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The impact of flap design on swelling, trismus, and pain after the lower third molar surgery: buccal triangular flap vs. envelope flap

Uticaj dizajna režnja na otok, trizmus i bol posle hirurgije trećih donjih molara: bukalni triangularni režanj vs. „envelop" režanj

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Abstract

Background/Aim. Swelling, trismus, and pain (STP) are the most common complications that occur after the surgical extraction of impacted lower third molars (LTM). Buccal triangular and envelope flaps are the two most commonly used mucoperiosteal flaps in LTM surgery. The aim of this study was to compare the possible impact of these two types of flaps on the occurrence and intensity of postoperative STP after the surgical extraction of impacted LTMs. **Methods.** The study included 30 adult patients of both genders, with fully impacted LTMs in vertical position according to Winter classification and class I or II, and position A or B, according to Pell and Gregory classification. All patients were randomly divided into two groups depending on the type of the applied mucoperiosteal flap (triangular or envelope type). The degree of edema, interincisal distance (trismus), and the level of pain were evaluated preoperatively and at each follow-up (on the first, second, and seventh day postoperatively). **Results.** No statistically significant difference was found among the examined groups in terms of STP reduction in the postoperative period ($p > 0.05$). **Conclusion.** The choice of mucoperiosteal flap design, buccal triangular or envelope, during the surgical extraction of impacted LTMs has no impact on the intensity of postoperative STP.

Key words:
edema; molar, third; oral surgical procedures; pain; postoperative complications; surgical flaps; tooth, impacted; trismus.

Apstrakt

Uvod/Cilj. Otok, trizmus i bol (OTB) su najčešće komplikacije nakon hirurške ekstrakcije impaktiranih donjih trećih molara (DTM). Bukalni triangularni i „envelop" režanj su dva najčešće primenjivana mukoperiostalna režnja u hirurgiji DTM. Cilj istraživanja bio je da se uporedi mogući uticaj te dve vrste korišćenih mukoperiostalnih režnjeva na intenzitet OTB nakon hirurške ekstrakcije impaktiranih DTM. **Metode.** Studijom je obuhvaćeno 30 odraslih pacijenata oba pola, sa potpuno impaktiranim DTM u vertikalnoj poziciji prema Winterovoj klasifikaciji i klase I ili II i pozicije A ili B, prema klasifikaciji Pell-a i Gregory-a. Svi pacijenti su nasumično podeljeni u dve grupe, u zavisnosti od primenjenog mukoperiostalnog režnja (triangularni ili „envelop" tip). Stepen prisutnog otoka, interincizalno rastojanje i nivo bola određivani su preoperativno i pri svakoj kontrolnoj poseti (prvog, drugog i sedmog postoperativnog dana). **Rezultati.** Nije utvrđena statistički značajna razlika između ispitivanih grupa u pogledu smanjenja OTB u postoperativnom periodu ($p > 0,05$). **Zaključak.** Izbor vrste mukoperiostalnog režnja, bukalni triangularni ili „envelop" tip, prilikom hirurške ekstrakcije impaktiranih DTM nema uticaja na stepen inteziteta postoperativnog OTB.

Ključne reči:
edem; molar, treći; hirurgija, oralna, procedure; bol; postoperativne komplikacije; režnjevi, hirurški; zub, impakcija; trizmus.

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Introduction

Surgical extraction of impacted lower third molars (LTM) can be accompanied by a large number of postoperative complications, the most common and almost inevitable being postoperative swelling, trismus, and pain (STP). The occurrence and intensity of these complications are influenced by numerous factors, primarily the applied surgical technique. Selection of an appropriate mucoperiosteal flap design can directly affect the visibility and accessibility of the operative field, influencing the degree of postoperative trauma and consequent STP [1–3]. Buccal triangular and envelope flaps are the two most commonly used mucoperiosteal flaps in LTM surgery [4]. Although most often described in the literature, there is still no consensus on the choice of flap design regarding the reduction of postoperative complications – data from the literature are sometimes conflicting.

The aim of this prospective study was to examine the possible impact of different mucoperiosteal flap designs (buccal triangular vs. envelope) used for the impacted LTM surgery on the occurrence and intensity of postoperative STP.

Methods

The study was approved by the Ethics Committee of the Faculty of Medical Sciences, University of Priština in Kosovska Mitrovica, Serbia (No. 09-453/2021) and is part of a research project that consisted of two mutually independent studies [5].

This randomized prospective study included a total of 30 patients of both genders, aged 18 and above, with impacted LTMs (class I or II and position A or B according to Pell and Gregory [6] classification, and vertical position according to Winter [7] classification). The position of the impacted LTM was analyzed using panoramic radiography. All patients were randomly divided into two groups, 15 patients in each group, depending on the applied mucoperiosteal flap design. Hence, in the first group (the triangular group), a standard buccal triangular flap was applied, while in the second group (the envelope group), an envelope flap was used.

The study excluded the following patients: those with deeply impacted teeth (Pell and Gregory [6] classification – class C tooth) and teeth in all other positions except for vertical according to Winter [7] classification; systemic diseases and therapy that affects immune response and wound healing; present pain sensations; local inflammation and preoperative trismus correlated with tooth impaction; patients with previous episodes of pericoronitis; patients with poor oral hygiene. Surgical interventions that lasted longer than 60 min and the occurrence of severe surgical complications were also reasons for exclusion from the study.

Surgical procedure

Surgical extractions were performed under local anesthesia – inferior alveolar nerve block with the additional plexus anesthesia for the buccal nerve branches (Ubistesin forte®, 1:100.000, Ultradent, Germany). After buccal mucoperiosteal flap elevation (triangular or envelope), depending on the group, alveolotomy and, if necessary, separation of the crown and roots of the impacted tooth were performed using round and fissured carbide rotary drills and mandatory cooling with saline solution. After the tooth extraction, all surgical wounds were primarily sutured. Patients were advised to use cold compresses postoperatively for six hours. No medications were prescribed to patients.

Postoperative analysis

Postoperative follow-up visits were done on the first, second, and seventh postoperative day in order to determine the degree of present STP sensations.

In order to determine the degree of postoperative swelling, the method of Schultze-Mosgau et al. [8] was used. Preoperatively, and at each follow-up visit, distances between certain facial points were measured: the tragus and the angle of the lips; the tragus and the pogonion; the lateral angle of the eye; the angle of the mandible. For this purpose, a silk thread was used to measure the distance between two points, and then it was transferred to a millimeter ruler. The mean value of the obtained values was calculated for each patient and compared afterward with the measurements obtained in the postoperative period.

The assessment of trismus (interincisal distance) was carried out as follows: first, preoperatively, the distance between the incisal edges of the upper and lower central incisors was clinically measured with a ruler to determine the basic value for subsequent comparisons with postoperative measurements. Afterwards, postoperatively, the extent of the present trismus was determined using the same method.

The level of postoperative pain was determined using a 10 cm long visual-analog scale (VAS), with a score range from 0 to 10, where grade 0 presented total absence of pain and grade 10 presented unbearable pain.

Statistical analysis

The *t*-test was used to assess the significance of the difference in the preoperative values of swelling and trismus. Repeated ANOVA test and linear mixed model were used (where trismus and VAS pain scale over time were dependent variables in relation to the type of flap) to model the relationship between swelling volumes of two groups, and $p = 0.05$ was taken as the level of statistical significance. All data were processed in the IBM SPSS Statistics 22 (SPSS Inc., Chicago, IL, USA) software package and the R-3.6.3 software environment (The R Foundation for Statistical Computing, Vienna, Austria).

Results

Swelling

There was no statistically significant difference in the extent of swelling between the groups preoperatively (tri-

Table 1

Values of the postoperative swelling

Postoperative day	Group		*p*-value between groups
	triangular	envelope	
1st	13.0 ± 0.5	12.1 ± 1.7	
2nd	13.1 ± 0.5	12.1 ± 1.7	0.149
7th	12.0 ± 0.5	11.4 ± 1.6	
p-value in time series		$p < 0.001$	

Results (in mm) are shown as mean ± standard deviation.

Table 2

Values of postoperative interincisal distance

Postoperative day	Group		*p*-value between groups
	triangular	envelope	
1st	3.1 ± 0.6	3.6 ± 0.5	
2nd	3.1 ± 0.6	3.6 ± 0.5	0.129
7th	4.0 ± 0.5	3.9 ± 0.5	
p-value in time series		$p < 0.001$	

Results (in mm) are shown as mean ± standard deviation.

Table 3

Values and variations of pain level measured by visual analog scale

Postoperative day	Group		*p*-value between groups
	triangular	envelope	
1st	3 (1–7)	4 (3–8)	
2nd	3 (0–7)	3.5 (1–8)	0.333
7th	0 (0–1)	0 (0–2)	
p-value in time series		$p < 0.001$	

Results are shown as mean (minimum-maximum).

angular group – 11.9 ± 0.5 mm; envelope group – 11.4 ± 1.6 mm; $p = 0.354$). Postoperatively, the swelling significantly decreased in both groups ($p < 0.001$), but comparing the groups mutually, no statistically significant difference was found ($p = 0.149$) (Table 1).

Trismus (interincisal distance)

There was no statistically significant difference in the values of interincisal distance between the groups preoperatively (triangular group – 4.0 ± 0.5 mm; envelope group – 3.8 ± 0.7 mm; $p = 0.52$). Postoperatively, the interincisal distance significantly increased in both groups ($p < 0.001$), but comparing the groups mutually, no statistically significant difference was found ($p = 0.129$) (Table 2).

Postoperative pain measured by VAS

Postoperatively, the pain level significantly decreased in both groups ($p < 0.001$), but comparing the groups mutually, no statistically significant difference was found ($p = 0.333$) (Table 3).

Discussion

STP are the most common and almost unavoidable postoperative complications of LTM surgery. Although transitory, they significantly affect the quality of life of patients in the early postoperative period. Several intraoperative and postoperative procedures have been shown to be relevant in reducing complications of this type [9, 10]. Some authors consider that the choice of mucoperiosteal flap can affect the occurrence and degree of postoperative STP [11, 12].

The main difference between the envelope and the buccal triangular flap is the vertical incision in the buccal area of the lower second molar done for raising the buccal triangular flap. This vertical incision might lead to greater trauma of the periosteum and buccal muscle fibers, which may contribute to a greater degree of postoperative edema and trismus. Koyuncu and Cetingül [13], as well as Tareen et al. [14], consider that due to the presence of a vertical relaxation incision of the buccal triangular flap, its repositioning and suturing is somewhat more difficult, which results in a longer overall duration of the operation. This may further cause more intensive release of inflammatory mediators and, consecutively, a significantly higher degree of swelling. Therefore, some authors point out that the degree of swelling and trismus is significantly lower when an envelope flap is used compared to a buccal triangular one [15–18]. Similarly, Rabi et al. [19] concluded that the degree of trismus is higher when the buccal triangular flap is applied, while there is no significant difference in terms of edema.

In a large meta-analysis that involved 20 studies, no significant difference was found between these two flap designs in terms of postoperative complications, although a slight advantage could be given to the envelope flap in terms

of swelling and trismus [20]. Abandansari and Foroughi [21] also pointed out that there is no statistically significant difference in the degree of STP when applying the envelope flap compared to the buccal triangular flap and considered that the choice of flap design solely depends on the surgeon's attitude.

Analyzing the results of our study, it can be concluded that the degree of swelling and trismus was slightly lower in the envelope group than in the triangular group. However, there was no statistically significant difference in the observed parameters between the two types of flaps examined in this study.

Comparing the levels of postoperative pain sensations, the results of our study are in agreement with numerous studies that state that there is no statistically significant difference between the examined types of mucoperiosteal flaps [4, 22]. Yet, some authors still prefer a buccal triangular flap in terms of reducing postoperative pain. Thus, Sandhu et al. [23] concluded that the occurrence of postoperative pain is observed more often when an envelope flap is used. Such conclusions, in some studies, might be explained by the fact that the occurrence of postoperative wound dehiscence, as well as alveolar osteitis, is more common when an envelope flap is used [11, 15, 24].

The choice of flap may also have an impact on the appearance of other postoperative complications that are not covered by this study: dehiscence, alveolar osteitis, hematoma, and change in the periodontal status of the lower second molar. Bearing all this in mind, as well as the results of this study and the inconsistency of results in similar studies by other authors, it can be said that the choice of flap design should solely depend on the attitude and personal experience of the surgeon.

Conclusion

We have concluded that there is no significant difference between using buccal triangular and envelope flap in the LTM surgery regarding the intensity of postoperative STP sensations.

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