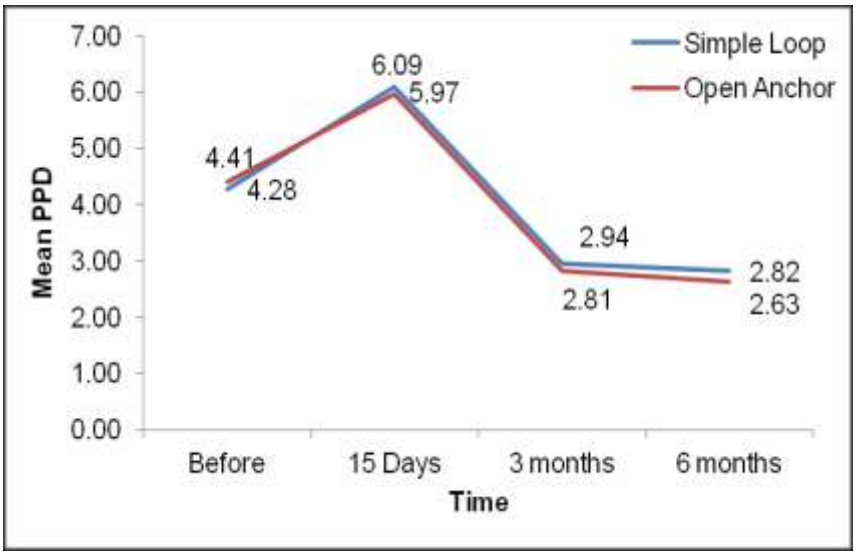
**Obtained using Fisher's exact test; NS: Not significant*



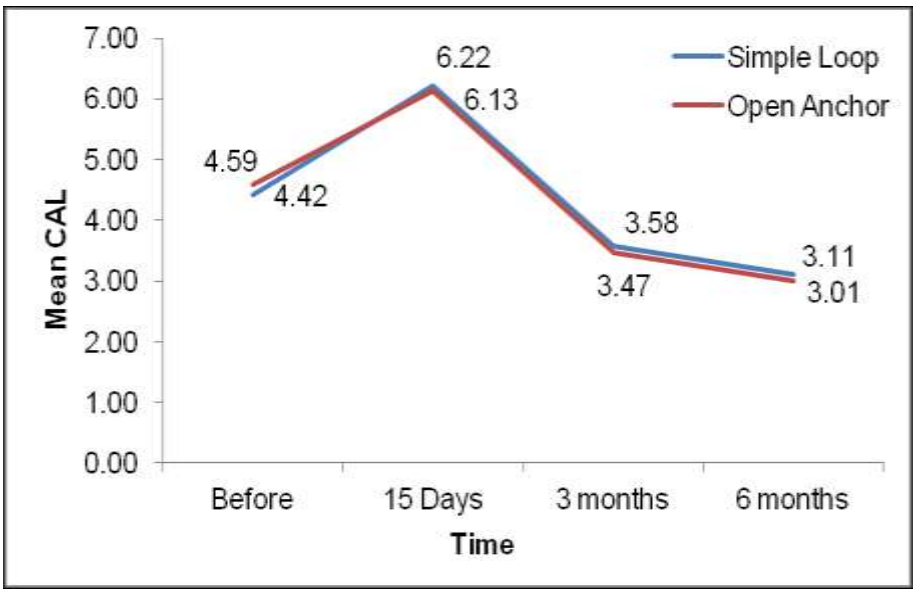
Graph 1: Bar chart showing mean age of patients in two groups



Graph 2: Bar chart showing gender distribution of patients in two groups



Graph 3: Line plots showing the mean PPD levels at different times in two study groups



Graph 4: Line plots showing mean CAL levels at different times in two groups.

ANNEXURE-I

DEPARTMENT OF ORAL & MAXILLOFACIAL SURGERY

CASE HISTORY PROFORMA

Case number-

Date-

Name-

Age/Sex-

Registration No-

Address-

Education-

Occupation-

Chief Complaint-

History of present illness –

Cause of tooth extraction-

1. Orthodontic
2. Periodontitis
3. Carious
4. Others

Past Medical History-

Past Dental History-

Drug Allergy History-

Family History-

Personal History-

- Diet
- Oral habits
- Sleep
- Oral hygiene

Examination-

Extraoral examination:

- Facial Symmetry
- TMJ
- Lymph nodes

Intraoral Examination**:**

- Teeth present
- Missing teeth
- Root piece
- Occlusion
- Caries/attrition/abrasion/erosion/abfraction
- Mobility
- Others

Diagnosis-

Radiographic investigations: IOPA-

OPG-

Other investigations-

Advice-

ANNEXURE - II

ASSESSMENT FORM

1. Wound dehiscence

Wound dehiscence	Absent	Present
7th postoperative day		

2. Periodontal Probing Pocket Depth

	Preoperative PPD			15th Postoperative day PPD			3rd Postoperative day PPD			6th Postoperative day PPD		
	D.B.	M.D.	D.L.	D.B.	M.D.	D.L.	D.B.	M.D.	D.L.	D.B.	M.D.	D.L.
Simple Loop Suture												
Open Anchor Suture												

3. Clinical Attachment Level

	Preoperative CAL			15th Postoperative day CAL			3rd Postoperative day CAL			6th Postoperative day CAL		
	D.B.	M.D.	D.L.	D.B.	M.D.	D.L.	D.B.	M.D.	D.L.	D.B.	M.D.	D.L.
Simple Loop Suture												
Open Anchor Suture												

ANNEXURE-III

DEPARTMENT OF ORAL & MAXILLOFACIAL SURGERY

INFORMED CONSENT FORM
(Confidential)

"Impact of suturing techniques on the periodontal health status of mandibular second molar after extraction of impacted third molars- A Randomised Control Trial."

I _____resident of _____aged years.

Exercising my free will, without any pressure/lure of incentive in any form, hereby give my consent to be included as subject in the said clinical study.

The doctor has informed me about this research project suitably and sufficiently to my satisfaction. I agree to allow my photographs to be drawn as required. I agree to take part in this project and will not mix any other projects during the period of this trial. I shall report to the dental hospital or other place where called on given appointment dates and time. I shall inform the doctor on any adverse effect or unusual symptom noticed by me. I shall co-operate with the doctors in all respects. I permit publishing the results of my participation in this study. I shall not be given any reimbursement or compensation. I have been informed about my right to withdraw from the research project at any given time.

I hereby record my consent for participation in the said trial.

1. _____	_____	_____	_____
Patient's name	Signature	Date	Time
2. _____	_____	_____	_____
Witness name	Signature	Date	Time
3. _____	_____	_____	_____
Investigator's name	Signature	Date	Time

ANNEXURE IV
MASTER CHART
BASELINE

Sr no	Age/Sex	Group I SIMPLE LOOP					
		PPD			CAL		
		Disto Buccal	Mid Distal	Disto Lingual	Disto Buccal	Mid Distal	Disto Lingual
1	23/M	3	5	5	3	5	5
2	21/F	2	4	4	3	4	4
3	24/M	3	5	4	3	5	4
4	28/M	4	6	5	5	6	5
5	22/F	3	4	4	3	5	4
6	26/F	4	5	4	4	5	4
7	27/F	4	5	6	4	5	6
8	21/M	3	5	4	3	5	4
9	24/M	3	4	4	3	5	4
10	28/F	4	6	5	5	6	5
11	20/M	5	5	4	5	5	4
12	22/M	5	6	6	5	6	6
13	23/F	4	5	4	4	5	4
14	26/M	3	4	4	3	4	4
15	27/M	3	5	5	4	5	5
16	24/F	4	5	4	4	5	4
17	23/M	3	5	4	3	5	5
18	24/M	3	4	4	3	4	4
19	25/M	4	5	5	4	5	5
20	23/F	3	5	5	3	5	5
21	26/F	3	5	4	4	5	4
22	27/F	4	5	4	4	5	4
23	23/F	3	5	5	4	5	5
24	25/M	2	5	4	4	5	4
25	24/M	3	4	5	3	4	5
26	22/M	4	5	5	4	5	5
27	23/F	4	4	4	4	5	4
28	21/F	3	4	4	3	5	4
29	22/F	5	6	5	5	6	5
30	26/M	4	5	4	4	5	4

BASELINE

Sr no	Age/Sex	Group II OPEN ANCHOR					
		PPD			CAL		
		Disto Buccal	Mid Distal	Disto Lingual	Disto Buccal	Mid Distal	Disto Lingual
1	22/F	4	5	5	4	5	5
2	24/M	3	5	5	3	5	5
3	26/M	3	4	4	3	5	4
4	20/M	4	5	4	4	5	4
5	24/F	3	5	4	3	5	4
6	21/M	3	4	4	4	4	4
7	24/F	4	5	6	4	5	6
8	20/M	3	6	5	3	6	5
9	29/F	3	6	5	3	6	5
10	27/F	4	6	5	4	6	5
11	21/M	4	5	5	4	5	5
12	25/F	5	6	6	5	6	6
13	27/M	4	5	5	4	5	5
14	23/M	3	5	4	5	6	4
15	27/F	3	5	4	5	5	4
16	21/F	4	6	4	4	6	4
17	23/F	3	5	4	3	5	4
18	24/F	4	5	4	4	5	4
19	23/M	4	5	5	5	6	5
20	22/M	4	5	4	4	5	4
21	23/F	3	5	4	4	6	4
22	25/M	4	5	4	4	5	4
23	22/F	3	5	5	3	6	5
24	21/F	3	5	4	4	5	4
25	22/F	3	4	5	3	4	5
26	24/M	4	5	5	5	5	5
27	22/F	4	5	4	4	6	4
28	24/M	3	5	4	4	5	4
29	23/M	5	6	5	5	6	5
30	26/F	4	5	4	4	5	4

15 DAYS

Sr no	Group I SIMPLE LOOP					
	PPD			CAL		
	Disto Buccal	Mid Distal	Disto Lingual	Disto Buccal	Mid Distal	Disto Lingual
1	5	7	6	5	7	6
2	4	7	5	4	7	5
3	5	7	6	5	8	6
4	5	7	7	7	7	7
5	5	6	6	5	6	6
6	6	7	7	6	7	7
7	5	7	7	5	8	7
8	5	7	7	6	7	7
9	5	6	6	5	6	6
10	6	7	6	6	7	6
11	7	7	6	7	7	6
12	6	7	8	6	7	8
13	6	8	7	6	8	7
14	4	7	7	4	7	7
15	5	8	6	5	8	6
16	5	6	6	6	6	6
17	5	8	7	5	8	7
18	5	6	6	5	6	6
19	5	8	7	6	8	7
20	4	6	6	5	6	6
21	4	7	6	5	7	6
22	5	7	7	5	7	7
23	5	7	6	6	7	6
24	4	7	5	5	7	5
25	5	6	6	5	6	6
26	5	7	6	6	7	6
27	5	6	7	5	6	7
28	5	6	6	5	6	6
29	6	7	6	6	7	6
30	5	7	6	5	7	6

15 DAYS

Sr no	Group II OPEN ANCHOR					
	PPD			CAL		
	Disto Buccal	Mid Distal	Disto Lingual	Disto Buccal	Mid Distal	Disto Lingual
1	5	7	6	5	7	6
2	5	6	7	6	6	7
3	4	7	6	4	7	6
4	5	6	5	5	6	5
5	5	7	6	5	8	6
6	5	7	5	6	7	5
7	5	6	6	5	7	6
8	5	7	5	5	8	5
9	5	7	6	6	8	6
10	5	7	5	5	7	5
11	5	6	7	5	6	7
12	6	7	6	6	8	6
13	5	7	7	6	7	7
14	5	6	6	5	6	6
15	5	7	6	6	7	6
16	5	7	7	5	8	7
17	6	6	6	6	6	6
18	5	6	7	5	6	7
19	5	7	6	5	7	6
20	6	7	7	6	7	7
21	5	7	5	5	8	5
22	5	7	6	5	7	6
23	6	6	7	6	6	7
24	5	7	6	5	7	6
25	4	6	7	4	6	7
26	5	6	6	5	7	6
27	6	6	6	6	6	6
28	5	7	6	5	7	6
29	6	7	7	6	7	7
30	5	7	6	6	8	6

3 MONTHS

Sr no	Group I SIMPLE LOOP					
	PPD			CAL		
	Disto Buccal	Mid Distal	Disto Lingual	Disto Buccal	Mid Distal	Disto Lingual
1	3	4	3	3	5	4
2	3	3	3	3	5	3
3	3	3	3	3	6	3
4	3	4	3	4	5	4
5	2	4	3	3	4	4
6	3	3	3	4	4	3
7	3	3	4	3	5	4
8	3	3	3	4	5	4
9	2	2	2	2	4	3
10	3	4	3	4	5	4
11	3	4	3	4	5	4
12	3	4	4	4	5	5
13	3	3	4	4	5	5
14	2	3	2	3	4	3
15	3	3	3	3	5	4
16	2	4	3	3	4	3
17	3	4	3	3	4	3
18	2	2	2	2	3	2
19	3	4	3	3	4	3
20	2	3	4	2	4	4
21	3	3	3	3	4	3
22	2	3	4	3	3	4
23	3	4	3	3	4	3
24	2	3	3	3	3	3
25	3	2	3	3	2	3
26	3	3	3	3	3	3
27	3	2	2	3	3	2
28	2	2	2	2	4	3
29	3	3	3	4	4	3
30	2	3	3	3	4	4

3 MONTHS

Sr no	Group II OPEN ANCHOR					
	PPD			CAL		
	Disto Buccal	Mid Distal	Disto Lingual	Disto Buccal	Mid Distal	Disto Lingual
1	3	4	3	3	5	3
2	2	3	2	3	3	4
3	2	4	2	2	4	3
4	2	2	2	3	3	3
5	2	3	2	3	5	3
6	2	3	2	3	3	3
7	3	3	3	3	4	3
8	2	4	2	3	5	3
9	2	4	3	3	5	3
10	2	3	3	3	4	3
11	2	4	2	3	4	4
12	3	3	3	3	5	3
13	3	3	3	3	4	3
14	2	3	2	3	4	2
15	2	4	3	4	4	4
16	3	3	2	3	4	4
17	2	3	3	4	4	3
18	2	3	2	3	4	3
19	3	4	3	3	4	3
20	2	3	2	3	4	3
21	2	3	3	3	4	3
22	2	4	4	3	4	4
23	3	3	2	3	3	4
24	2	4	4	3	4	4
25	2	3	3	3	4	4
26	2	4	3	3	4	3
27	3	3	4	3	4	4
28	3	4	2	3	4	3
29	3	4	4	3	4	4
30	2	4	3	3	5	3

6 MONTHS

Sr no	Group I SIMPLE LOOP					
	PPD			CAL		
	Disto Buccal	Mid Distal	Disto Lingual	Disto Buccal	Mid Distal	Disto Lingual
1	3	3	3	3	4	3
2	3	3	3	3	3	3
3	3	3	3	3	3	3
4	3	4	3	3	4	3
5	2	2	2	3	2	4
6	3	3	3	3	3	3
7	3	3	4	3	4	4
8	3	3	3	3	3	3
9	2	2	2	2	3	2
10	3	3	2	3	3	3
11	3	3	3	3	3	3
12	3	4	4	3	4	4
13	3	3	4	3	3	4
14	2	2	2	2	3	2
15	3	3	3	3	3	3
16	2	4	3	3	4	3
17	3	3	3	3	3	4
18	2	2	2	2	3	2
19	3	3	3	3	5	3
20	2	3	4	4	3	4
21	3	3	3	3	5	3
22	2	3	4	2	3	4
23	3	3	3	3	4	4
24	2	3	3	2	3	3
25	3	2	3	3	2	3
26	3	3	3	4	4	4
27	3	2	2	3	3	2
28	2	2	2	2	3	3
29	3	3	3	3	3	3
30	2	3	3	3	3	3

6 MONTHS

Sr no	Group II OPEN ANCHOR					
	PPD			CAL		
	Disto Buccal	Mid Distal	Disto Lingual	Disto Buccal	Mid Distal	Disto Lingual
1	3	3	3	3	4	3
2	2	3	2	3	4	2
3	2	2	2	2	3	3
4	2	2	2	3	2	2
5	2	3	2	2	3	3
6	2	3	2	2	3	2
7	3	3	3	3	3	3
8	2	3	2	3	3	3
9	2	4	3	3	4	3
10	2	3	3	2	3	3
11	2	3	2	2	3	4
12	3	3	3	3	4	3
13	3	3	3	3	3	3
14	2	3	2	2	4	3
15	2	3	2	2	3	4
16	3	3	2	3	4	2
17	2	3	3	2	4	3
18	2	3	2	3	3	2
19	3	3	3	4	4	3
20	2	3	2	3	3	2
21	2	3	3	3	4	3
22	2	3	3	3	4	3
23	2	3	2	3	3	2
24	2	3	3	4	4	3
25	2	3	3	3	3	3
26	2	4	3	2	4	3
27	3	3	4	3	4	4
28	3	3	2	4	3	2
29	3	3	3	3	3	3
30	2	4	3	2	4	3

WOUND DEHISCENCE AT 7 DAYS

Case No.	GROUP I	GROUP II
1	Absent	Absent
2	Absent	Absent
3	Absent	Absent
4	Absent	Absent
5	Absent	Absent
6	Present	Absent
7	Absent	Absent
8	Absent	Absent
9	Absent	Absent
10	Absent	Absent
11	Absent	Absent
12	Present	Absent
13	Absent	Absent
14	Absent	Absent
15	Absent	Absent
16	Absent	Absent
17	Absent	Absent
18	Absent	Present
19	Absent	Absent
20	Absent	Absent
21	Absent	Absent
22	Absent	Absent
23	Absent	Absent
24	Present	Absent
25	Absent	Absent
26	Absent	Absent
27	Absent	Absent
28	Absent	Absent
29	Absent	Absent
30	Absent	Absent