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Evaluation of the Effect of Polybutester and Polypropylene Sutures on Complications after Impacted Lower Third Molar Surgery

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Abstract: Complications that can occur in the post-operative period of impacted lower third molar extraction are factors that have an impact on the daily routine of patients. In this study, it was aimed to evaluate the efficacy of polybutester and polypropylene sutures on postoperative complications after impacted lower third molar surgery. Two different suture materials were used in the 35 patients with bilateral impacted lower third molars included in the study: polybutester suture in group 1 and polyprolene suture in group 2. Measurements were taken to evaluate swelling and trismus before surgery and on the 2nd and 7th days after surgery, and pain was evaluated using a visual analogue scale (VAS), which patients were asked to complete after surgery. Wound healing, suture-related injury and suture-related discomfort in patients were also evaluated. The pain and suture-related discomfort felt on the side where the polybutester suture was used was less on the second postoperative day than on the side where the polypropylene suture was used. These results support the use of polybutester suture in impacted third molar surgery.

Keywords: impacted third molar; suture; polybutester; polypropylene; pain

1. Introduction

Removal of impacted lower third molar (ILTM)'s is one of the most common oral surgery procedures. Before deciding to remove affected teeth, the necessity of the procedure and possible complications arising from the procedure must be evaluated. Patients are informed about the possible risks before the procedure. Asymptomatic teeth that are located far away from the adjacent tooth, have complete root formation, are completely surrounded by bone and are deeply located are more suitable for follow-up rather than extraction. When the decision is made to leave the tooth in place, the patient should be followed up regularly for a possible pathologic condition. The patient should also be informed about complications that may occur with advancing age [1].

It usually takes 7-10 days for the patient to recover after extraction of ILTM's. During this period, postoperative complications resulting from inflammatory tissue reactions negatively affect the daily routines of patients [2,3]. There may be post-operative complications such as pain, swelling, trismus, alveolitis, bleeding, nerve damage and damage to the temporomandibular joint. [4]. Various methods are used to treat complications, such as drugs, cold or hot compresses, different surgical approaches or low-dose laser therapy [5–7].

Sutures are materials used to close wound surfaces and/or compress blood vessels to stop bleeding. Sutures are still the most commonly used method of stitching surgical incision lines together. In recent years, efforts have been made to reach the ideal suture material in parallel with technological developments and the properties of suture materials have been improved [8]. The ideal suture material should create sufficient tension to close the wound site without creating a dead space, be loose enough not to cause ischemia or necrosis in the tissue, provide hemostasis and allow proper flap positioning, have appropriate tensile strength against rupture, have good knot security to prevent untying, be flexible and workable, have low tissue reactivity and be resistant to bacterial infection. It should also reduce postoperative pain, prevent bone exposure due to delayed healing

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and prevent unfavorable resorption [9]. The choice of material for sutures usually depends on the type of wound and the surgeon's preference. Today, there are many suture materials with different chemical, physical, mechanical and biological properties [10].

The polybutester (PE) suture material is a copolymer made from polyglycol terephthalate and polybutylene terephthalate. It is a synthetic monofilament suture material that is not absorbable. Compared to other monofilaments, PE is stronger. Suture has a weak suture memory and does not retain the shape of the package. This makes it easier to work with and increases knotting security. Compared to other synthetic sutures, PE suture adapts better to tension. Most suture materials show limited elasticity in the case of increased tension. After a certain load, they lose their elasticity and undergo a dimensional change called creep. This value is quite low in PE sutures. PE sutures exhibit a high level of elasticity under low load. After this, it will elongate until it breaks at a load similar to other suture materials. Compared to other non-resorbable monofilament sutures, this controlled low-strain elongation offers significant clinical advantages. The PE suture is designed to conform to increasing wound oedema and return to its original shape as the oedema subsides. Its ability to adapt to the changing configuration of the wound also reduces the risk of hypertrophic scarring. It gives better cosmetic results [8,11].

Polypropylene (PP) suture is produced by forming isotactic stereoisomers of a linear hydrocarbon crystalline polymer into sterile monofilaments. A non-absorbable synthetic monofilament suture made from the polymer PP. It is the most widely used monofilament suture. It has a high level of compressive strength and low tissue reactivity. It has resistance to infection formation. In general, it has a good ability to close and protect the wound. It can easily pass through tissues, host response is minimal. It can be easily applied and removed due to its smooth structure. However, its smooth surface reduces knot security and requires extra knots to be tied. High plasticity, which allows for stretching caused by post-operative oedema, is another important feature of PP. Suture memory is high and therefore difficult to handle and this is another factor that reduces knot security. Allergic reaction due to PP sutures is very rare [8,12–17].

A limited number of studies were found in the literature evaluating the effectiveness of suture for complications after ILTM surgery, and no studies were identified on the use of polybuester in the oral region. Due to the superior physical properties of PE, we believe that it will be effective on postoperative complications of ILTM surgery. The aim of this study was to evaluate the effectiveness of PE and PP sutures on postoperative complications after ILTM surgery.

2. Materials and Methods

This prospective, randomized, split-mouth, double-blind study was conducted between September 2019 and September 2020 at Van Yüzüncü Yıl University Faculty of Dentistry, Department of Oral and Maxillofacial Surgery Clinic. Van Yüzüncü Yıl University Faculty of Medicine Clinical Research Ethics Committee approval (decision no. 11 dated 03.07.2019) was obtained for the study. Patients were informed about the study in detail. Voluntary individuals who agreed to participate in the study were included in the study after signing the informed consent form. The study was conducted in accordance with the current version of the Declaration of Helsinki.

Individuals between the ages of 18-35 years, ASA0 and ASA1 individuals according to ASA classification, individuals with bilateral, similarly positioned and asymptomatic impacted lower wisdom teeth indicated for extraction for orthodontic reasons, and individuals who did not use any medication until 2 weeks before the operations were included in the study.

Smokers, pregnant or breastfeeding individuals, individuals who were allergic to the drugs to be used in the study, individuals who could not come to the controls, individuals who did not use the given drugs regularly or who used non-study drugs, individuals who did not fill out the visual analogue scale (VAS) form, individuals with postoperative alveolitis (alveolitis was considered when the pain, which started 2-4 days after extraction with halitosis and could not be alleviated with analgesics, continued severely until 5-10 days after the operation without decreasing) were excluded from the study [18].

After dental and medical histories were taken, clinical and radiologic evaluations were performed. Before each operation, the distances between the angulus-lateral canthus, tragus-labial

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commissure, tragus-pogonion in millimeter for edema evaluation and the maximum interincisal distance between the incisal edges of the upper and lower central teeth at maximum mouth opening in millimeter for trismus evaluation and recorded in the anamnesis forms containing the demographic information of the patients.

2.1. Study groups

In the study, a PE suture (Group 1), (3/0, reverse cutting, 3/8, 19 mm; Novafil™, Covidien, Ireland) on one side and a PP suture (Group 2), (3/0, reverse cutting, 3/8, 19 mm; Surgipro™, Covidien, Ireland) on the other side were used at different times. To ensure randomization, combinations of the suture to be used (PE or PP) and the side of surgery (right or left) were written on sealed envelopes before the patient's first surgery. the patient select an envelope from the envelopes prepared by the assistant staff, and in this way, the side and group for the first operation were determined. The patient selected an envelope from the envelopes prepared by the assistant staff, and in this way the side and group of the first operation were determined. Suture procedures were performed by an independent surgeon who was not involved in the study to ensure double-blindness of the study. Both of the suture materials were blue in color, they were straightened and prepared by the assistant staff, and were given to the surgeon.

2.2. Surgical application and data collection

Under local anesthesia, the three-cornered mucoperiosteal flap was removed after ward incision including a vertical incision passing through the mesial third of the second molar. Retentive bone tissues were removed, and teeth were separated when necessary and extractions were completed. Extraction sockets were irrigated with saline. After controlling bleeding, the wound lips were closed with PE or PP sutures. Sutures were removed after 1 week. All patients received antibiotics (amoxicillin 3*1), painkillers (ibuprofen 2*1) and mouthwash (0.12% chlorhexidine digluconate and 0.15% benzidamine hydrochloride 3*1) were prescribed and used for 1 week. Patients were also given paracetamol 500 mg as a rescue painkiller to be used only in case of need, with a maximum of 4 units per day. They were asked to note the number and time of use on the VAS forms given to them. Postoperative soft diet was recommended, and patients were informed about their follow-up appointments. There was a 4-week interval between operations. Surgical procedures were performed on Mondays, Tuesdays and Wednesdays for postoperative controls, and care was taken to perform the operations at the same time. All operations were performed by the same research surgeon.

'Visual Analogue Scale (VAS) and Side Effect Form' were given to the patients to measure postoperative pain. Patients were asked to select the appropriate value ranging from 0 (absence of pain) to 10 (presence of unbearable pain) corresponding to the pain they felt at the 3rd (1T), 6th (2T), 12th (3T) and 24th (4T) postoperative hours and on the 2nd (5T), 3rd (6T), 5th (7T) and 7th (8T) days. The pain felt by the patients during the 7-day postoperative period was evaluated using VAS scales. The distances between the angulus-lateral canthus, tragus-labial commissure and tragus-pogonion for edema evaluation and maximum interincisal distance for trismus evaluation were measured preoperatively (D0) and repeated on postoperative days 2 (D2) and 7 (D7) . Wound healing (wound dehiscence in the postoperative period in millimeter), suture-related injuries and discomfort were evaluated 2 (D2) and 7 (D7) days after the operation. The data obtained were recorded on patient anamnesis forms. Preoperative and postoperative measurements were performed by the other research surgeon who did not perform the operations.

2.3. Statistical analysis

Statistical analysis was performed using the Number Cruncher Statistical System (NCSS) program (Kaysville, Utah, USA). Study data were analysed using descriptive statistical techniques (mean, median, standard deviation, ratios, frequencies, minimum, maximum). To test the normality of quantitative data, the Kolmogorov-Smirnov test, the Shapiro-Wilk test and graphs were used. To compare normally distributed parameters between PE and PP sutures, the paired sample t-test was

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used, and non-normally distributed parameters were compared using the Wilcoxon signed-ranks test. Repeated measures analysis of variance (ANOVA) was used to assess follow-up of normally distributed variables, and pairwise comparisons were assessed using the Bonferroni test. For non-normally distributed variables, the Friedman test was used, and Bonferroni-Dunn and Wilcoxon signed-ranks tests were used for pairwise comparisons. The Mann-Whitney U test was used to compare variables that were not normally distributed. Significance was assessed at a minimum level of $p<0.05$. G*Power (v3.1.7) was used to determine sample size. The power of a study was expressed as $1-\beta$ (β = probability of type II error), and generally studies should have 80% power. Based on the study by Mathew P. Varghese et al, the effect size was calculated as $d=0.512$ as a result of the calculation made according to the difference in RNFB scores, and it was calculated that there should be at least 32 people in the study to obtain 80% power at $\alpha=0.05$ level [19]. Taking into account that there may be losses during the course of the study, it was decided that this number should be 40. 3 patients were excluded from the study due to missed appointments and 2 patients due to alveolitis. The remaining 35 patients were enrolled.

3. Results

Of the 35 patients included in the study, age ranged from 18 to 34 years with a mean of 22.40±4.47 years, 34.3% (n=12) were male and 65.7% (n=23) were female. Analysis of brushing habits revealed that 5.7% (n=2) of patients had no brushing habits, 25.7% (n=9) brushed once a day, 60% (n=21) brushed twice a day and 8.6% (n=3) brushed more than twice a day. While 57.1 per cent (n=20) of the participants had completed high school or less, 42.9 per cent (n=15) had completed university (Table 1).

Table 1. Descriptive characteristics distribution.

		n	**%**
Age	Minimum-Maximum	18-34	
	Mean ± Standart deviation	22.40±4.47	
Gender	Male	12	34,3
	Female	23	65,7
Brushing habit	None	2	5,7
	Once daily	9	25,7
	Twice daily	21	60,0
	More than twice daily	3	8,6
Level of education	High school and below	20	57,1
	University	15	42,9

Sd: Standard deviation.

The mean operation time was 15.86±8.09 minutes in the PE group and 17.71±14.21 minutes in the PP group. In terms of operation times, no statistically meaningful difference between PE and PP groups. ($p>0.05$) (Table 2).

Table 2. Operating time evaluation.

	PE	**PP**	[a]p
Minumum – maximum	5-35	5-90	0,314
Mean ± Standart deviation	15,86±8,09	17,71±14,21	

[a] Wilcoxon Signed Ranks Test

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3.1. Pain evaluations

The difference was not statistically meaningful in VAS scores between the PE and PP groups at the 1T, 2T, 3T, 4T, 6T, 7T and 8T ($p>0.05$). The 5T VAS scores in the PP group were significantly higher than those in the PE group ($p<0.05$) (Table 3).

3.1.1. Pain evaluations in the PE group

Statistically meaningful changes were observed in the VAS measurements on the 1T, 2T, 3T, 4T, 5T, 6T, 7T and 8T ($p<0.01$). Pairwise comparisons revealed statistically meaningful decreases in VAS scores on the 7T and 8T compared to the 1T ($p<0.01$). The decrease in VAS scores on the 5T, 6T, 7T and 8T in comparison to the 2T was also statistically meaningful ($p<0.05$). The decrease in VAS scores on the 5T, 6T, 7T and 8T compared to the 3T was also found to be statistically meaningful ($p<0,05$). The decrease in VAS scores on the 8T compared to the 4T, the 8T compared to the 5T and the 8T compared to the 6T were also found to be statistically meaningful ($p<0,05$). In other pairwise comparisons, no significant difference was found between the VAS scores ($p>0.05$) (Table 3).

3.1.2. Pain evaluations in the PP group

Changes in 1T, 2T, 3T, 4T, 5T, 6T, 7T and 8T VAS scores were statistically meaningful ($p<0.01$). As a result of pairwise comparisons, the decrease in the 4T, 6T, 7T and 8T VAS scores compared to the 1T was found to be statistically meaningful ($p<0.05$). The decrease in VAS measurements at the 4T, 6T, 7T and 8T compared to the 2T was also found to be statistically meaningful ($p<0,05$). The decrease in VAS measurements on the 7T and 8T compared to the 3T was also found to be statistically meaningful ($p<0.01$). The decrease in VAS measurements on the 8T compared to the 4T and on the 8T compared to the 5T was also statistically meaningful ($p<0.01$). No significant difference was found between VAS measurements of other pairwise comparisons ($p>0.05$) (Table 3).

Table 3. Evaluation of VAS measurements.

		PE	**PP**	[a]p
1T	Minumum-maximum	0-10	0-10	0,175
	Mean ± Standart deviation	4,80±3,13	5,26±2,98	
2T	Minumum-maximum	0-10	0-10	0,057
	Mean ± Standart deviation	4,49±2,58	5,29±2,65	
3T	Minumum-maximum	0-10	0-9	0,546
	Mean ± Standart deviation	4,51±2,91	4,17±2,81	
4T	Minumum-maximum	0-10	0-9	0,798
	Mean ± Standart deviation	3,31±2,48	3,37±2,56	
5T	Minumum-maximum	0-9	0-8	**0,031***
	Mean ± Standart deviation	2,97±2,24	3,60±2,30	
6T	Minumum-maximum	0-8	0-8	0,988
	Mean ± Standart deviation	2,86±2,41	2,89±2,29	
7T	Minumum-maximum	0-8	0-8	0,785

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		Mean ± Standart deviation	2,20±2,29	2,40±2,45	
	8T	Minumum-maximum	0-6	0-7	0,341
		Mean ± Standart deviation	1,26±1,82	1,60±2,00	
		[b]p	**0,001****	**0,001****	
Changes within the group, [c]p		1T– 2T	1,000	1,000	
		1T - 3T	1,000	1,000	
		1T - 4T	1,000	**0,042***	
		1T - 5T	0,096	0,204	
		1T - 6T	0,082	**0,001****	
		1T - 7T	**0,001****	**0,001****	
		1T - 8T	**0,001****	**0,001****	
		2T - 3T	1,000	1,000	
		2T - 4T	1,000	**0,016***	
		2T - 5T	**0,042***	0,088	
		2T - 6T	**0,036***	**0,001****	
		2T - 7T	**0,001****	**0,001****	
		2T - 8T	**0,001****	**0,001****	
		3T - 4T	0,471	1,000	
		3T - 5T	**0,015***	1,000	
		3T - 6T	**0,012***	0,236	
		3T - 7T	**0,001****	**0,002****	
		3T - 8T	**0,001****	**0,001****	
		4T - 5T	1,000	1,000	
		4T - 6T	1,000	1,000	
		4T - 7T	0,471	0,652	
		4T - 8T	**0,001****	**0,004****	
		5T - 6T	1,000	1,000	
		5T - 7T	1,000	0,163	
		5T - 8T	**0,036***	**0,001****	
		6T - 7T	1,000	1,000	
		6T - 8T	**0,042***	0,121	
		7T - 8T	1,000	1,000	

[a]Wilcoxon Signed Ranks Test [b]Friedman Test, [c]Bonferroni Dunn Test, **p<0,01, *p<0,05.

3.2. Swelling evaluations

In the PE and PP groups, the D0, D2 and D7 mean facial measurements did not show a statistically meaningful difference (p>0.05) (Table 4).

3.2.1. Swelling evaluations in the the PE group

The changes in mean facial measurements on the D0, D2 and D7 were statistically meaningful (p<0.01). As a result of pairwise comparisons, the increase in mean facial measurements on the D2 and D7 compared to the D0 was found to be statistically meaningful (p<0.01). The decrease in mean facial measurements on the D7 compared to the D2 was also found to be statistically meaningful (p<0.01) (Table 4).

3.2.2. Swelling evaluations in the PP group

The changes in mean facial measurements on the D0, D2 and D7 were statistically meaningful (p<0.01). As a result of pairwise comparisons, the increase in mean facial measurements on the D2 and D7 compared to the D0 was found to be statistically meaningful (p<0.01). The decrease in mean facial measurements on postoperative 7th day compared to postoperative 2nd day was also found to be statistically meaningful (p<0.01) (Table 4).

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Table 4. Evaluation of swelling measurements.

			PE	PP	[a]p
	D0	Minumum-maximum	103,3-141,67	102,7-141,67	0,989
		Mean ± Standart deviation	118,98±8,11	118,99±8,28	
	D2	Minumum-maximum	113,3-141,67	103,3-146,67	0,663
		Mean ± Standart deviation	124,72±7,00	124,16±8,40	
	D7	Minumum-maximum	110-140	107,3-141,67	0,946
		Mean ± Standart deviation	121,99±7,69	121,92±7,33	
		[b]p	**0,001****	**0,001****	
Changes within the group; [c]p		D0-D2	**0,001****	**0,001****	
		D0-D7	**0,009****	**0,001****	
		D2-D7	**0,001****	**0,001****	

[a]Paired Samples t Test [b] Repeated Measures Test, [c]Bonferroni Dunn Test, **p<0,01.

3.3. Trismus evaluations

In PE and PP groups, the D0, D2 and D7 trismus measurements did not show statistically meaningful difference (p>0.05) (Table 5).

Table 5. Evaluation of trismus (maximum mouth opening) measurements.

			PE	PP	[a]p
	D0	Minumum-maximum	30-56	34-50	0,615
		Mean ± Standart deviation	41,74±6,44	41,31±4,00	
	D2	Minumum-maximum	11-44	5-44	0,241
		Mean ± Standart deviation	26,31±9,29	24,29±9,91	
	D7	Minumum-maximum	21-54	23-50	0,793
		Mean ± Standart deviation	36,54±6,90	36,23±6,75	
		[b]p	**0,001****	**0,001****	
Changes within the group; [c]p		D0-D2	**0,001****	**0,001****	
		D0-D7	**0,001****	**0,001****	
		D2-D7	**0,001****	**0,001****	

[a]Paired Samples t Test, [b]Repeated Measures Test, [c]Bonferroni Dunn Test, **p<0,01.

3.4. Wound healing evaluations

The difference was not statistically meaningful between PE and PP groups in terms of wound dehiscence at the incision line the D0, D2 and D7(p>0.05) (Table 6).

Table 6. Wound healing evaluations (wound dehiscence measurements).

			PE	PP	[a]p
	D0	Minumum-maximum	0	0	-
		Mean ± Standart deviation	0	0	
	D2	Minumum-maximum	0-3	0-1	0,221
		Mean ± Standart deviation	0,20±0,68	0,06±0,24	
	D7	Minumum-maximum	0-3	0-1	0,160
		Mean ± Standart deviation	0,26±0,74	0,06±0,24	
		[b]p	0,144	0,135	
Changes within the group; [c]p		D0-D2	1,000	1,000	
		D0-D7	1,000	1,000	
		D2-D7	1,000	1,000	

[a]Wilcoxon Signed Ranks Test, [b]Friedman Test, [c]Bonferroni Dunn Test.

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3.5. Evaluations of soft tissue injury

The D0, D2 and D7 soft tissue injury rates in PE and PP groups do not show statistically meaningful difference (p>0.05) (Table 7).

Table 7. Evaluations of soft tissue injury.

		PE n (%)	**PP n (%)**	*[a]p*
D0	Present	35 (100)	35 (100)	-
	Absent	0 (0)	0 (0)	
D2	Present	30 (85,7)	28 (80,0)	0,317
	Absent	5 (14,3)	7 (20,0)	
D7	Present	31 (88,6)	30 (85,7)	0,655
	Absent	4 (11,4)	5 (14,3)	
	[b]**p**	**0,030***	**0,004****	
Changes within the group; [a]p	D0-D2	**0,025***	**0,008****	
	D0-D7	**0,046***	**0,025***	
	D2-D7	0,564	0,157	

[a]Wilcoxon Signed Ranks Test, [b]Friedman Test, *p<0,05, **p<0,01.

3.6. Evaluations of suture discomfort

While the D0 and D7 suture discomfort rates in the PE and PP groups did not show a statistically meaningful difference (p>0.05), it was found significant that the rate of discomfort on the D2 the PP group was higher than that in the PE group (p<0.05) (Table 8).

Table 8. Evaluations of suture discomfort.

		PE n (%)	**PP** n (%)	[a]p
D0	Present	35 (100)	35 (100)	-
	Absent	0 (0)	0 (0)	
D2	Present	25 (71,4)	21 (60,0)	**0,046***
	Absent	10 (28,6)	14 (40,0)	
D7	Present	23 (65,7)	21 (60,0)	0,414
	Absent	12 (34,3)	14 (40,0)	
	[b]p	0,001**	0,001**	
Changes within the group; [a]p	DO-D2	**0,002****	**0,001****	
	D0-D7	**0,001****	**0,001****	
	D2-D7	0,414	1,000	

[a]Wilcoxon Signed Ranks Test, [b]Friedman Test, *p<0,05, **p<0,01.

3.5. Evaluations according to gender

The 1T, 2T and 3T VAS scores of the patients did not show statistically meaningful difference according to gender (p>0.05). It was found statistically meaningful that the mean VAS scores of female patients at the 4T, 5T, 6T, 7T and 8T were higher than male patients (p<0.01). The intra-group comparison of pain values of men and women according to time were given in detail in Table 9.

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Table 9. VAS evaluations according to gender.

			Male	Female	[a]p
	1T	Minumum-maximum	0-10	0-10	0,384
		Mean ± Standart deviation	4,46±3,03	5,33±2,61	
	2T	Minumum-maximum	0-8	0-9,5	0,329
		Mean ± Standart deviation	4,33±2,20	5,17±2,35	
	3T	Minumum-maximum	0-8	0-9,5	0,130
		Mean ± Standart deviation	3,42±2,32	4,83±2,65	
	4T	Minumum-maximum	0-5	0-9,5	**0,004****
		Mean ± Standart deviation	2,00±1,30	4,04±2,23	
	5T	Minumum-maximum	0-4	0-8,5	**0,001****
		Mean ± Standart deviation	1,83±1,32	4,04±2,08	
	6T	Minumum-maximum	0-4	0-8	**0,001****
		Mean ± Standart deviation	1,33±1,25	3,67±1,89	
	7T	Minumum-maximum	0-4	0-6,5	**0,003****
		Mean ± Standart deviation	0,96±1,16	3,00±2,02	
	8T	Minumum-maximum	0-3	0-5,5	**0,008****
		Mean ± Standart deviation	0,50±0,90	1,91±1,81	
		[b]p	**0,001****	**0,001****	
Changes within the group; [c]p		1T– 2T	1,000	1,000	
		1T - 3T	1,000	1,000	
		1T - 4T	0,847	1,000	
		1T - 5T	0,391	1,000	
		1T - 6T	0,099	0,449	
		1T - 7T	**0,011***	**0,001****	
		1T - 8T	**0,001****	**0,001****	
		2T - 3T	1,000	1,000	
		2T - 4T	0,391	0,449	
		2T - 5T	0,167	0,488	
		2T - 6T	**0,037***	0,066	
		2T - 7T	**0,004****	**0,001****	
		2T - 8T	**0,001****	**0,001****	
		3T - 4T	1,000	1,000	
		3T - 5T	1,000	1,000	
		3T - 6T	0,685	1,000	
		3T - 7T	0,113	**0,005****	
		3T - 8T	**0,003****	**0,001****	
		4T - 5T	1,000	1,000	
		4T - 6T	1,000	1,000	
		4T - 7T	1,000	0,350	
		4T - 8T	0,491	**0,001****	
		5T - 6T	1,000	1,000	
		5T - 7T	1,000	0,321	
		5T - 8T	1,000	**0,001****	
		6T - 7T	1,000	1,000	
		6T - 8T	1,000	**0,008****	
		7T - 8T	1,000	1,000	

[a]Mann Whitney U Test, [b]Friedman Test, [c]Bonferroni Dunn Test, *p<0,05, **p<0,01.

4. Discussion

Pain, trismus and swelling are common complications after ILTM surgery. It has been reported that the quality of life of patients with postoperative pain, swelling and trismus is three times more negatively affected than asymptomatic patients [20]. Pain, swelling and trismus that occur after ILTM

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surgery are due to inflammation at varying levels. Removal of the impacted tooth and surrounding tissue causes the release of biochemical mediators, especially histamine and bradykinin. Histamine and bradykinin play an effective role in pain and swelling. Following the formation of swelling and pain, loss of function occurs as another phase of inflammation. Loss of function occurs as trismus in the oral region [21,22]. Factors such as age, gender, inadequate oral hygiene, pericoronitis, medical history, smoking, oral contraceptives, operation time, operation technique, surgeon's experience and suture material used are effective factors in the formation of complications [5,23].

In studies examining suture materials in the literature, the physical properties of suture materials, their effects on wound healing and tissue reaction were generally investigated [24]. The majority of these studies consisted of in vitro studies and animal studies and it was observed that the most investigated suture was PP. Few clinical studies have focused on the effects of sutures on tissue reaction. Dragovic et al. investigated the effects of Sofsilk®, Surgipro®, Polysorb® and Caprosyn® on wound healing after ILTM surgery. Sutures were removed on the 7th postoperative day. Scanning electron microscopy examination revealed more dental plaque in multifilament sutures. Histologic analysis showed more inflammation in multifilament sutures. Microbial analysis showed less microbial attachment in monofilament sutures. In clinical analysis, it was observed that synthetic materials were more successful in wound healing than natural materials. It has been shown that pain during suture removal occurs more in multifilament sutures than in monofilament sutures. It was stated by the physician that the most comfortable suture was monofilament Surgipro® and the most difficult suture was multifilament Sofsilk®. It was reported that the least discomfort caused by the suture was found in Caprosyn® [25]. In a study by Banche et al. on bacterial adhesion of suture materials in the mouth, they compared silk, nylon, polyester and polyglecapron 25 suture materials in 60 patients who underwent periodontal surgery. The researchers found that silk showed the highest bacterial adhesion and the resorbable suture material Polyglecaprone 25 (Monocryl) showed less bacterial adhesion than silk. They found that twice as many anaerobic bacteria grew on unresorbable sutures than on resorbable sutures [26]. In their study investigating the capillarity properties of suture materials and bacterial transmission, Geiger et al. added a coloring agent to the medium to examine fluid transmission and bacteria to examine bacterial transmission in sutures kept in a closed and sterile environment. According to the results of the study, a certain amount of colorant and bacterial migration was detected in all multifilament suture materials and they reported that this migration was independent of the absorption capacity of the suture materials, coating and the presence of open suture ends [27]. Leknes et al. examined the tissue reaction of flexible polytetrafluoroethylene (ePTFE) and silk sutures on the oral mucosa in a study on greyhounds and applied antibiotics or mouthwash in addition to the sutures. The mucoperiosteal flaps around the mandibular premolars of greyhounds were lifted, repositioned, and sutured with two different materials on the opposite jaws. Biopsies were evaluated for inflammatory cells, epithelial cells, fibroblasts and bacterial plaques around the sutures. According to the results obtained, bacterial plaque invasion was observed at a rate of 6/9 for silk suture and 0/9 for ePTFE in the antibiotic group and 6/6 for silk suture and 3/6 for ePTFE suture in the mouthwash group [28]. In a study examining the tissue reactions of polyglactin 910, polyglecapron 25, and polytetrafluoroethylene (PTFE) suture materials in Wistar albino rats, fibrosis, angioblastic and fibroblastic proliferations, and inflammation intensities were evaluated histologically on the 2nd, 7th, 14th and 21st days by optical microscopy. According to the results of the study, the frequency of tissue reaction was found to be polylecapron 25, polyglactin 910 and polytetrafluoroethylene, respectively [29]. When the studies were evaluated in general, it was observed that monofilament sutures caused less tissue reaction and inflammation than multifilament sutures. Multifilament sutures were generally found to have less physical strength and more bacterial adhesion. However, dissolvable multifilament sutures were generally better tolerated by patients than other sutures. Silk sutures, which are frequently used in oral surgical procedures, were found to be unsuccessful compared to other sutures in terms of bacterial retention, pain during suture removal, tissue reaction and inflammation. The reason for choosing two different monofilament sutures in this study is that monofilament sutures are superior in terms of their

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physical and biological properties (wound healing, tissue reaction and inflammation) as seen in the results of the mentioned studies.

When the studies using PP suture were examined, Yaltırık et al. evaluated the soft tissue reaction of different suture materials in their study on Sprague-Dawley rats. They found that PP caused less tissue reaction than silk [30]. Masini et al. evaluated the residual bacterial retention of polylecapron, PP, silk, polyglycolic acid 63 and triclosan antimicrobial polyglycolic acid suture materials. Bacterial retention on PP was found to be lower than that on polyglycolic acid suture [31]. In a study evaluating the capillarity differences of different suture materials, it was shown that the liquid absorption capacity of PP was lower than that of PGA, polylactic acid, and silk [24]. According to the results of these studies, PP suture was found to produce low bacterial adhesion, low fluid absorption and low tissue reaction. In this study, no wound healing complications were observed in the PP group in the postoperative period. This result supports the results obtained with PP sutures in the mentioned studies. PP was preferred as the active control group in this study because of its time-independent structural durability, high knot security, flexibility and other favorable physical properties.

When the studies in which PE sutures were used were examined; Rodeheaver et al. investigated the stress and strain properties of PE, nylon and polyglycolic acid suture knots. Under 2 Newton load, PE was shown to elongate four times more than nylon and ten times more than polyglycolic acid [32]. In a study comparing PE and nylon for ophthalmologic use, both sutures showed similar manipulation properties and nylon was shown to biodegrade more than PE over an average of 18 months [33]. Carlberg and Fewkes recommended that PE sutures should be preferred when postoperative swelling is expected [14]. According to the results of the previously mentioned studies, polybutterster suture, which is synthetic, monofilament and non-resorbable, was found to have high elasticity as well as minimal inflammation [13,15,16]. In this study, no wound dehiscence was encountered in the postoperative period in the PE suture group. In addition, it was observed that suture discomfort was less in the PE group on postoperative day 2. This shows that PE was tolerated better.

Studies comparing PE and PP sutures have shown that PE has higher strength, lower stiffness and lower coefficient of friction than PP [13–16,18]. No study comparing PE and PP in oral and maxillofacial surgery was found in the literature. Megerman et al. showed in their study on femural artery anastomosis in dogs that PE produced more successful anastomoses than PP [34]. Bang and Mustafa compared PE with PP in patients with skin injuries. They found that the PE suture was easier to use and remove and had better cosmetic results [35]. In this study, swelling and trismus values were similar between the PE and PP groups on postoperative 2nd day and postoperative 7th day. Both suture materials were similar in terms of wound dehiscence at the incision line. In terms of surrounding tissue injury caused by the suture, both sutures were similar. On postoperative 2nd postoperative day, it was observed that less pain was felt on the side where PE was used. We think that due to the more flexible structure of the PE, the tension on the suture was less transmitted to the soft tissues on the day when swelling was high, resulting in less pain in patients. On postoperative 2nd postoperative day, patients felt less discomfort on the side where PE was used. The contact of the sutures to the cheek tissue probably increased on postoperative 2nd postoperative day when the swelling was the highest, and the patients felt less discomfort during this contact because the PE suture was softer. In this study, the positioning of the sutures buccal, medial or lingual to the incision line was not standardized. The length and number of sutures were also not considered. These are the limitations of the study.

5. Conclusions

This was the first study which PE suture was used in oral surgery and its effects were evaluated. On postoperative 2nd day, less pain was observed on the side where the PE was used. It was also found that the PE was better tolerated on postoperative 2nd day. It was found that women felt more pain than men. These results support the use of the PE suture in ILTM surgeries. There are very few clinical studies on sutures in the literature. Therefore, there is a need for further randomized,

prospective, clinical studies investigating the effect of both PE and other suture materials on postoperative complications.

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