

# Effectiveness of Low-Level Laser Therapy on Stability of Dental Implants: A Systematic Review

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**Abstract:- It is a form of alternative therapy that uses laser light at low levels. The light is used in the surface skin to reduce pain, swelling, wound healing and prevent the damage of tissues and nerves. The aim of this study is to determine the effectiveness of low-level laser therapy on stability of dental implants. A systematic review was conducted based on literature search in the databases PubMed, Wiley online library, Cochrane library, Elsevier science direct, Prospero, Scopus, Ovid Medicine, Grey literature using the search keywords ( low level laser) AND (stability) AND (dental implants). Randomised controlled trials investigating the effect of low-level laser therapy and further followed by Cochrane database bias assessment was done. Five randomised controlled trials were included and after discussed, the result of p value is not significant in low level laser therapy on stability of dental implants. There is a positive relationship between the use of low-level laser therapy in the wound healing process and has no positive effect on the stability of dental implants.**

**Keywords:-** low- level laser, Stability, dental implants.

## I. INTRODUCTION

In 1969, Branemark described the concept of osteointegration for new dimension [1]. The disadvantages of osteointegration for the implant placement the time is required before the prosthesis placed. The development of new implant surfaces and techniques will consider reduction in the initial healing process [2]. The implant variation of the technique is to reduce the function of osteointegration time, by altering the texture of titanium implant surface [3]. Dental implants are used for replacing the teeth in lost area [4]. For the placement of screw- type implants, the healing time takes place at 3 to 4 months. In the posterior mandible and maxilla, the healing time of 5 to 6 months may take due to the more cancellous bone structure [5]. According to Lekholm and Zarb classification, the bone for the implant placement in type 4, the healing time in the mandible increase from 1 or 2 months. The advances in materials and designs of dental implants, the treatment protocols for patients demand with very short recovery time and few surgical procedures needed [6].

The adequate primary stability of implant at the time of placement is the prerequisite for implant loading [7]. The implant stability is defined as no mobility after placement and depends on mechanical involvement of implant in fresh bone socket; implant stability increases by new bone formation at the bone implant interface and its gradual remodelling over time [8]. The factors affecting the primary stability of dental implants includes bone quality and quantity, morphology of implant, rough surface, surface topography and surgical technique [9,10]. Dental implant and surgical technique are the properties of secondary stability. At the time of implant loading, it can resist masticatory forces due to secondary stability. In many cases, the sites don't have the quality and quantity of bone. For the quality and quantity of bone, there is a need to induce bone regeneration around implants [11].

Low- level laser therapy is the process to enhance the bone healing. The use of low- level laser therapy in cellular level enhances biochemical and molecular process of tissues. Many studies show positive effects on healing process of tissues in low- level laser therapy [12]. The process of stimulation of low- level laser therapy includes wound healing [13,14], protein and collagen synthesis [15], cell proliferation [16], cell regeneration [17], bone remodelling, after injury repair of nerve function, hormonal balance function, immunity and lymphatic regulation system, decreased inflammation, swelling and pain relief. Many studies reported positive effects on osteogenesis by using application of laser in periodontology [18].

The low- level laser therapy on tissue healing has indication in bone maturation and increased bone implant [19]. The significance of stability in long-term success of dental implants in areas with low quality of bone to increase stability [20]. The resonance frequency analysis is used to assess the primary stability for 10 years. It is used to monitor and follow up the implant stability [21]. The aim of the study is to determine the effect of low- level laser therapy for stability of implants.

## II. MATERIALS AND METHODS

### A. Study Design:

A total of 120 articles were searched among those 5 articles are included in this study and this systematic review was done using low level laser therapy on stability of dental implants.

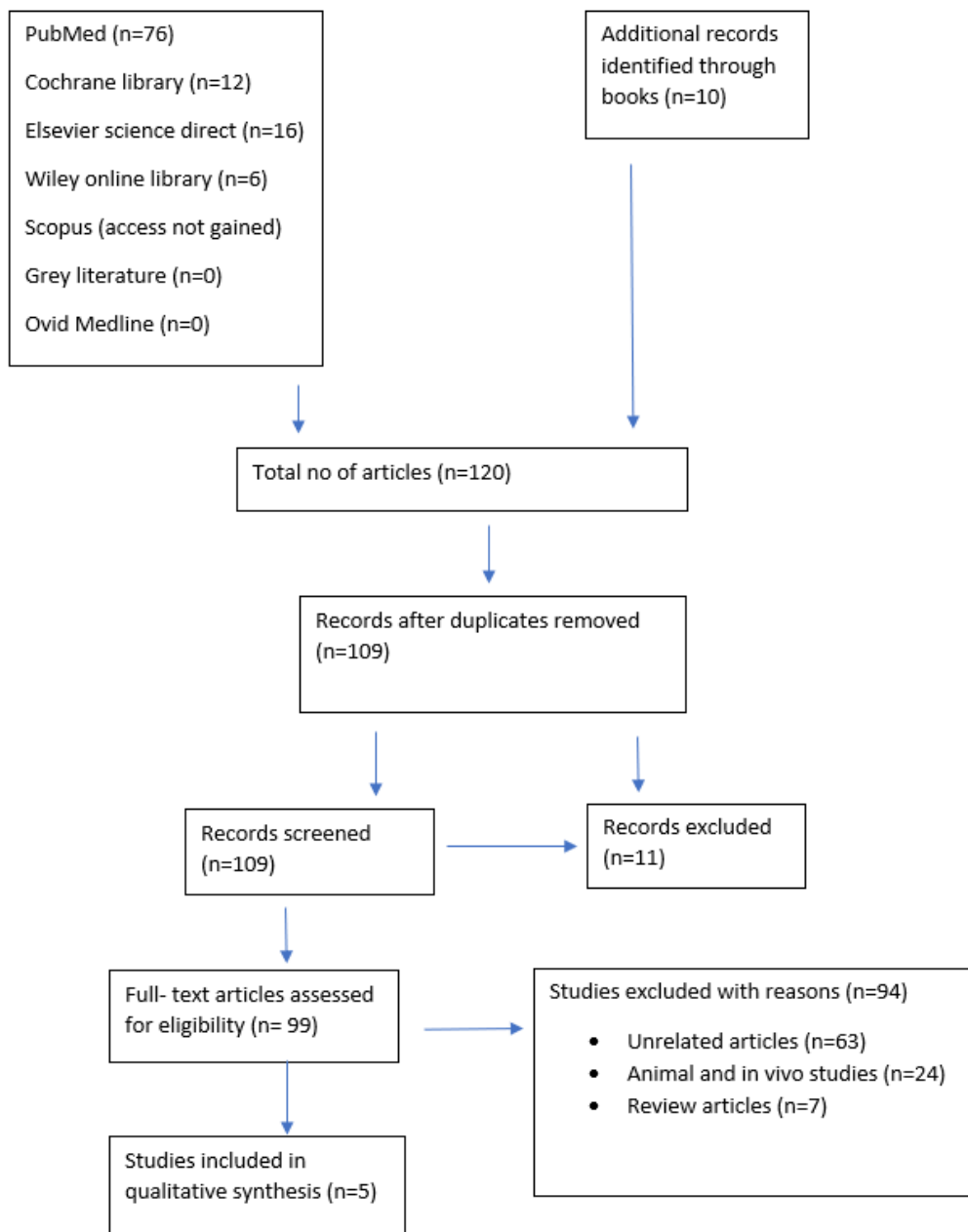


Fig 1:- Flow diagram showing the number of studies identified, screened, assessed for eligibility, excluded and included in the systematic review

**B. Eligibility Criteria:**

➤ **Inclusion criteria:**

1. Studies published in English
2. Articles on the effectiveness on low level laser therapy
3. Full text articles

➤ **Exclusion criteria:**

1. Only abstracts available
2. Unrelated articles
3. Animal studies

**C. Search Engines:**

- PubMed
- Wiley online library

- Cochrane library
- Elsevier science direct
- Scopus
- Ovid Medicine
- Grey literature

After the search using the appropriate mesh terms a total of 120 articles were found from the online databases. After duplicates removal of 109 articles were screened and 99 full-text articles were available. Inclusion-exclusion criteria were applied and finally 5 related articles were selected for further assessment.

## III. RESULTS

AUTHOR NAME	YEAR	SAMPLE	IMPLANT DIMENSION	NO OF IMPLANT	DRUG AND DOSAGE	IMPLANT STABILITY AND PLACEMENT
Joelle Marie Garcia-Morales et al [24]	2012	Among 8 patients, 2 males and 6 females in the mean age of 36 years	Diameter: 3.8mm Length: 11mm	30	Cap amoxicillin 500mg Tab diclofenac 50mg Tab acetaminophen 750 mg 0.12% chlorhexidine mouth rinse Local anaesthesia with 3% mepivacaine and 1:100,000  Low level laser of 830nm diode laser	After 10 days, 3,6, 9 and 12 weeks
Parviz Torkzoban et al [26]	2018	19 patients, 10 females in the mean age of 43 years and 9 males in the mean age of 41 years	Diameter: 4 – 4.5mm Length: 10-11.5mm	80	Cap amoxicillin 500mg Tab gelofen 400mg 0.2% chlorhexidine mouth rinse Local anaesthesia lignocaine with 1:80,000 epinephrine  Low level laser of 940nm diode laser	After 10 days, 3,6 and 12 weeks
Jacek Matys et al [27]	2019	24 Patients, 8 females and 16 males in mean age of 47 years	Diameter: 4.5mm Length: 10-12mm	40	Tab clindamycin 600 mg Tab ibuprofen 400 mg 0.1% chlorhexidine mouth rinse  Low level laser of 635nm diode laser	After 2 and 4 weeks
Renan Pablo Bittencourt Lobato et al [28]	2020	44 Patients, 22 males and 22 females Mean age of 51 years	Implant Diameter and Length is chosen based on bone availability	50	Cap amoxicillin 500mg Local anaesthesia articaine 4% with 1:100,000 epinephrine  Low level laser of 808nm diode laser	At the time
Rafal Flieger et al [29]	2019	20 Patients, 7 males and 13 females Mean age of 33 years	Diameter: 1.4mm Length: 10mm	40	0.1% chlorhexidine mouth rinse  Low level laser of 635nm diode laser	After 3,6,9,12,15, 30 and 60 days

Table 1:- Characteristics of the intervention in the included studies

Table 1: shows the characteristics of the intervention in the included studies. In all above the effectiveness of low-level laser therapy on stability of implant was reviewed.

AUTHOR NAME	YEAR	STUDY DESIGN	OUTCOME	RESULT
Joelle Marie Garcia-Morales et al [24]	2012	double-blind randomized clinical study	shows no significant difference in implant stability at 10 days, 3, 6, 9 and 12 weeks	P<0.028 shows not statistically significant
Parviz Torkzoban et al [26]	2018	randomized controlled clinical trial	shows a no significant difference in implant stability at baseline and at 10 days, 3, 7, and 12 weeks postoperatively.	P<0.05 shows not statistically significant
Jacek Matys et al [27]	2019	randomized controlled clinical trial	shows no significant difference in implant stability at baseline, 2, 4, 8, and 12 weeks	P<0.01 shows not statistically significant
Renan Pablo Bittencourt Lobato et al [28]	2020	randomized controlled clinical trial	Shows no significant difference in implant stability at that time	P=0.433 shows not statistically significant
Rafal Flieger et al [29]	2019	Randomized Clinical Split-Mouth Trial	shows no significant difference in implant stability at baseline, 3, 6, 9, 12, 15, 30 and 60 days	P=0.365 shows not statistically significant

Table 2:- Outcome data as reported in included studies

Table 2: shows an outcome and result of the effectiveness of low-level laser therapy in stability of dental implants in above-mentioned studies.

AUTHOR NAME	YEAR	RANDOM SEQUENCE GENERATION	ALLOCATION CONCEALMENT	SELECTIVE REPORTING	INCOMPLETE OUTCOME DATA	BLINDING OF OUTCOME ASSESSMENT	BLINDING PARTICIPANTS AND PERSONALS
Joelle Marie Garcia-Morales et al [24]	2012	-	-	-	++	?	?
Parviz Torkzoban et al [26]	2018	++	-	?	-	-	++
Jacek Matys et al [27]	2019	-	++	++	-	-	-
Renan Pablo Bittencourt Lobato et al [28]	2020	-	-	-	-	?	++
Rafal Flieger et al [29]	2019	-	++	?	-	-	-

Table 3:- Bias analysis of included studies

Table 3: shows the bias analysis of all the included studies. It is categorized as high-risk bias “-“, low risk bias “++” and unclear “?”.

#### IV. DISCUSSION

Osseointegration is necessary for the need of dental implant success [22]. Many studies reported the positive effects of low-level laser therapy on bone healing. The effect in osseointegration and implant stability is limited in clinical studies. The best loading time for primary stability of dental implants is 10 years [23]. In Joelle Marie Garcia- Morales et al, 2012, the laser stability and implant stability placement are for after 10 days, 3, 6, 9 and 12 weeks and this result of p value shows not significant. It is a double blind randomized clinical study; the implant dimension of diameter is 3.8mm and length is 11mm. The drug and dosage used this study is Capsule of amoxicillin 500mg, tablet of diclofenac 50mg, tablet of acetaminophen 750 mg and mouth rinse used is 0.12% chlorhexidine mouth rinse. The procedure is done by Local anaesthesia with 3% mepivacaine and 1:100,000 [24]. But Mayer et al in-animal studies shows significant difference in implant stability and low-level laser therapy. In many studies the low- level laser therapy has a healing phase but not significant in implant placement. The implant stability is decreased due to bone remodelling around dental implants. There is an increased cell proliferation, cell differentiation and production of bone matrix around dental implants in laser therapy. The low-level laser therapy is used to assess the effect of implant placement in bone graft and in patients with systematic conditions such as diabetic condition and smokers. Though, it is not significant and there is no effect in low- level laser therapy on stability of dental implants [25].

Parviz Torkzoban et al, 2018 the implant stability and placement are for after 10 days, 3,6 and 12 weeks and this result of p value shows not significant. It is randomized controlled clinical trial; the implant dimension of diameter is 4-4.5 mm and length are 10-11.5 mm. The drug and dosage used this study is Capsule of amoxicillin 500mg, tablet of gelofen 400mg, and mouth rinse used is 0.2% chlorhexidine mouth rinse. The procedure is done by Local anaesthesia with lignocaine 1:80,000 epinephrine. Though, it is not significant and there is no effect in low- level laser therapy on stability of dental implants [26].

Jacek Matys et al, 2019, the implant stability and placement are for after 2 and 4 weeks and this result of p value shows not significant. It is randomized controlled clinical trial; the implant dimension of diameter is 4.5 mm and length are 10-12 mm. The drug and dosage used this study is Tablet of clindamycin 600 mg, tablet of ibuprofen 400 mg and mouth rinse used is 0.1% chlorhexidine mouth rinse. Though, it is not significant and there is no effect in low- level laser therapy on stability of dental implants [27].

Renan Pablo Bittencourt Lobato et al 2020, at the time the implant stability is placed and this result of p value shows not significant. It is randomized controlled clinical trial; the implant dimension of diameter and length are based on bone availability. The drug and dosage used this study is Capsule of amoxicillin 500mg. The procedure is done by Local anaesthesia articaine 4% with 1:100,000 epinephrine. Though, it is not significant and there is no effect in low- level laser therapy on stability of dental implants [28].

Rafal Flieger et al, 2019, the implant stability and placement are for after 3,6,9,12,15, 30 and 60 days and this result of p value shows not significant. It is a randomized Clinical Split-Mouth Trial; the implant dimension of diameter is 1.4 mm and length are 10 mm. The drug and dosage used is 0.1% chlorhexidine mouth rinse. Though, it is not significant and there is no effect in low- level laser therapy on stability of dental implants [29].

#### V. CONCLUSION

There is a positive relationship between the use of low-level laser therapy in the healing process and has no positive effect on the stability of dental implants. Therefore, it is not significant in all the study discussed above. This study proved that there is no effect of using low-level laser therapy on the stability of dental implants

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