

## Effect of autologous platelet-rich fibrin on periodontal healing after mandibular third molar removal

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### Abstract

**Objective:** The study aimed to evaluate the effect of platelet-rich fibrin (PRF) on periodontal probing depth and clinical attachment level at the distal aspect of mandibular second molar after third molar removal.

**Materials & Methods:** A split-mouth design clinical study was set up comprising 10 patients with bilateral third molar impactions underwent third molar removal at the dental hospital, Faculty of Dentistry, Prince of Songkla University. After the surgical removal, in the study group, PRF was placed in the socket followed by simple interrupt suturing, whereas in the control group only suturing was performed. Periodontal probing depth and clinical attachment level were measured at 3 locations (mid-distal, disto-lingual and disto-buccal aspect of second molar) preoperatively and 2-months postoperatively. The data of age, type of impaction, difficulty index and time of operation were also recorded.

**Results:** The preoperative periodontal probing depth and clinical attachment in level both groups were comparable due to no statistical difference ( $P < 0.05$ ). For the postoperative assessment, reduction of postoperative periodontal pocket depth was seen in all sites. There was statistically significant difference only at disto-lingual aspect of the distal root surface of second molar ( $p=0.03$ ) in the study group. The postoperative clinical attachment level was not significant different from preoperative clinical attachment level in both groups. The postoperative gaining values of probing depth or clinical attachment level showed no statistic significant difference between groups.

**Conclusion:** The Platelet-rich fibrin application in the surgical mandibular third molar sockets was able to improve periodontal healing at the distal aspect of second molar after removing the visible impacted mandibular third molars associating with mesial crestal bone loss. The improvement in surgical technique in adaptation and protection of the PRF clot should be considered.

**Keywords:** Impacted mandibular third molar, Surgical removal, Platelet-rich fibrin, Periodontal healing

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## Introduction

Removal of the mandibular third molar has been carried out by many reasons. One of which is to prevent or treatment of periodontal disease. Periodontal problem at distal aspect of second molar are common in older age and in visible impacted third molars because the deeper pocket has more surface area contact for biofilm and gingiva. Early removal of impacted third molar has been suggested for it is easier to perform, reduces postoperative morbidity, best tissue and bone healing and prevent further damage to periodontal tissue of adjacent second molar.<sup>1-4</sup> The factors increasing risk of periodontal defects after third molar surgery are age, preoperative intrabony defect and mesioangular or visible third molar and post-extraction local plaque contro.<sup>5-8</sup> The patients age older than twenty-five years old or the patients with preoperative deep periodontal intrabony defects have more incidence of worsen probing depth or attachment levels after third molar removal due to limitation of healin.<sup>9</sup>

Platelet-rich fibrin (PRF) is developed by Choukroun et al.<sup>10</sup> in 2005 and was introduced as a growth factor delivery system for periodontal regeneration approach. Because of the combined properties of fibrin, platelets, leukocytes, growth factors and cytokines, PRF is therefore a potential healing biomaterial for bone and soft tissue regeneration. The use of PRF as a sole grafting material has been applied clinically for periodontal intrabony defects and seemed to be an effective modality of regenerative treatment.<sup>11, 12</sup> In patients who appear to have high risk for periodontal defects after mandibular third molar removal; for example, 26-year of age, pre-existing periodontal defects, and horizontal or mesioangular impaction, a predictable benefit for reconstructing the dentoalveolar defect at the time of removal is considered possible. The available data are limited in clinical study of PRF for those defects at the distal aspect of mandibular second molars after third molar removal. The aim of this controlled clinical trial was to evaluate the effectiveness of PRF

on periodontal pocket depth and clinical attachment at the distal aspects of mandibular second molar after third molar removal.

## Materials and methods

The split-mouth controlled clinical trial was conducted in the department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Prince of Songkla University from November 2014 to February 2015. The study included 10 patients registered to the outpatient department for the surgical removal of both right and left mandibular third molar impactions. The study protocol was approved by the ethics committee of the Faculty and informed consent was performed in each patient.

The criteria for inclusion of the patients in this study were they who:

1. aged not less than 20 years old.
2. were systematically healthy (ASA class I: The American Society of Anaesthesiologists).
3. had bilateral impacted mandibular third molars with mesioangular or horizontal angulation position and degree of impaction (according to panoramic radiograph).
4. required to remove bilateral third molars in one visit.
5. No presence of pericoronitis within 2 weeks before surgery.
6. Had no history of long-term anti-inflammatory medications or antibiotics taking 2 weeks before surgery.
7. had no alveolar bone crest or had intrabony defects ( $\geq 4$ mm.) at distal aspect of both mandibular second molars.

The patients who were excluded from the study were they who had:

1. uncontrolled systemic disease.
2. pregnancy or lactation.
3. history of anaphylaxis to penicillin or NSAIDs
4. no willing to sign and informed consent.

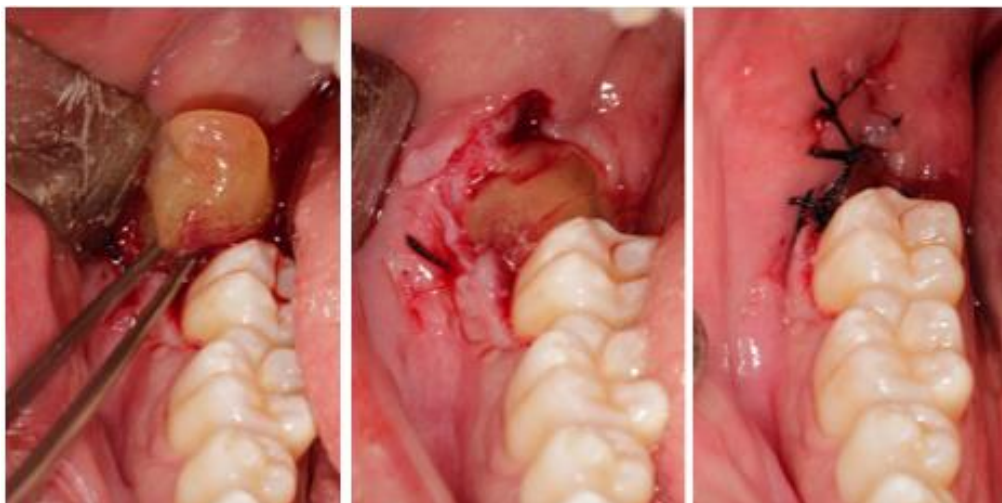
Both sides of impacted teeth in each patient were surgically removed in the same

visit. The order of removal and the case side grafted with PRF were randomly performed by using coil randomization. A preoperative orthopantomograph (OPG) was investigated with preoperative periodontal measurement.

#### *Surgical procedure*

The surgical procedure was carried out by the same operator. Aseptic technique was done at the field of operation by painting with 10% povidone iodine extra-orally, 4% bupivacaine with adrenaline 1:100,000 was used to block inferior dental nerve, long buccal nerve and lingual nerve. An envelope flap was raised, buccal and distal bone was removed to exposed the tooth. The tooth was

sectioned by fissure bur and all parts were elevated by elevator. The tooth-sac remnant was removed by artery forceps. The wound was toileted by normal saline irrigation. In the case side, a piece of PRF was filled into the socket in vertical direction and closely to the distal aspect of the second molar. (Figure 1.). The flap was repositioned and sutured with 3-0 black silk with simple interrupted suture. Postoperatively, the patients were prescribed amoxicillin 500 mg, 3 times a day for 3 day, and Ibuprofen 400 mg, every 8 h. An appointment for suture removal and follow-up was 7days later, and the periodontal assessment was performed 2 months after surgery.



**Figure 1** PRF was filled into the socket and adjusted closely to the distal aspect of second molar

#### *PRF preparation*

10 ml of venous blood was drawn from the antecubital vein and collected in a centrifuged at 3000 rpm for 10 minutes. A fibrin clot was easily taken from middle part of tubes, whereas the upper part contained acellular plasma and lower part contained red corpuscles. sterile glass test tube and immediately

#### *Periodontal examination*

The periodontal assessment was performed by a single examiner and this was done before surgical removal and 2months

after surgery. The periodontal examination was located in 3 areas (disto-buccal, middistal, distal-lingual) at the distal aspect of mandibular second molar by using William's periodontal probe. The periodontal parameter includes:

1. probing depth measured from gingival margin.
2. clinical attachment level measured from cemento-enamel junction to the depth of sulcus

The probing measurement was repeated 3 times, and average value was recorded.

### Statistical Analysis

Statistical analysis was carried out using a Statistical Package for Social Sciences software (SPSS 21 for Mac OS). Pair t-test was used to compare pre- and postoperative periodontal parameter both within and between groups. The significance level was determined as 0.05.

### Results

Ten patients were enrolled in this study. All of the patients were male with a mean age of  $24.9 \pm 2.64$  years (range 21-30 years). The data of type of impaction and difficulty index, operating time (including local anesthetic and surgical procedures) and postoperative complications was shown in Table 1. The most frequent position of the third molars according to the classification of Winter and Pell & Gregory was horizontal

and class IIA. The Pederson's difficulty index was mostly in the moderate level (85%). The total time used in operation in the study sides ( $55.75 \pm 11.59$  min) was longer than the control sides ( $46.00 \pm 13.88$  min) which showed no statistically significant difference ( $p=0.55$ ). There were postoperative complications occurred in 3 patients. The first one was localized infection, small gingival abscess at buccal side of the socket, occurring 1 month after surgical procedure. Saline irrigation and additional antibiotics were prescribed and then healing obtained. Dry socket (alveolar osteitis) was found in two patients, which occurred in the first week after surgery (one in experimental side and the other in control side) and managed by saline irrigation with white-head-varnish dressing. Systemic Ibuprofen with dosage of 400 mg every 8 h for pain was delivered.

**Table 1** Demographic characteristics and variables related to the surgical procedures

Demographic data	
Gender, Male	10 Patients
Age (mean $\pm$ SD)	$24.9 \pm 2.64$ Years
Impaction characteristics	
Angulation,	
Mesioangular	7 Teeth
Horizontal	13 Teeth
Depth, n (%)	
A	10 Teeth
B	7 Teeth
C	3 Teeth
Difficulty	
Very difficult	1 Teeth
Moderately difficult	17 Teeth
Slightly difficult	2 Teeth
Operating time (mean $\pm$ SD)	
Study group	$55.75 \pm 11.59$ mins
Control group	$46.00 \pm 13.88$ mins
Postoperative complication	
Delayed infection	1 Case
Dry socket	2 Cases ( <i>1 study side and 1 control side</i> )

After surgical removal, the all surgical socket healing was obtained by secondary intention at the time of 2-month follow-up and the shallow soft tissue clefts obviously remained (figure 2).

*The comparison of probing depth and clinical attachment level*

The preoperative probing depth and clinical attachment level of the study sides and control sides were compared and no significant difference was found.

At the 2-month time, the postoperative periodontal status was measured. The comparison of pre- and postoperative periodontal status were performed (Table 2). The probing depth decreased in all locations in the study group, and there was statistically significant difference at one site, disto-lingual aspect ( $p = 0.03$ ). In the control group, there was no statistically significant difference in all sites of the control group.

When pre- and postoperative clinical attachment level was compared, there was no statistical difference in both groups (Table 3). The amount of value gain or loss between pre- and postoperative probing depth as well as clinical attachment level was calculated and it was found no significant difference between both study and control groups (Table 4, Figure 3 and 4).

**Discussions**

In the past studies, to prevent periodontal defects after surgical removal of mandibular third molar, platelet-rich plasma was used for the periodontal healing at distal root surface of mandibular second molar because of containing many growth factors and found to have satisfactory reduction in periodontal depth and attachment gain.<sup>13, 14</sup> It was currently suggested PRF be superior to PRP in inducing soft and hard tissue healing due to its sustained release of growth factors<sup>15-17</sup>, and its advantages in ease of preparation, no biochemical handling if of blood or use of any gelling agent. The PRF clot forms a strong natural fibrin matrix which contains almost all the platelets and growth factors of

the harvested blood.<sup>10-18</sup> The PRF has been reported as a slow-sustained release of key growth factors for at least 7 days<sup>19</sup> and up to 28 days.<sup>20</sup> Some clinical applications of PRF have been described in cases of sinus-lift grafting and socket preservation.

The present study aimed to study the effectiveness of PRF in improvement of periodontal status at the distal root surface of mandibular second molar after third molar surgery. Twenty surgical sites of 10 patients were selected for the study with split- mouth design. Randomization could not be completed in this study because when one site was randomly assigned as study or control, the other would be automatically selected itself to the remaining group. Patient blinding was neither possible owing to the procedures of blood collection and immediate grafting in the study side. The mean preoperative periodontal probing depth and clinical attachment level in the study and control groups showed no statistical significant difference. It implied these two groups were basically comparable.

This study performed the probing depth measurement in three locations, disto-lingual, mid-distal, disto-buccal, at the distal surface of mandibular second molar. There was reduction in probing depth at all locations both in study and control groups but it was statistically significant at disto-lingual location in the study group. The clinical attachment level was found there was reduction at only the disto-lingual side in the study group and at disto-lingual and disto-buccal sides in the control group but there was no statistical difference between pre- and postsurgical value in all locations of both groups. A similar case-and-control study<sup>12</sup> on using PRF to increase healing after impacted mandibular third molar surgery. In that study there was improvement of pocket depth at the distal aspect of second molar in case and control groups at 1-month and 3-month after surgery. The pocket depth was less in the case group but the difference from control was statistical significant only at the end of 3 months.

In contrast to the previous studies, the deeply impacted teeth were recruited. In the present study, all visible impacted third molars were selected and this is possibly assumed that the technical limitation in the selected cases of partially erupted impaction could result in no coverage of gingival flap to support and adapt the PRF clot to the distal root surface of second molar during early postoperative healing. We observed the PRF clot collapsed down to the socket resulting in some exposure of distal root surface of mandibular second molar in the first week after surgery. Thus the result possibly showed negative gain in attachment level at the mid-distal and disto-buccal locations in the study group. However there was no significant difference in attachment gain between two groups.

The limitation of this present study in periodontal assessment technique was the indirect vision in conventional measuring and the scale of periodontal probe which possibly could not achieve the accurate value, and that was solved by three times measuring per one location and average values were recorded. Other limitation was the impaction of occlusal part of the impacted third molar to the distal root of second molar that could hinder the probe to reach the depth in the preoperative procedure. However, it should be considered effective improvement in periodontal healing when using PRF grafting in the surgical third molar socket from the result of probing depth.

The time of periodontal assessment in this study seemed earlier than other studies which performed the periodontal examination 3 month after surgery<sup>11, 13</sup> and up to 1 year postoperatively.<sup>21</sup> It would better wait for 3 months after surgery for maturation of periodontal healing. Although early periodontal assessment was done at 2 month postoperatively in this study, significant reduction in periodontal depth was observed in the study group. The evaluation of bone density was not assessed in this study because the postoperative follow-up time was too short for measuring the bone regeneration. A study reported no statistical significant difference in bone density of surgical third

molar sockets between both study and control groups, PRF and non-PRF graft, at 3 months after surgery.<sup>12</sup> Similarly, a previous study using PRP filled in the sockets when compared with the control group showed no significant difference.<sup>14</sup>

Postoperative alveolar osteitis occurred in two sockets (10%) which were carried out with the longest surgical time in each group (66 minutes in study group and 70 minutes in control group). A similar incidence in a study, effect of PRF on frequency of alveolar osteitis following mandibular third molar surgery, found at 14.74% of all sockets (case and control)<sup>22</sup>. One localized infection occurred at study site. A small abscess in soft tissue presenting at the distal part of incision area distant to the second molar whereas the complete granulation were observed in the socket. Debridement and curettage found a little pus and food debris inside. It could be assumed that food debris accumulation can cause this delay infection.

## Conclusions

The result of this clinical study showed that the Platelet-rich fibrin application in the surgical mandibular third molar sockets was able to reduce the periodontal probing depth of distal aspect of second molar when the removed third molars associated with mesial crestal bone loss. This useful technique significantly improved the periodontal healing after surgical removal of mandibular third molar. The surgical technique to adapt and protect the PRF clot to the distal root surface of second molar in the partial erupted impaction should be developed and much longer time for postoperative assessment in not only soft tissue healing but hard tissue healing. And it was suggested that the more reliable periodontal measurement parameter should be developed in further studies.



**Figure 2** Healing of surgical sockets after 2 months of surgical removal.

**Table 2** Comparison of the mean probing depth in study and control groups preoperatively and 2 months postoperatively

Group	Locations (mm, Mean $\pm$ SD)		
	Disto-lingual	Mid-distal	Disto-buccal
Preoperatively	3.73 $\pm$ 1.33	4.39 $\pm$ 1.75	4.63 $\pm$ 1.68
2 months postoperatively	2.69 $\pm$ 0.63*	3.36 $\pm$ 1.56	4.39 $\pm$ 1.84
Control group			
Preoperatively	3.69 $\pm$ 1.69	4.00 $\pm$ 1.11	5.16 $\pm$ 1.97
2 months postoperatively	2.56 $\pm$ 0.80	3.29 $\pm$ 1.07	4.10 $\pm$ 2.18

\* Statistically significant ( $P < 0.05$ )

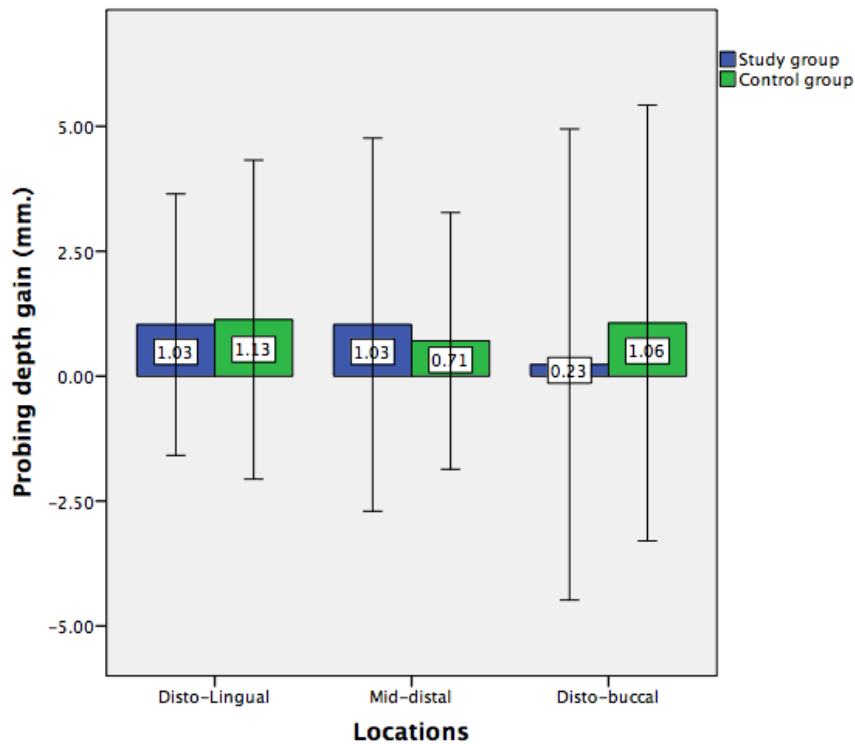
**Table 3** The clinical attachment level between the study and the control groups preoperatively and 2-months postoperatively

Group	Locations (mm, Mean $\pm$ SD)		
	Disto-lingual	Mid-distal	Disto-buccal
Preoperatively	2.64 $\pm$ 1.58	2.79 $\pm$ 1.66	4.13 $\pm$ 2.33
2 months postoperatively	1.99 $\pm$ 0.87	2.96 $\pm$ 1.78	4.43 $\pm$ 2.36
Control group			
Preoperatively	3.03 $\pm$ 2.51	1.85 $\pm$ 1.30	4.53 $\pm$ 1.90
2 months postoperatively	1.76 $\pm$ 1.04	2.22 $\pm$ 1.93	4.26 $\pm$ 2.18

**Table 4** The probing depth and clinical attachment level gain in study and control groups preoperatively and 2 months postoperatively

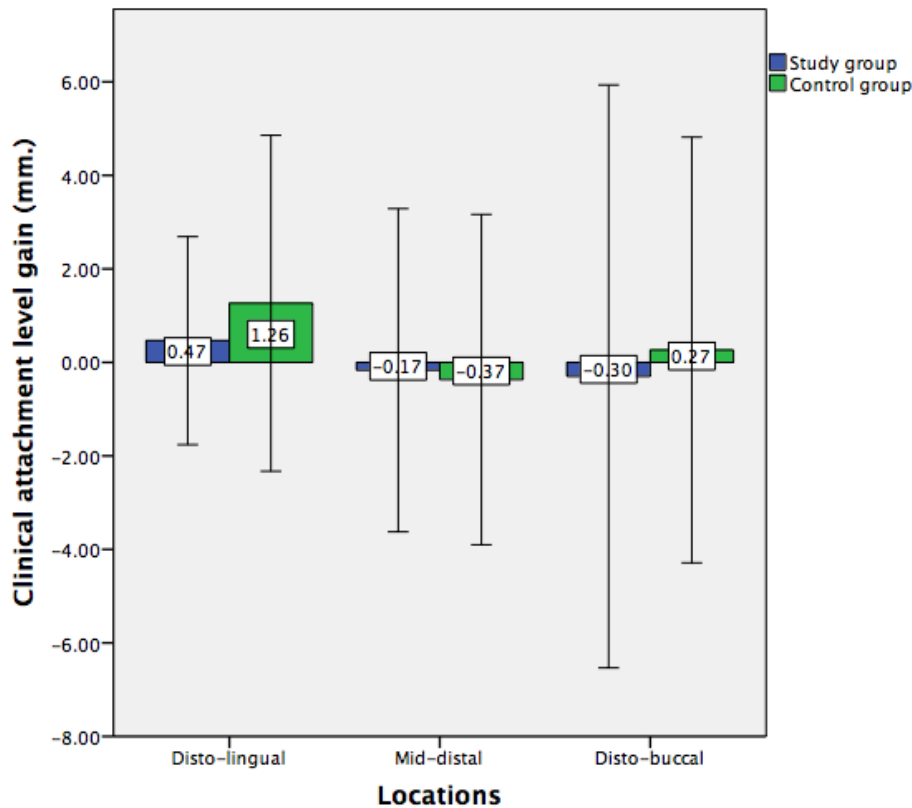
Measurement	Locations (mm, Mean ± SD)		
	Disto-lingual	Mid-distal	Disto-buccal
<b>Probing depth</b>			
Study group	1.03 ± 1.30	1.10 ± 1.96	0.23 ± 2.35
Control group	1.13 ± 1.59	0.70 ± 1.28	1.06 ± 2.18
<b>Clinical attachment level</b>			
Study group	0.29 ± 1.78	-0.46 ± 1.11	-0.30 ± 3.11
Control group	0.36 ± 1.76	-1.26 ± 1.79	0.26 ± 2.27

The minus(-) sign infers the negative gain of clinical attachment level.



**Figure 3.** Comparison of probing depth gain in study and control groups preoperatively and 2 months postoperatively





**Figure 4** Comparison of clinical attachment level gain in study and control groups preoperatively and 2 months postoperatively

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## ผลของของเกล็ดเลือดที่อุดมไฟบรินต่อการหายของเนื้อเยื่อปริทันต์ภายหลังการผ่าตัดฟันคุด

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### บทคัดย่อ

วัตถุประสงค์: การศึกษามีวัตถุประสงค์เพื่อประเมินผลกระทบบของเกล็ดเลือดที่อุดมไฟบริน (PRF) กับความลึกปริทันต์และระดับเนื้อเยื่อยึดที่ด้านท้ายของฟันกรามล่างที่สองหลังจากการกำจัดฟันกรามที่สาม

วัสดุและวิธีการ: การศึกษาถูกออกแบบเป็นแบบการทดลองแยกซึ่งประกอบด้วยผู้ป่วย 10 ที่พบฟันคุดทั้งสองข้าง และทำการผ่าตัดเพื่อกำจัดฟันกรามที่สามที่โรงพยาบาลทันตกรรมคณะทันตแพทยศาสตร์มหาวิทยาลัยสงขลานครินทร์ หลังจากการผ่าตัดในกลุ่มการศึกษา, PRF ถูกวางไว้ในซ็อกเก็ตตามด้วยการเย็บง่ายแบบซัดจิ้งหะ หลังจากนั้นดำเนินการวัดเนื้อเยื่อปริทันต์ใน 3 ตำแหน่งรอบฟัน (ไกลกลาง, ไกลลิ้น, ไกลแก้ม) ก่อนผ่าตัดและ 2 เดือนหลังผ่าตัด

ผลการทดลอง พบทั้งสองกลุ่มเปรียบเทียบไม่มีความแตกต่างทางสถิติ ( $p < 0.05$ ) สำหรับการประเมินผลหลังการผ่าตัดลดความลึกของกระเป๋าหลังผ่าตัดปริทันต์ที่มีความแตกต่างอย่างมีนัยสำคัญทางสถิติที่เป็นเพียงแ่งมุมไกลกลาง-ไกลลิ้น ( $p = 0.03$ ) ในกลุ่มการศึกษาหลังผ่าตัดไม่พบความแตกต่างอย่างมีนัยสำคัญที่แตกต่างจากก่อนการผ่าตัดในทั้งสองกลุ่ม

สรุป: การประยุกต์ใช้ไฟบรินที่อุดมเกล็ดเลือดในการผ่าตัดขากรรไกรล่างบริเวณฟันกรามที่สามสามารถที่จะปรับปรุงการรักษาปริทันต์ที่ด้านไกลกลางของฟันกรามที่สองได้

คำสำคัญ: เกล็ดเลือดที่อุดมไฟบริน

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