

## **Comparison of wound healing after using low level laser therapy and scalpel technique only on gingivectomy: a systematic review**

Perbandingan penyembuhan luka setelah penggunaan *low level laser therapy* dan teknik scalpel pada gingivektomi: systematic review

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### **ABSTRACT**

**Objective:** To compare wound healing after gingivectomy using low level laser therapy and surgical technique. **Methods:** Two search engines were used in this research that is Pubmed and Wiley to identify articles published in dental journal, that was focused on wound healing after low level laser therapy and scalpel technique only. Full-text articles and related review were manually performed. There were 91 articles found, but only 2 studies met the inclusion criteria. **Result:** The initial database search resulted 91 articles. Only full-text review was selected in this study. A total of 2 studies were met the inclusion criteria, with 60 patients as subjects. All of the studies showed improved wound healing based on epithelization after 3<sup>rd</sup>, and 7<sup>th</sup> day gingivectomy using the low level laser therapy. The differences between control and test groups outcome showed that using low level laser therapy is the best result. **Conclusion:** Treatment using low level therapy showed better result than scalpel technique only. **Keywords:** gingivectomy, surgical, laser therapy, wound healing

### **ABSTRAK**

**Tujuan:** Untuk membandingkan penyembuhan luka setelah *gingivektomi* menggunakan *low level therapy* dan teknik *scalpel*. **Metode:** Dua mesin pencarian jurnal digunakan pada penelitian ini, yaitu Pubmed dan Wiley untuk mengidentifikasi artikel yang telah dipublikasi pada jurnal kedokteran gigi, yang berfokus pada penyembuhan luka setelah *low level therapy* dan teknik *scalpel*. Artikel *full-text* dan *review* yang berhubungan dilakukan secara manual. Sebanyak 91 artikel ditemukan, tetapi hanya dua penelitian yang sesuai dengan kriteria inklusi. **Hasil:** Pencarian awal menghasilkan 91 artikel. Hanya *full-text* dipilih dalam penelitian ini. Terdapat dua penelitian yang memenuhi kriteria inklusi, dengan 60 pasien sebagai sampel. Semua penelitian menunjukkan peningkatan penyembuhan luka berdasarkan epitelisasi setelah hari ketiga dan ketujuh gingivektomi setelah menggunakan *low level laser therapy*. Perbedaan antara kelompok kontrol dan uji menunjukkan bahwa *low level laser therapy* memberikan hasil terbaik. **Simpulan:** Perawatan menggunakan *low level therapy* menunjukkan hasil yang lebih baik dibandingkan teknik *scalpel*.

**Kata kunci:** gingivektomi, bedah, terapi laser, penyembuhan luka

### **INTRODUCTION**

Gingiva is keratinized soft tissue that cover the alveolar bone and root of the tooth to cemento enamel junction. Based on the anatomy, gingiva is divided into 3 areas, that are marginal, attached, and interdental gingiva. All the gingiva types function as a defense against mechanical and microbial damage. The most occurred disease in periodontal tissue is the gingival disease. Gingival disease almost always disturbs the aesthetic of a patient is gingival enlargement.<sup>1-3</sup>

Gingival enlargement, a common finding and usually related to some etiologic and pathogenic factors, such as dental plaque, hormonal changes, medication, is defined as an increased in size of the gingiva. It may be a result from chronic or acute inflammation but gingival enlargement may appear as a secondary complication to other disease that can

cause the gingival enlargement. Gingival enlargement almost always disturbs the aesthetic of a patient. It may also cause more plaque accumulation and eventually will cause more severe damage to the periodontium.<sup>3,4</sup>

The classification of gingival enlargement can be distinguished etiologically and pathologically, that are inflammatory enlargement, they are chronic and acute, drug-induced enlargement, then enlargement associated with systemic diseases or conditions, they are pregnancy, puberty, plasma cell gingivitis, ascorbic acid deficiency, gingival enlargement caused by systemic disease, leukemia, granulomatous diseases, neoplastic enlargement, benign and malign and false enlargement.<sup>1-3</sup>

Gingival enlargement level can be scored as 1) Grade 0: absence of gingival enlargement; 2) Grade I: Gingival enlargement occurs only in the interdental

papilla; 3) Grade II: Gingival enlargement extends to papilla and marginal gingiva; and 4) Grade III: Gingival enlargement covers three quarters or more of the crown.<sup>2</sup>

The primary objective of periodontal therapy is to achieve the normal dan physiological condition and contour of the periodontium. The modality of treatment consists of having a detailed medical history of the patient, nonsurgical therapy, and then followed by surgical therapy to obtain esthetical and functional of the periodontium.<sup>3,5,6</sup>

Gingivectomy is excision of the gingiva, the pathological tissue and pocket wall is removed surgically meanwhile the physiological form of the gingiva is maintained. The indications of gingivectomy are elimination of suprabony pockets, without regard of the wall pockets, eliminate gingival enlargement, and suprabony abscess, and gingivectomy contraindication, they are the need for bone surgery or examination of the shape of the bone and morphology, bottom of the pocket is apical to the mucogingival junction, and when aesthetics are taken into consideration.<sup>1-3</sup>

Laser therapy has been used in dentistry since 1990s, that is a simple and atraumatic technique. Laser is divided into low- and high-lasers and has been used in dentistry such as oral surgery, endodontics, and periodontics. Surgery on the soft tissue use variety of laser wave lengths has been reported. There are many types of laser that been used in dentistry, such as low-level laser therapy, CO<sub>2</sub>, Nd:YAG, Er:YAG, Er, CR:YSGG. Reduced bleeding, minimal post-operative discomfort, and reduced the need of suture has been reported on laser therapy.<sup>5,7</sup>

Low-level laser therapy (LLLT) is delivered by various types of light source such as, helium-neon, ruby, diode, and gallium arsenide. Low-level laser therapy is a promising treatment for wounds, and rheumatoid arthritis, pain management, healing of atrophic ulcers, healing of indolent wound, bone formation and burn have been treated using the low level laser therapy. Diode lasers with wavelength 588, 670, and 685 nm have been used to perform the LLLT. To promote wound healing and reduce pain after gingivectomy, endodontic surgery, or orthodontic surgery, LLLT has been used.<sup>5,8,9</sup>

The aim of the present review is to evaluate wound healing after using low level laser therapy and scalpel technique on gingivectomy by observing epithelization of the gingiva systematically.

## METHODS

This systematic review was written according to guidelines of preferred reporting items for systematic review and meta-analyses (PRISMA) for reporting

studies evaluating healthcare intervention. Population, intervention, control, outcome (PICO) question of the present systematic review were P) patient with gingival enlargement, then I) gingivectomy using LLLT after scalpel technique, C) scalpel technique only, and O) comparing the epithelialization of the gingiva after using low-level laser therapy and scalpel technique only

## Search Strategy

Initial Pubmed and wiley search of the English language literature was performed to establish a study protocol. These searches were performed to identify articles published in dental journal focusing on study of gingivectomy wound healing using LLLT after scalpel technique and scalpel technique only. The MeSH or NCBI PubMed keywords used were "gingivectomy" and "surgical" and "laser therapy" and "wound healing". The search limits applied to the electronic search were Article type. Manual searches of published full-text articles and related review were performed afterward. There are 7 studies have shown on this matter on PubMed, and 84 studies in Wiley, with only 2 studies met the inclusion criteria. Specific keywords were used to identify the appropriate study needs, and followed by the characteristic of PICO question.

## Eligibility Criteria

The inclusion criteria in this systematic review were 1) English language article, 2) full-text article, and 3) studies that reported treatment of gingivectomy using LLLT after scalpel technique and scalpel technique only.

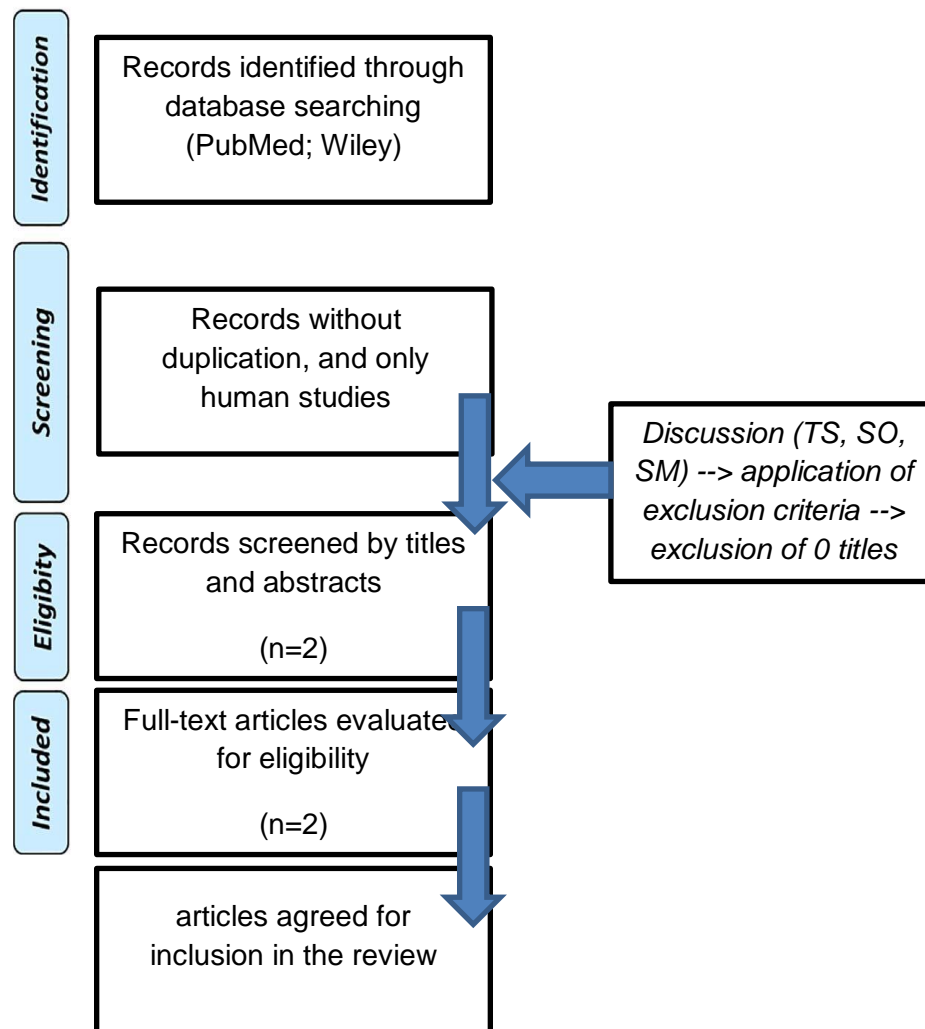
The exclusion criteria were all studies which did not meet the above mentioned criteria, such as animal studies, systematic review, and meta-analysis.

## Selection of Study

Specific keywords were used by two participating authors, resulted the selection of papers based on reading the abstracts and the full-texts. The two investigators selected the paper based on inclusion criteria formerly set independently. After that, all the abstracts and the full-texts were downloaded and individually evaluated. The eligibility criteria were used to identify the articles that will used for this systematic review.

## Extraction of Data

The data were retrieved by two reviewers that regarding following parameter namely authors, year of publication, number of patients, technique, and objective. All of the full-text which met the inclusion



**Figure 1** Article selection flow chart

**Table 1** Descriptive data from Clinical parameter (mean  $\pm$  SD) of wound healing index between low level laser therapy and scalpel technique only on gingivectomy.

Author	Subject	Intervention	Healing Index (epitelization)			
			3rd day	7th day	15th day	30th day
Kohale BR (2018)	40	LLLT after scalpel technique	2.60 $\pm$ 0.50	2.85 $\pm$ 0.36	-	4.75 $\pm$ 0.44
		scalpel technique only	3.00 $\pm$ 0.00	3.35 $\pm$ 0.48	-	5.00 $\pm$ 0.00
Ozcelik O (2008)	20	LLLT after scalpel technique	1.53 $\pm$ 0.79	0.61 $\pm$ 0.87	0.17 $\pm$ 0.24	-
		scalpel technique only	1.60 $\pm$ 0.81	1.02 $\pm$ 0.91	0.33 $\pm$ 0.23	-

criteria were read independently by two reviewers, and evaluated to formulate this systematic review.

## RESULT

The database search yielded 91 articles, include 7 form PubMed and 84 from Wiley. After removing the duplicates references, there were 90 articles remained. The titles and abstracts were review afterwards, and two studies were eligible for further

analysis. All of the full-texts then be reviewed by the investigators and yielded 2 articles which met the inclusion criteria. The flowchart of article selection is shown in figure 1 with total 2 selected articles from initial yield of 91 articles by electronic literature search. After the 91 titles reviewed, 2 articles were selected for this systematic review inclusions.

Two studies were published in 2008 and 2018. The participants in these studies were 60 patients

with 120 sites. All the studies dealt with gingival enlargement. Each study provided the comparison of healing index score at 3<sup>rd</sup> day and 7<sup>th</sup> day. The clinical parameters showed in table 1.

Bhagyashree et al. reported that the mean of healing index scores of control site at 3<sup>rd</sup> day was  $2.60 \pm 0.50$ , and 7<sup>th</sup> day was  $2.85 \pm 0.36$ , and the mean of healing index score of test site at 3<sup>rd</sup> day was  $3.00 \pm 0.00$ , and 7<sup>th</sup> day was  $3.35 \pm 0.48$ . Ozcelik et al reported that the mean of healing index score of control site at 3<sup>rd</sup> day was  $1.60 \pm 0.81$ , and 7<sup>th</sup> day was  $1.02 \pm 0.91$ , and the mean of healing index score of test site at 3<sup>rd</sup> day was  $1.53 \pm 0.79$ , and 7<sup>th</sup> day was  $0.61 \pm 0.87$ .

## DISCUSSION

There are many advantages of using laser therapy such as, laser exhibits strong ablation, hemostasis, detoxification and bactericidal effects on human body, but there are disadvantages of laser therapy such as, high financial cost, and each laser has different characteristics because of their wavelength, so the clinician have to know the fundamental of the lasers, and improper radiation of teeth and periodontal pocket can damage the tooth and the root surfaces. In spite of the disadvantage, the effects of lasers could become benefits during periodontal treatment, especially for fine cutting of soft tissues as well as in the debridement of diseased tissues. There are two theories are accepted to explain the effect of laser therapy on tissues: light of a specific wavelength activate cells mitochondrial respiratory chain and lights acts as by opening the calcium channel on the cell membrane.<sup>7,8,10</sup>

Low-level laser therapy treatment improved wound healing, it has been applied since 1967. The LLLT apart from pain reduction is also known to help in process of repair and thus subsequently accelerating the wound healing process. Many studies have shown that LLLT provides beneficial effect in pain reduction. Kohale, et al in 2018 reported that using LLLT on gingivectomy was comparatively less than the control group that treated using scalpel technique only. LLLT are known to have a stimulatory effect on cells at high dosage. The mechanism of LLLT is by stimulating the mitochondrion to increase the adenosine triphosphate production to increase the reactive oxygen species, which in turn influences redox signaling, affecting intercellular homeostatis of the cells proliferation. LLLT also has effect on microcirculation, which reduces edema by changing the capillary hydrostatic pressure. The ideal dosage of LLLT will lead to formation of new endothelium and blood vessels that will help granulation of tissue formation and will accelerate healing. Wound healing after gingivectomy mainly includes fibroblasts, keratinocytes and immune

cells. Within a few days, the epithelial cells start to migrate over the wound surface from the margin.<sup>7,9,10</sup>

The LLLT application may accelerate wound healing by the motility of human keratinocytes and promoting early epithelization, by increasing the proliferation of fibroblast and matrix synthesis and by advancing neovascularization. At the time of surgery, laser therapy produces an increase in blood flow that results in the recruitment of proinflammatory, anti-inflammatory and growth factors to the wound site. At the initial phase of inflammation, laser therapy can stimulate the degranulation of the mast cells, and unleashing the inflammatory response. It also increases protein synthesis and the release of growth factor by these cells. Altogether, these will culminate in faster clinical wound healing.<sup>6,9,10</sup>

In order to achieve the effectiveness of LLLT, there are important factors that should be noted, they are wavelength and the amount of energy applied. Most experimental and clinical studies on LLLT were performed using semiconductor diode laser with wavelengths in range of 635–830 nm. Bhagyashree et al. reported that using LLLT wavelengths of 940 nm and output power 100 mW, and the resultant energy density delivered was  $4 \text{ J/cm}^2$ , showed better healing of that test sites at the end of 1 months. Ozcelik, et al reported that LLLT wavelengths of 588 nm, and resultant energy density delivered was  $4 \text{ J/cm}^2$ , these wavelengths has the best absorption of the light, which leads to LLLT-induced cellular mitochondrial respiratory chain activation and subsequent fibroblastic activity occurs between wavelengths of 562 nm and 600 nm.<sup>8,9</sup>

Firat, et al reported that gingivectomy in rats, on day 7 follow up, the histological findings demonstrated that the LLLT group, there are fibroblast activity and collagen fiber formation was better rather than in the control group that treated with scalpel technique only, which epithelium was not evident. The LLLT group, the blood capillaries were greater in number, and fibroblast and collagen fiber were more regular. On day 14, on the control group, group of epithelium had started to form, meanwhile on the LLLT group, the epithelium was better developed, with a greater number of layer and slight keratinization was observed. On day 21, on the LLLT group, the stratified structure of epithelium was more clear than the control which the epithelium was stratified, with slight keratinization and microscopic papilla slightly visible. In Firat, et al study showed that the healing had already begun on day 7 after gingivectomy, and completed by day 21, and the healing was observed to have occurred much more rapid in the LLLT group than the control group.<sup>11</sup>

Jose Claudio, et al reported that the LLLT group showed effectiveness in inducing changes within the cultured cells, and will increased the healing effect. After gingivectomy, formation of collagen and better gingival tissue organization will occur gradually within 3-4 weeks as the inflammation and vascularity of the granulation tissue decrease. The acceleration of wound healing process using LLLT can be explained by a higher collagen synthesis in fibroblast and proliferation of vascular on the connective tissue.<sup>5</sup>

The healing of the wound after gingivectomy is similar to wound healing in other parts of the body. However, in the dentogingival junction, the interaction of the epithelium and connective tissue with the hard tissue is different. Firat, et al reported that the activity of fibroblast was greater, so produced a stronger junction in the LLLT group than the control.<sup>11</sup>

It was concluded that gingivectomy using LLLT after scalpel technique was better based on the wound healing rather than using scalpel technique only.

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