



# Comparison of interrupted and locked continuous suture techniques in oral surgery regarding wound healing: a split-mouth clinical trial

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**Abstract** (J Korean Assoc Oral Maxillofac Surg 2025;51:41-45)

**Objectives:** Although many publications compare suture materials *in vivo* and *in vitro*, only some studies have compared suture techniques, and those studies only compare dehiscence rates, not wound healing. This study compares wound healing with interrupted and locked continuous sutures in edentulous ridges.

**Materials and Methods:** This study was designed as a prospective, split-mouth clinical study, with crestal surgical wounds divided into two halves up to the midline and sutured using interrupted and locked continuous techniques. Patients who required maxillary full-arch alveoloplasty were included in the study. Three expert observers evaluated the wounds via an Early Wound Healing Score (EHS) on days 3 and 7. These scores, suture time, suture removal difficulty, and suture removal pain were compared between groups.

**Results:** Our study included 34 patients, among whom suture removal difficulty, pain, and day 3 EHS were not significantly different. Suture time and day 7 EHS significantly differed between interrupted and locked continuous suturing techniques. The locked continuous suture also required less suturing time and showed better healing scores on day 7.

**Conclusion:** Our findings suggest that the locked continuous suture technique can lead to significant time savings and better wound healing in the context of edentulous full arch procedures.

**Key words:** Suture techniques, Wound closure techniques, Wound healing

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## I. Introduction

Suturing is one of the most common procedures surgeons perform to promote primary healing. The aim is to bring wound edges together and fix them closed in position until recovery is complete. Sutures are made of many different materials and thicknesses, with varying needle lengths and cross-sections. Suture techniques are less diverse than suture materials.

According to most researchers, oral surgical sites are prone to infection and delayed healing<sup>1</sup>. Therefore, the required suture material should be durable, not resorbable by oral fluids, and not permit saliva leakage into the wound during the healing phase. Many randomized controlled studies<sup>1,2</sup> have been conducted for suture materials used in oral surgery. However, studies comparing suture techniques are limited. To our knowledge, there are only three randomized clinical trials in oral suture techniques<sup>3-5</sup>, and these three studies compared only the dehiscence rates, not wound healing and were not related to dentoalveolar surgery.

Suture techniques may affect healing and can be critical, especially in wounds such as those from oral surgery, which are prone to infection, slow recovery, and unstable tissue that is difficult to stabilize<sup>1,6</sup>. The three most used closure techniques in oral surgery are interrupted, mattress, and continuous sutures. The continuous suture technique has been shown to reduce the time and suture material used<sup>4</sup>. However, some studies argue that continuous suture impairs eating and causes wound dehiscence, though the collateral blood circulation of the mouth decreases the impact of this effect<sup>5</sup>.

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Several healing indexes can be used in oral surgery wounds. However, the index must be reliable over time, especially in the first week of evaluation<sup>7</sup>. The Early Wound Healing Score (EHS) was recently proposed for evaluating primary wound closure in the early stages of recovery<sup>8</sup>. It scores wounds from 1-10, with higher numbers indicating better healing.

In this study, we aimed to compare wound healing between locked continuous and interrupted suture techniques in edentulous alveolar ridges. The null hypothesis was that the suture technique does not affect wound healing.

II. Materials and Methods

This study was conducted as a prospective randomized clinical trial in the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Selçuk University, between October 2023 and February 2024. Ethical approval was obtained from Ethics Committee of the Faculty of Dentistry, Selçuk University (No. 2022/46) following the Declaration of Helsinki. A consent form was acquired from all patients. The study is a registered clinical trial (NCT06020157) and is presented according to Consolidated Standards of Reporting Trials (CONSORT) Statements<sup>9</sup>.

The inclusion criteria were age between 40 and 65 years, full-arch maxillary alveoloplasty in an edentulous ridge, no diagnosed systemic condition, no drug use, and no smoking. The exclusion criteria were lack of control appointments, wound healing complications, and excision of soft tissue.

1. Sample size determination

An a priori power analysis was conducted using “pwr” packages in R 3.6.0 (<https://www.r-project.org/>) to detect differences in the EHS using an independent samples *t*-test, a medium effect size (*d*=0.50), and an alpha of 0.05. Results showed that 68 samples (in a split-mouth study; 34 patients) were required to achieve a power of 80%.

2. Study design

Patients needing full maxillary arch alveoloplasty were asked to participate in the study. If the patient accepted and fit the inclusion criteria, after the study director’s approval, the patient was enrolled and signed the informed consent form. Randomization with a coin toss determined the sides of suture techniques. All operations were conducted by the same senior resident (Ş.K.) in the Department of Oral and Maxillo-

facial Surgery, Faculty of Dentistry, Selçuk University using two types of suturing techniques. One side was closed using the interrupted technique and the other was closed with a locked continuous technique, both using 3-0 silk sutures (Silk; Doğan). Suture times were recorded in minutes. After surgery, all patients were prescribed 875 mg of amoxicillin, 125 mg of clavulanic acid (2×1), 25 mg of dexametopfen (2×1), and mouthwash containing chlorhexidine (3×1).

The EHS was used to evaluate the wounds based on the assessment criteria in Table 1<sup>8</sup>. On days 3 and 7, maxillary full-arch photography (Canon EOS RP 24-105); Canon was performed for every patient. Three oral and maxillofacial surgeons evaluated the wounds in these photographs to define EHS on days 3 and 7. On day 7, another resident in the department reported suture removal difficulty, and the patient was asked to describe the associated pain. A Visual Analogue Scale was used to rate removal difficulty and pain. No one was blinded to the study because the sutures were visible to all.

The primary outcome of the study was EHS score. Suture removal difficulty and pain and suturing time were the secondary outcomes.

3. Statistical analysis

All statistical analyses were performed using R Statistical Language (<https://www.r-project.org/>). Shapiro-Wilk’s normality test and Q-Q plots were used to verify the normality of the data. Levene’s test was used to assess the homogeneity

Table 1. Early Wound Healing Score criteria

Assessment	Points
CSR	
Merged incision margins	6
Incision margins in contact	3
Visible distance between incision margins	0
CSH	
Absence of fibrin on incision margins	2
Presence of fibrin on incision margins	1
Bleeding at incision margins	0
CSI	
Absence of redness along incision length	2
Redness involving <50% of incision length	1
Redness involving >50% of incision length and/or pronounced swelling	0
Maximum total score	10

(CSR: clinical signs of re-epithelialization, CSH: clinical signs of haemostasis, CSI: clinical signs of inflammation)  
Adapted from the article of Marini et al. (J Periodontal Implant Sci 2018;48:274-83)<sup>8</sup> under the terms of the Creative Commons Attribution Non-Commercial (CC BY-NC 4.0) license.  
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of the variances. Independent samples *t*-test was applied to compare EHS, suture removal pain and difficulty, and suturing time differences. The intra-class correlation coefficient (ICC) with a 95% confidence interval (CI) was computed to assess the agreement between three experts in the EHS in 34 individuals. Continuous variables are presented as mean±standard deviation. A two-tailed *P*-value less than 0.05 was considered statistically significant.

### III. Results

The study was carried out from October 2023 and February 2024. An initial 42 patients volunteered for the study; eight were excluded (one for infection, seven for lack of participation in control appointments). The remaining 34 patients, 19 (55.9%) males and 15 (44.1%) females with an average age of 55.9±8.5 (40-65) years, were included in the study.(Fig. 1)

A comparison of EHS and clinical findings for interrupted and locked continuous suture technique groups is given in Table 2. EHS results showed significantly higher results on the 7th day in the locked continuous technique group (5.98±2.10 vs. 7.29±1.79; *P*=0.013, Cohen's *d*=0.672) compared with the interrupted technique group. EHS on the 3rd day was similar in the interrupted and continuous suturing groups (*P*=0.191). Additionally, the suturing time was significantly lower in the locked continuous suturing group (5.41±1.86 vs. 4.47±1.85; *P*=0.040, Cohen's *d*=0.508) compared with the interrupted suturing group. The suture removal pain (24.47±9.80 vs. 26.50±9.47, *P*=0.388) and difficulty levels (16.68±5.70 vs.

18.35±5.77, *P*=0.232) were similar in the interrupted and continuous suturing groups.

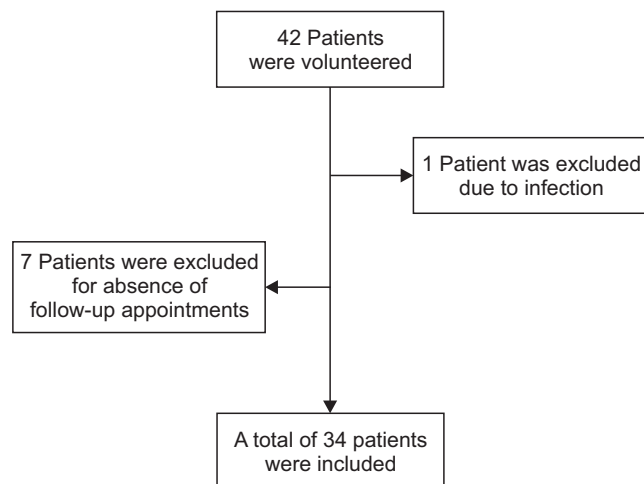
Inter-rater agreement coefficients showed fair agreement on the 3rd day EHS with the interrupted technique (ICC: 0.569 [95% CI: 0.378-0.734]) and good agreement with the locked continuous technique (ICC: 0.630 [95% CI: 0.452-0.777]). The 7th day EHS of both interrupted (ICC: 0.824 [95% CI: 0.883-0.964]) and locked continuous (ICC: 0.817 [95% CI: 0.705-0.896]) suturing was excellent<sup>10</sup>.

### IV. Discussion

This study was conducted to compare interrupted and locked continuous suture techniques regarding wound healing in edentulous alveolar ridges. In addition, suturing time, suture removal difficulty, and pain were also evaluated. The null hypothesis was rejected due to a significant difference between groups on day 7 EHS. Also, the suturing time significantly favors the locked continuous technique. Other parameters did not show significant differences. Considering the agreement between the scores of the three experts, the EHS seems repeatable and reliable.

The interrupted technique is the most used technique in oral surgery. In short or complex areas, suturing is rarely possible with other techniques. Though continuous suturing is usually indicated for use in long incisions, which are uncommon in oral surgery, this technique is among the most used. However, most researchers emphasize that continuous sutures are disadvantaged because a break in the suture thread jeopardizes wound healing through thread loosening and dehiscence<sup>3</sup>. The locked continuous suture was developed to overcome this disadvantage in oral surgery.

To compare interrupted and locked continuous suture techniques, long incision lines are needed<sup>3,5,11</sup>. We included the



**Fig. 1.** Flowchart diagram for included patients.

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**Table 2.** Comparison of EHS and clinical data for simple and locked continuous suturing techniques

	Simple (n=34)	Locked continuous (n=34)	<i>P</i> -value
EHS 3	7.53±1.17	7.85±1.09	0.191 <sup>2</sup>
EHS 7	5.98±2.10	7.29±1.79	0.013 <sup>2</sup>
Suture removal pain	24.47±9.80	26.50±9.47	0.388 <sup>1</sup>
Suture removal difficulty	16.68±5.70	18.35±5.77	0.232 <sup>1</sup>
Suturing time	5.41±1.86	4.47±1.85	0.040 <sup>1</sup>

(EHS: Early Wound Healing Score)

<sup>1</sup>Independent sample *t*-test, <sup>2</sup>Mann-Whitney U test.

Values are presented as mean±standard deviation.

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patients undergoing full arch alveoloplasty to meet that requirement. We only included the maxillary arch to standardize the cases because healing of the mandibular and maxillary arches can be affected by different external factors. Although alveoloplasty naturally varies between patients, we focused only on soft tissue healing and ignored the content of the operation. Patients who required alveoloplasty but needed to have soft tissue excised to prevent unsupported ridge formation were excluded.

Dehiscence is one of the most undesirable conditions in wound healing and requires a second intervention when it will delay wound healing<sup>12</sup>. Although continuous sutures are thought to be more prone to wound dehiscence due to the blocked blood supply, this has not been shown clinically, probably due to compensation by the collateral blood supply in the oral cavity<sup>13</sup>. In contrast, continuous sutures evenly distribute the pulling forces to the wound lips<sup>3,4</sup>. Studies have shown dehiscence in both techniques, with no significant difference between them<sup>3,5,11</sup>. However, dehiscence was not observed in our study, which may have been because only maxillary arches were included, and all patients had enough keratinized gingiva to resist the tension. In addition, it may have been an advantage that all procedures were performed by a senior resident with ample experience. Also, almost all studies involving dehiscence have been performed on muscular, mobile tissues, including uvulopalatopharyngoplasty and facial soft tissue wounds<sup>3,11</sup>. Dehiscence in non-muscular cleft repairs may be due to low stability of the hard layer. Regardless, no differences between the suture techniques have been reported in cleft repair studies<sup>4,5</sup>.

Healing times of surgical wounds vary. In oral surgery, wound closure is usually achieved between the 7th and 10th days, after which the sutures are removed. However, most studies compare the performance of suture material rather than tissue healing during this period. Researchers suggested that monofilament sutures shorten the time for recovery due to lower inflammation, microorganisms, and slack.<sup>1</sup> However, silk sutures are almost always used in our department because of knot security<sup>14</sup> and price/performance ratio.

Wound healing scoring is one of the most significant controversies in oral surgery as most indices are made for skin or chronic wounds and are not appropriate for either mucosal or early wound healing. The EHS is a recently presented index for early wound healing, and it demonstrated good intra- and inter-rater agreement in our study<sup>7</sup>.

A few studies have compared suture techniques in clefts<sup>4</sup>, oropharyngeal regions<sup>3</sup>, and third molar surgeries<sup>15</sup>, and all of

them evaluated interrupted and locked continuous or continuous techniques. Most performed evaluations based on dehiscence rate, time, number of suture packs used, pain, swelling, and trismus and did not consider wound healing scores. Only one study (not randomized) has compared suturing techniques for wound healing on oral mucosa after maxillofacial trauma<sup>16</sup>. Their findings align with ours, showing statistically better results on days 3 and 7 with the locked continuous technique. They emphasized, as in other studies, that the locked continuous technique is faster than the interrupted technique in suturing time and wound healing<sup>3,4,11</sup>. Factors such as lower plaque retention and more equal force distribution on the wound edges may be influential for faster healing.

Both groups' wound healing scores decreased between the 3rd and 7th days, possibly due to stretching and loosening of the sutures with movement of the intraoral tissues. The distinction between merged and contact coding in re-epithelialization is difficult to see without using a surgical instrument like a periodontal probe. Even a slight difference could shift the classification from merged to contact, causing changes in code points. Based on the high inter-rater agreement, we posit that this coding difference occurs with every rater and that our results are not controversial. However, we think that an evaluation in the clinic is a more suitable method for the EHS than an evaluation from photographs.

The most important limitation of this study is that we only included the maxilla. Another limitation is that we compared only two suture techniques. In addition, only full-arch alveoloplasty patients has long incision enough incision lines, and most of these patients appeared to be middle-aged and older. Additional studies including young individuals are necessary to evaluate more comprehensively the healing. Another limitation is that blinding was not possible in this study. Future studies should include the entire oral mucosa and other suture techniques and materials.

## V. Conclusion

Using the locked continuous technique with the incision line of maxillary ridges both shortens the suturing time and improves wound healing.

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## Authors' Contributions

Ş.K. performed all surgeries. All authors participated in data collection, the study design, and the writing of the manuscript. All authors read and approved the final manuscript.

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## Ethics Approval and Consent to Participate

This study was reviewed and approved by Ethics Committee of the Faculty of Dentistry, Selçuk University (No. 2022/46). The patient was enrolled and signed the informed consent form.

## Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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