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Extraction of impacted inferior third molars: A randomised, split-mouth controlled study to compare the flapless surgical approach and a novel single incision access

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Abstract
Background: Nowadays, various standards have been proposed for the impacted inferior 3rd molar extraction. However, there are conflicting data on the effect of the surgical removal of Ms3, with varying outcomes for post-operative re-injury and patient comfort.
Objective: To compare the innovative surgical technique for the removal of impacted inferior third molars (iMs3).
Methods: This strategy was evaluated using a randomised, split-mouth controlled clinical trial, adhering to the CONSORT standards. We compared the revolutionary single incision access (SIA) with flapless surgical approach (FSA). The main objective of the study was to assess the rate at which the 3rd molar extraction site healed. The secondary outcomes included the measures of gum health such as pocket probing depth (PPD) and attached gingiva as well as the occurrence of discomfort (pain) and edoema. The research was conducted on a sample of 74 teeth extracted from 37 individuals who presented with bilateral impaction of the third molars.
Results: The cohort consisted of 47% Caucasian males and 53% Caucasian females, with an average age of 31.5±8.1 years. A notable disparity in the rate of recovery and wound healing was seen between the side treated with SIA (29.4±3.7 days) and the side treated with FSA (40.5±4.5 days; $p<0.05$). PPD was substantially lower on day 45 after surgery compared to baseline ($p<0.05$). Likewise, attached gingiva substantially increased from baseline to comparison ($p<0.05$). Both the single incision access strategy and the flapless surgical procedure had similar effects. Oedema and pain were comparable in both the surgery groups.
Conclusion: FSA and SIA techniques were comparable in improving the healing time following 3rd molar extraction. The data suggested the early post-surgical enhancements in connected gingiva, as well as the reduction in oedema and discomfort.

Keywords: Impacted inferior third molars, extraction, single incision access, flapless surgical approach, healing recovery

Introduction
The removal of impacted mandibular third molars is a frequently performed surgical treatment within the field of oral and maxillofacial surgery. The extraction of these teeth is warranted due to many factors, such as the occurrence of acute or chronic pericoronitis, the presence of cysts or tumours, periodontal issues, and the existence of a carious lesion on the second or third mandibular molars [1]. Extraction is occasionally conducted as a first step for orthodontic therapy or orthognathic surgery, as well as to prevent potential problems such as odontogenic tumours and cysts associated with third molars [2, 3]. While the extraction of lower and upper third molars is commonly performed, it is important to note that this treatment might result in many post-operative problems. These consequences include alveolar osteitis, discomfort, edoema, trismus, nerve injuries, haemorrhages, buccal fat pad involvement, and mandibular fractures [4]. The aforementioned postoperative problems have a significant influence on the individual's overall quality of life, everyday functioning, and general well-being. The social and psychological elements, as well as the perceptions of discomfort, are influenced by the severity, intensity, and duration of symptoms [5].

The extraction of an impacted third molar often necessitates a surgical approach involving a flap, ostectomy, odontotomy, and subsequent suturing of the soft tissue [6]. Regarding the surgical procedure utilised, it is apparent that there exists a divergence of findings regarding the efficacy of surgical removal of M3, leading to diverse outcomes in the neighbouring molar 2 [7]. The literature provides descriptions of various flap designs utilised in surgical procedures, as well as their corresponding impacts on periodontal health. Numerous researchers have conducted investigations on the impacts of various mucoperiosteal flap designs, including the envelope flap, triangle flap, Szmyd flap, and their respective modified iterations [8]. In recent studies, researchers have proposed the use of a flapless surgical approach (FSA) for the extraction of inferior third molars (iMs3) and the use of a single incision access (SIA) technique [9, 10]. The employment of a flapless technique in the surgical extraction of iMs3 was found to be a favourable alternative when compared to the typical envelope flap [11]. The FSA presents a compelling viewpoint about pain treatment, reduction of oedema, and the management of attached gingiva. In contrast, both the conventional envelope flap and flapless surgical techniques had comparable outcomes in terms of full postoperative recovery [9].

The current study involved the implementation of a clinical trial at a single centre, whereby we aimed to compare the efficacy of two different surgical approaches, namely the flapless surgical method and the single incision access technique. The primary focus of this comparison was to evaluate the recovery time and level of comfort experienced by patients following the extraction of impacted inferior third molars. The main objective of the study was to determine the rate at which iMs3 extraction healing time was accelerated. The secondary outcomes encompassed the frequencies of pain and edoema, as well as the assessment of gum health, namely connected gingiva and pocket probing depth.

Materials and Methods

Study Participants and Design

Ethical Consideration: The present study adhered to the principles outlined in the Declaration of Helsinki pertaining to medical protocols and ethical standards. The study received approval from the Regional Ethical Review Board. All patients provided written informed permission prior to their participation in the study, and their involvement was voluntary. The participants also expressed their willingness to undergo periodic evaluations. A signed discharge was acquired in order to get consent for the utilisation of patients' photographs.

Inclusion criteria: The process of patient enrolment and subsequent follow-up was conducted from January 2019 to December 2021. The participants in this research were selected from the population seeking examination for the removal of an impacted third molar at the dental department. The study incorporated individuals who satisfied the specified inclusion criteria, which consisted of: (1) the presence of both lower third molars affected by comparable circumstances (on the left and right sides), assessed using the Winter classification [12] and the Pell and Gregory classification [12] (see to Figure 1), and (2) an age range of 15 to 50 years.

Exclusion criteria: Patients were excluded for the following criteria: (1) presence of diabetes; (2) current smoking habits; (3) autoimmune diseases; (4) chronic illnesses requiring regular drug treatments; (5) pregnancy; (6) presence of stomatitis; and (7) a full-mouth plaque score (FMPS) exceeding 20%, along with an overall compromised medical or psychological condition.

Presurgical evaluation

A preoperative surgical assessment was conducted to determine the impairment of the third molar, based on the winter and Pell and Gregory categories [11]. The participants had radiographic evaluation using ortho-panoramic X-ray (Planmeca ProMax® with a one-shot cephalo-stat, Helsinki, Finland). Prior to the operation, appropriate professional hygiene measures were implemented and a review of oral maintenance was conducted. The objective was to achieve plaque control of F.M.P.S. p<20%. Cone-beam computed tomography (CBCT) imaging using the Planmeca ProFace® system from Helsinki, Finland, was conducted in situations where the tooth overlapped with the inferior alveolar nerve. This procedure was recommended when the examination of the tooth's location using a periodontal probe did not yield conclusive results.

Randomisation and masking

The allocation of the sequence left and right was randomised in a 1:1 ratio between the FSA and SIA groups. The process of randomization was conducted using a software programme that generated a random sequence. The side that was allocated an odd number was included in the FSA, but the opposite side, which was allotted an even number, had the SIA procedure. The patients were not provided with information on the methodologies employed on either side. Dental practitioners routinely monitored patients for several indicators of comfort/discomfort, including pain levels assessed using the Visual Analogue Scale, presence of swelling (oedema), and the duration of healing following molar extraction.

Pre-Surgical Treatment and Procedure

At the beginning of each surgical procedure, the oral cavity was subjected to a 60-second rinsing with a chlorhexidine-based mouthwash solution (0.20% concentration). The procedure for administering lower alveolar nerve block anaesthesia consisted of the bilateral injection of 1.8 mL of articaine [12] and adrenaline 1:100,000 on both sides, both buccally and lingually, extending up to the first teeth. Subsequently, peripheral local anaesthetic was administered in the vicinity of the third molar. In conclusion, a dosage of 8 mg (4 mg/1 mL per side) of dexamethasone [13] was delivered via intramuscular injection in the masseteric area just before to the initiation of the surgical extractions.

Surgical Planning

In earlier research [9, 10], the precise technique for these two procedures was outlined.

FSA Surgical Design: FSA involves making an initial incision in the connected gingiva at the surface of the inferior second molar (iM2), running from the distolingual to the distobuccal sites. Following the shape and placement of the ostectomy, a second incision is made beginning at the distal end of the previous one. Odontotomies and buccal ostectomy are carried out. Since no flap has been lifted, the FSA is closed without suture.

Design of SIA Surgery: SIA surgery is different from FSA in that just one incision is made and no soft tissue is cut out. The delicate buccal mucosa is the site of the single incision. Through a single incision, an ostectomy is carried out using an OT6 piezosurgical device. Using a 31F elevator, the affected tooth is quickly mobilised. A surgical bur and a surgical air-rotor are used during odontotomy.

Postoperative Care and Procedure

Every patient was given instructions on how to care for themselves following surgery, including how to: (1) apply ice to the cheek, switching sides every 5 minutes throughout the day; (2) eat cold food and refrain from rinsing for the first day; and (3) rinse the mouth with 0.12% chlorhexidine after meals for a week starting on the second day. Ibuprofen 600 mg was given every 12 hours for three days to treat the pain. Standard procedures did not call for the use of antibiotic treatment [13].

Endpoints and Outcomes Evaluation

The innovative SIA technique, which allows access through a single incision without removing soft tissue from the impacted third tooth, was the predictive variable. The primary outcome was the speeding up of extraction healing time, which was assessed by clinical practitioners with extensive expertise who were concealed during weekly postoperative consultations. In the first week following surgery (days 1, 2, and 3), the incidence of discomfort and oedema as well as gingival health (Connected gingiva and pocket probing depth) were documented. Evaluations were carried out by asking patients questions and using a VAS or medical examinations. The soft tissue interface on the distobuccal side of the 2M tooth, which demonstrated the amount of gingival recession as a result of the operational treatment, was given special attention in the clinical data about gingival health. As a result, measurements were made using a periodontal probe (Hu-Friedy CP UNC 15, Chicago, IL, USA) both prior to surgery (baseline) and after the healing process was complete. Each measurement was carried out three times.

Analytical Statistics

The endpoint evaluation's masked data were gathered and examined. The primary and secondary endpoints' means and standard deviations were statistically compared. The statistical software package SPSS 25 (IBM Corp., 2017. IBM SPSS statistical for Windows, Version 25.0, Armonk, New York, NY, USA) was used to complete the calculations. ANOVA was used for this purpose, followed by the Mann-Whitney test and the Turkey post-hoc test. The acceptable significance threshold was $p< 0.05$.

Results

Patient and Baseline Characteristics

The split-mouth research involved 74 teeth from 37 individuals, both of whom had impacted third molars. The group had a median age of 31.5±8.1 (23-57) years and was made up of 47% Indian men and 53% Indian women. In accordance with the exclusion criteria, the patients had similarly compromised 3rd molars on the left and right sides, namely 26% V-2A (Winter–Pell and Gregory classifications), 14% V-2C, 10% M-2C, 11% M-1B, 10% D-2B, 9% M-1A, 7% M-2B, 4% M-2A, 4% D-2A, and 5% V-2B. Gender and age did not statistically correlate with the presence of pain or oedema. Recruitment of patients and patient monitoring were finished between January 2021 and December 2022.

Clinical Follow-Up and Outcome Measures

The primary endpoint was affected by the surgical approach employed. Indeed, we observed faster recovery/wound healing on the SIA side (29.4±3.7 days) than on the FSA one (40.5±4.5 days); ($p< 0.05$).

Table 1: Recovery time between the flapless surgical approach (FSA) and the single incision access (SIA)

Surgeries	Flapless surgical approach	Single-incision access	P Value
Variable			
Recovery time (Mean Days ±SD)	40.5±4.5	29.4±3.7	<0.05

Investigated variables are expressed as mean (standard deviation). RT = recovery time.
*$p< 0.05$ between FSA and SIA.

Regarding the secondary endpoints, none of the patients experienced problems following surgery related to pocket probing depth (PPD). Table 2 displays the results of the AG and PPD analyses. PPD was substantially lower on day 45 after surgery compared to baseline ($p<0.05$). Likewise, attached gingiva substantially increased from baseline to comparison ($p<0.05$). Both the single incision access strategy and the flapless surgical procedure had similar effects.

Only 7% of the sides that received surgery with FSA and 3% of those who underwent surgery with SIA saw an increase in the associated gingiva probing depth. In contrast, in 12% of FSA and 8% of SIA, PPD and the associated gingiva (AG) were identical before and after surgery, whereas a statistically significant improvement was seen in the remaining majority of cases (P0.05). PPD and AG gingival measures, however, did not show any statistically significant changes between FSA and SIA ($p>0.05$). Neither group had alveolitis or infections and no other significant injury was reported in either group. Oedema and pain were not significantly ($p>0.05$) affected by the FSA and SIA surgical methods (Table 3).

Table 2: Attached gingiva and pocket probing depth between the flapless surgical approach (FSA) and the single incision access (SIA)

Surgeries	Flapless surgical approach		Single-incision access		P Value
Variable	$T_{baseline}$	$T_{wound-healing}$	$T_{baseline}$	$T_{wound-healing}$	
Pocket probing depth (mm)	4.5±0.8	3.2±0.4*	4.7±0.72	3.5±0.36*	<0.05
Attached gingiva (mm)	2.7±0.31	3.9±0.53*	2.6±0.4	3.6±0.46*	<0.05

Values are expressed as mean± standard deviation. *$p<0.05$) between $T_{baseline}$ vs. $T_{wound-healing}$.

Table 3: Oedema and pain score between the flapless surgical approach (FSA) and the single incision access (SIA)

Surgeries	Flapless surgical approach			Single-incision access		
Variable	Baseline	Day 2 (48 hrs)	Day 3 (72 hrs)	Baseline	Day 2 (48 hrs)	Day 3 (72 hrs)
Oedema Score Mean±SD)	0.0±0.0	0.3±0.1*	0.2±0.2*	0.0±0.0	0.3±0.15*	0.2±0.13*
Pain Score (Mean±SD)	0.7±0.6	0.4±0.2*	0.3±0.2*	0.6±0.5	0.3±0.2*	0.2±0.11*

Values are expressed as mean (standard deviation). *$p<0.05$) between baseline and day 2 or day 3.

Discussion

The current focus on the quality of life signifies a revived emphasis on a patient-centred approach to healthcare interventions pertaining to non-life-threatening ailments. The evaluation of the quality of life pertaining to dental health, both prior to and after to the removal of 3rd molar, reveals detrimental effects experienced by patients. According to the cited study, a significant proportion of individuals, namely over 37%, opted for the 3M operation due to the presence of discomfort and the subsequent apprehension related to potential post-operative complications [14]. Conversely, the acute decline in quality of life was reported following 3rd molar surgery [15]. In recent years, there has been a focus on enhancing surgical recovery and minimising patient suffering in the context of mandibular wisdom teeth extraction [16]. In a 3-cornered laterally rotated flap technique was found to enhance periodontal healing an increased levels of discomfort and edoema [17]. The researchers specifically highlighted the modified Szmyd flap as exhibiting superior primary periodontal healing compared to the 3-cornered flap. A 3rd molar extraction surgery using a buccal envelope flap and pedicle design suggested that the utilisation of the pedicle flap technique resulted in a lower occurrence of wound dehiscence and dry socket, as well as an improved quality of life, in comparison to the envelope flap technique [18]. However, no significant disparities were observed in terms of discomfort, edoema, and trismus between the two surgical techniques. In a recent retrospective clinical investigation, a new flapless surgical technique for the extraction of impacted i3Ms is developed [9, 10]. This technique was found to have advantages over the conventional envelope flap method, including improvements in attached gingiva, as well as reductions in oedema and discomfort [9].

The findings of our clinical research, which employed a randomised, blinded, split-mouth design, provide further support for the efficacy of FSA in enhancing the initial stages of post-surgical recovery. Indeed, a comparative analysis of our present and past data has revealed a statistically significant correlation between FSA outcomes and improvements in attached gingiva, as well as reductions in oedema and discomfort. This finding suggests that FSA may possess superior qualities compared to TA. Based on the assessment of secondary endpoints, it was seen that SIA did not exhibit any significant distinctions in relation to FSA. Similar to FSA, SIA had the potential to alleviate early postoperative pain when compared to TA.

The findings have an impact on the discomfort experienced during i3M surgery, which has been identified as a factor impacting the quality of life in the initial three days following the extraction [19]. They reported a decline in oral health-related quality of life in the week following third molar surgery [19]. It is worth mentioning that in accordance with the primary endpoint, the SIA method for 3rd molar elimination resulted in a more rapid recovery compared to FSA, with a difference of one week. Approximately five weeks following the surgical procedure known as SIA, it was seen that the affected region had undergone successful healing, with the tissues having fully recuperated. The rate of recovery following FSA appears to be more rapid. The findings may have been influenced by a more meticulous approach to recovery follow-up and enhanced control of FSA techniques.

The FSA methodology corroborated the previously observed findings on the first postoperative enhancements in attached gingiva, as well as the reduction in edoema and discomfort associated with TA. The unique surgical intervention analysis (SIA) methodology aligns with the favourable early postoperative functional status assessment (FSA) findings, however exhibits enhanced tissue repair and recuperation compared to FSA throughout the latter stages of postoperative monitoring.

Conflict of Interest

Not available

Financial Support

Not available

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