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Efficiency of low-level laser therapy within induced dental movement: A systematic review and meta-analysis☆,☆☆

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ABSTRACT

The low level laser is widely used in Dentistry, in particular, to decrease pain and increase the speed of tooth movement. This study was to perform a systematic literature search to investigate the effectiveness of low level laser and low energy density therapy of the induced tooth movement.

This research was performed following the PRISMA instructions and was registered in the PROSPERO. The articles were searched in six electronic databases, with no date and language restriction. Only randomized clinical trials were selected. Articles that did not use the extraction of first premolars as orthodontic planning were excluded, as well as articles using high energy density laser therapy. The articles were assessed for risk of bias and individual quality. The results were analyzed using meta-analysis, using randomized effect.

The initial sample consisted of 161 articles. Six articles remained eligible for qualitative analysis and five for quantitative analysis. According to the individual quality, most articles were classified as high quality. Three articles detected statistically significant differences in induced movement by comparing the orthodontic movement between the experimental and control groups. For the maxilla, there was a statistically significant influence of the laser in three months and, for the mandible, in one month.

It may be concluded that there is no evidence that laser therapy can accelerate the induced tooth movement.

1. Introduction

Orthodontic treatment is essential for the aesthetic and functional rehabilitation of the stomatognathic system [1,2]. The average time for orthodontic treatment varies considerably. However, it mostly extends from 24 to 36 months [2]. Mechanical forces applied during orthodontic treatment promote alveolar bone remodeling by stimulating fibroblasts [3], osteoblasts [4], osteoclasts [5] and other cells involved in the dynamics of bone remodeling. The consequent tooth movements result in functional forces and remodeling of, particularly, the periodontal tissue and alveolar bone [6]. Currently, an increasing number of patients request faster treatments. Thus, the acceleration of tooth movement is highly desirable [1,2].

According to the literature, many studies have focused on finding pathways to stimulate the acceleration of the tooth movement, without damaging the tooth and periodontal tissues, such as the administration of osteocalcin [7,8], prostaglandin [9,10], 1,25(OH)2D3 (active form of vitamin D3) [11–13] and even the application of ultrasound [14,15] and electric stimulation [16,17]. Despite stimulating tooth movement, some of these pathways depend on injection, which may cause local discomfort and pain for the patients.

Based on that, many researchers have studied the use of low-level laser therapy (LLLT) [2,18–22], as well as its effects on the acceleration of bone remodeling [23] and collagen synthesis—major protein of the bone matrix [24,25]. However, there are still many controversies surrounding the real effects of laser application in Orthodontics. Thus, the present systematic review aims to investigate and expose the scientific evidence that supports the use the low intensity and low density laser therapy within the acceleration of induced tooth movement in humans.

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Table 1
Patient, Intervention, Comparison, Outcomes and Study design (PICOS) strategy adopted to achieve evidences in face of the research question.

Items	Description
Population	Patients in orthodontic treatment
Intervention	Orthodontic therapy associated with laser therapy
Comparison	Orthodontic treatment without association of laser therapy (control group)
Outcome	Laser therapy results in the speed of orthodontic movement
Study design	Clinical trials with randomization and blinding

2. Materials and Methods

2.1. Protocol and Registration

The present systematic review and meta-analysis were conducted following the instructions of the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) [26]. The systematic review protocol was registered at the International Prospective Register of Systematic Reviews (PROSPERO) under number CRD42015025009 (http://www.crd.york.ac.uk/PROSPERO).

2.2. Guiding Question

The present research aimed to answer the following focused question: Is the low-level and low energy density laser therapy effective to accelerate the induced tooth movement in humans when compared to the control group?

The research question was based on the Patient, Intervention, Comparison, Outcomes and Study design (PICOS) strategy (Table 1).

2.3. Research Strategy for the Identification of Articles

The methodology used in this systematic review was based on the PRISMA instructions (www.prisma-statement.org). In order to identify relevant articles, a search was conducted in the following electronic databases: PubMed, Scopus, SciELO, LILACS, BBO e OpenGrey. Specifically, OpenGrey database was used to search the grey literature and to avoid potential selection bias. The Medical Subject Headings (MeSH) was used to select the controlled descriptors. Boolean operators (OR and AND) were used to combine the descriptors. This research was performed in May 1st 2015, and updated in September 25, 2015. Table 2 shows the applied search strategy.

The data collection was performed in different moments. First, all the references were exported to Mendeley® Desktop 1.13.3 (Mendeley Ltd., London, England) software, in order to track potential duplicate records. Subsequently, titles and abstracts were read in detail to exclude articles out of the scope of the research. At this stage, literature reviews, case reports and experimental surveys with animals were also excluded. The articles of which the title and abstract did not present sufficient information were downloaded and had the full-text analyzed, in order to decide about their eligibility. Those that presented a title within the theme, but the abstracts were not available, were also obtained and fully analyzed. These evaluations were independently performed by two reviewers of the eligibility criteria (V.L.A. and V.L.A.G.). They were not blinded for authorship information and journals' names.

2.4. Eligibility Criteria

In order to include in the review, the articles should meet the following criteria:

- Inclusion criteria: Clinical trials on the influence of laser therapy to induce increase of speed in orthodontic movement when compared to the control group, without restriction of year, publication status, or language.
- Exclusion criteria: Articles that did not used the extraction of the first mandible bicuspids as a therapeutic target, and Studies that used high energy density.

Table 2
Electronic databases and applied search strategy.

Database	Search strategy	Total
PubMed http://www.ncbi.nlm.nih.gov/pubmed/	("laser therapy, low-level"[MeSH Terms] OR ("laser"[All Fields] AND "therapy"[All Fields] AND "low-level"[All Fields]) OR "low-level laser therapy"[All Fields] OR ("laser"[All Fields] AND "therapy"[All Fields]) OR "laser therapy"[All Fields] OR "laser therapy"[MeSH Terms] OR ("laser"[All Fields] AND "therapy"[All Fields])) AND orthodontic[All Fields] AND ("bone remodelling"[All Fields] OR "bone remodeling"[MeSH Terms] OR ("bone"[All Fields] AND "remodeling"[All Fields]) OR "bone remodeling"[All Fields])	20
	("laser therapy, low-level"[MeSH Terms] OR ("laser"[All Fields] AND "therapy"[All Fields] AND "low-level"[All Fields]) OR "low-level laser therapy"[All Fields] OR ("laser"[All Fields] AND "therapy"[All Fields]) OR "laser therapy"[All Fields] OR "laser therapy"[MeSH Terms] OR ("laser"[All Fields] AND "therapy"[All Fields])) AND orthodontic[All Fields] AND dental[All Fields] AND ("movement"[MeSH Terms] OR "movement"[All Fields])	48
	("laser therapy, low-level"[MeSH Terms] OR ("laser"[All Fields] AND "therapy"[All Fields] AND "low-level"[All Fields]) OR "low-level laser therapy"[All Fields] OR ("laser"[All Fields] AND "therapy"[All Fields]) OR "laser therapy"[All Fields] OR "laser therapy"[MeSH Terms] OR ("laser"[All Fields] AND "therapy"[All Fields])) AND orthodontic[All Fields] AND ("osteoclasts"[MeSH Terms] OR "osteoclasts"[All Fields])	8
Scopus http://www.scopus.com/	Low-level OR laser AND therapy OR low-level laser therapy AND orthodontic AND bone remodeling OR bone AND remodeling	18
	Low-level OR laser AND therapy OR low-level laser therapy AND orthodontic AND dental AND movement	32
	Low-level OR laser AND therapy OR low-level laser therapy AND orthodontic AND osteoclasts	10
SciELO http://www.scielo.org/	low-level laser therapy AND orthodontic	2
	laser therapy dental AND movement	3
LILACS lilacs.bvsalud.org/	tw:(low-level laser therapy AND orthodontic) AND (instance:"regional") AND (db:("LILACS"))	11
	tw:(low-level laser therapy AND movement) AND (instance:"regional") AND (db:("LILACS"))	9
OpenGrey http://www.opengrey.eu/	low-level laser therapy AND orthodontic	0
	laser therapy dental AND movement	0
BBO http://bases.bireme.br/	low-level laser therapy AND orthodontic	0
	low-level laser therapy AND movement	0
	Total	161

Table 3
Selection criteria and scores, adapted from Cericato et al. [27] used in the selected studies.

Selection criteria	Score
The abstract clearly presents the study objective, methodology, results and conclusion.	1 point
The study exposes the objective clear and precisely.	1 point
The ethical aspects of the research are cited in the text.	1 point
Description of the Study Type	1 point
The sample size calculation is reported.	2 points
The eligibility (1 point) and exclusion (1 point) criteria are described	2 points
Control groups are used.	1 point
The research design is adequate (randomization and blinding)	2 points
The statistical tests are described.	1 point
The *p* values are cited.	1 point
The study exposes the results clear and precisely.	1 point
The study limitations are discussed.	1 point

For preliminarily eligible studies, the full text was obtained and evaluated, in order to verify if they contemplated all the inclusion criteria. In specific cases, the authors of potentially eligible articles were contacted by e-mail and asked for missing information. Rejected articles were registered separately exposing the reasons for exclusion.

2.5. Risk of Bias/Quality Assessment in Individual Studies

The selected articles were evaluated based on the methodological quality using the checklist described in Table 3. Each article received a scored, and was classified as low quality (from 0 to 8 points), moderate quality (from 9 to 12 points), or high quality (from 13 to 15 points). This evaluation was adapted from Cericato et al. [27]—in which, the low quality studies were discarded, because they were considered methodologically poor.

2.6. Data Collection Process

Two examiners performed the quality control procedure (V.L.A. e V.L.A.G.). In case of disagreement, a third examiner (L.R.P.) was consulted. At this step, the review was blindly performed, masking both the name of authors and journals, avoiding any potential bias and conflict of interests during the sample selection.

2.7. Data Extraction of the Included Articles

After filtration, full-text articles underwent data systematic extraction. The following information were extracted from the articles: authorship, year of publication and location of the study; sample size and characteristics; sample age; study characteristics; type of laser therapy; energy density in J/Cm^2; anatomic location of laser application in the region of the canines; frequency of application; orthodontic

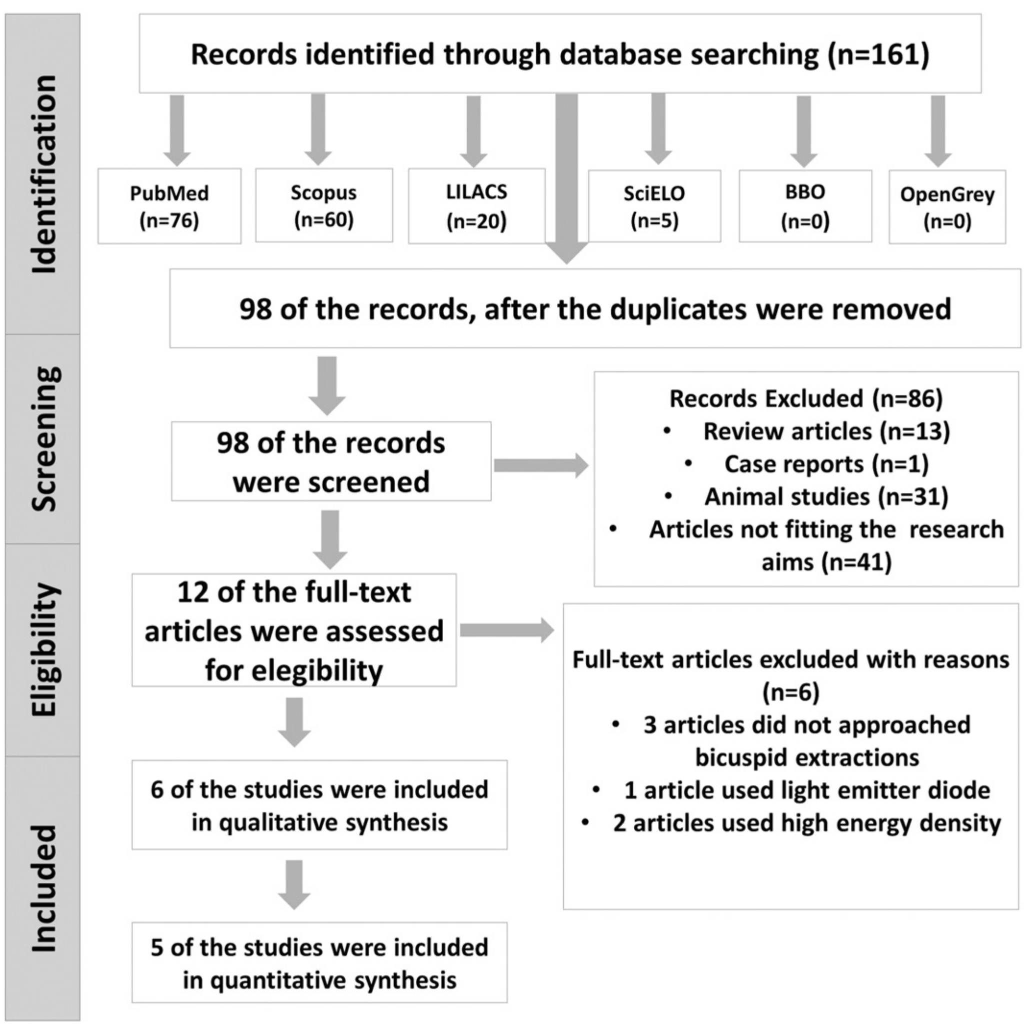

Fig. 1. Flow diagram of literature search and selection criteria adapted from PRISMA.

Table 4
Analysis of the potential risk for bias in the eligible articles.

Author	Q.1 (1 point)	Q.2 (1 Point)	Q.3 (1 point)	Q.4 (1 point)	Q.5 (2 Points)	Q.6 (2 Points)	Q.7 (1 point)	Q.8 (2 Points)	Q.9 (1 point)	Q.10 (1 point)	Q.11 (1 point)	Q.12 (1 point)	Total	Overall quality
Cruz et al. [1]	Yes	Yes	Yes	Yes	No	Yes (1 Point)	Yes	No	Yes	Yes	Yes	No	9 Points	Moderate
Sousa et al.[29]	Yes	Yes	Yes	Yes	No	Yes (1 Point)	Yes	Yes	Yes	Yes	Yes	Yes	12 Points	High
Doshi-Mehta and Bnad-Patil[28]	Yes	Yes	Yes	Yes	Yes	Yes (1 Point)	Yes	Yes	Yes	Yes	Yes	No	13 Points	High
Kansal et al.[23]	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	13 Points	High
Souza[30]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	15 Points	High
Pereira[31]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	15 Points	High

Q.1—The abstract clearly presents the study objective, methodology, results and conclusion. Q.2—The study exposes the objective clear and precisely. Q.3—The ethical aspects of the research are cited in the text. Q.4—The research design is described. Q.5—The sample size calculation is reported. Q.6—The eligibility (1 point) and exclusion (1 point) criteria are described. Q.7—Control groups are used. Q.8—The research design is adequate (randomization and blinding). Q.9—The statistical tests are described. Q.10—The *p* values are cited. Q.11—The study exposes the results clear and precisely. Q.12—The study limitations are discussed.

movement rate of the experimental group expressed in millimeters; and clinical outcome of the work.

2.8. Data Analysis

To analyze the results obtained in the studies that remained in the review, it was made the meta-analysis, using random effects. The calculations were performed on the Comprehensive Meta-Analysis Version 2.2.064 (Biostat, Englewood, NJ, USA) software.

3. Results

3.1. Research Strategy

The systematic searches performed within four electronic databases resulted in 161 articles, of which 76 were collected from PubMed; 60 from Scopus; 5 from SciELO, 20 from LILACS and no article was collected from BBO and OpenGrey (Table 2). Sixty three duplicates were excluded. After analyzing the articles using the inclusion and exclusion criteria, only six articles remained eligible. The Prisma diagram flowchart demonstrates our selection scheme (Fig. 1).

3.2. Risk of Bias within Studies

Table 3 describes the criteria to analyze the risk of bias, while Table 4 shows the results. According to the risk of bias evaluation, most of the studies were classified as high quality [23,28,29]. Only one study [1] presented moderate quality. However, additional important findings within the eligible studies were: Three studies [28,30,31] reported sample calculation tests. The studies [1,29,30,31] clearly described the type of research design. The discussion of the limitations and fragilities of the study was performed by four studies [23,29,30,31].

3.3. Included Studies and Intervention Outcomes

From the six eligible studies, two were performed in India and four in Brazil. All the studies were published between 2004 and 2014, in English and Portuguese language.

Table 5 indicates that all the studies were clinical trials, using the same modality of laser therapy (GaAlAs), with low energy density. The current medical literature does not standardize the anatomic region of laser application. However, slight variations were observed in within the eligible articles. Clearly, all the studies approached vestibular and palatal applications adjacent to the canine to be retracted.

Monthly variations on the orthodontic movement rate were observed (intervention outcomes) (Table 6). Sousa et al. [29], Souza [30] e Pereira [31] started the evaluation of orthodontic movement rate from the first month of stimulus to the third month of evaluation of the laser therapy. Kansal et al. [23] evaluated from the first to the second month. Cruz et al. [1] started the evaluation in the second month, restricting it to a single month. Doshi-Mehta & Bnad-Patil [28] started the evaluation in the third month extending it until half of the fifth month.

Three studies [1,28,29] revealed statistically significant differences in induced tooth movement when compared to movement rates between experimental and control groups. Table 7 and Fig. 2 show the results of the Meta-analysis of the effectiveness of the laser in the maxilla, showing a statistically significant influence of the laser in 3 months, but not in 1 and 2 months. Table 8 and Fig. 3 show the results in the mandible, in which, there is a statistically significant influence of laser in 1 month, but not in 2 and 3 months.

4. Discussion

Orthodontic movement is related to balanced resorption and bone neoformation mechanisms [32,33]. The application of orthodontic force causes traction and compression in opposite sides of the periodontal

Table 5
Description of the main characteristics found in the eligible studies.

Authorship, year of publication and country of origin	Sample size and gender	Years of age	Research design	Type of laser	Energy density (J/Cm^2)	Anatomic region of application (divided in 1/3)
Cruz et al. [1] Brazil	11 Gender not mentioned	12–18	Clinical Trial	GaAlAs	5	Cervical 1/3: 2 Applications Middle 1/3: 1 Application Apical 1/3: 2 Applications *Buccal and palatal surfaces
Sousa et al. [29] Brazil	4 ♂ 6 ♀	10.5–20.2	Blind clinical trial	GaAlAs	5	Mesiovestibular: 2 applications (Cervical 1/3 and Apical 1/3) Middle 1/3: 1 Application Distovestibular: 2 Applications (Cervical 1/3 and Apical 1/3) * Buccal and lingual surfaces
Doshi-Mehta and Bnad-Patil [28] Índia	8 ♂ 12 ♀	12–23	Blind and randomized clinical trial	GaAlAs	5	Cervical 1/3: 2 Applications Middle 1/3: 1 Application Apical: 2 Applications * Buccal and palatal surfaces
Kansal et al. [23] Índia	10 Gender not mentioned	Not mentioned	Triple-blind and randomized clinical trial	GaAlAs	4.2	Cervical 1/3: 2 Applications Middle 1/3: 1 Applications Apical 1/3: 2 Applications * Buccal and palatal surfaces
Souza [30] Brazil	11 Gender not mentioned	Not mentioned	Blind and randomized clinical trial	GaAlAs	10	Cervical 1/3: 2 Applications Middle 1/3: 1 Application Apical 1/3: 2 Applications * Buccal and palatal and lingual surfaces
Pereira [31] Brazil	7 ♂ 4 ♀	12–17	Double-blind and randomized clinical trial	GaAlAs	10	Cervical 1/3: 2 Applications Middle 1/3: 1 Application Apical 1/3: 2 Applications * Buccal and palatal and lingual surfaces

ligament fibers. Thus, instead of compression, there is a greater stimulus for the expression of certain pro-inflammatory mediators, such as tumor necrosis factor (TNF)-α and interleukin (IL)-1β [33]. These, in turn, stimulate the activation of osteoclastic cells that lead bone resorption [34,35]. However, instead of traction, there is a greater stimulus for the expression of certain anti-inflammatory mediators, such as interleukin-10 and the transforming growth factor (TGF)-β, that hamper the expression of TNF-α and IL-1β [33]. Consequently, an activation of osteoclastic cells does not occur and there is a predominance in the osteoblastic cells activity, culminating in bone neoformation [35,36].

Laser therapy is found among the various searches conducted to find a therapy that favors the increase of speed of induced tooth displacement [2,18–21]. Even though the interaction between the effects of this alternative therapy and cellular mechanisms involved in accelerating the orthodontic movement are not yet deeply understood, it is known that the laser stimulates collagen synthesis [24,25] and intensifies bone regeneration [24].

Currently, some articles [37–40] have shown that laser treatment can accelerate tooth movement in animals. Systematic reviews were conducted to evaluate the effectiveness of laser therapy, but using low and high energy density. Rather than these aspects, this systematic review sought, based on scientific evidences, to evaluate the effectiveness of application of low level laser and low energy density in the acceleration of orthodontic tooth movement.

Facing the effectiveness of low level laser therapy in induced tooth movement in humans, [1,28] it is possible to assumed that LLLT works increasing the cellular metabolism. The irradiation should transmit energy and stimulate DNA and RNA synthesis, resulting in increased protein synthesis and the formation of ATP, thereby, accelerating the mechanisms of bone neoformation and resorption, which results in acceleration of tooth movement.

Some authors [1,28] used a protocol of multiple laser applications and succeeded in accelerating induced tooth movement. However, Kansal et al. [23] also used a similar protocol, but with divergent results. Thus, it can be concluded that the amount of laser applications is not a determining factor in the effectiveness of tooth movement acceleration.

In this meta-analysis, five of the included studies [1,23,28,30,31] evaluated tooth displacement from one to three months, and only one study performed the evaluation from the third month on, hance not allowing the evaluation of this period. However, the work [28] evaluating this period found a statistically significant difference between the experimental and control groups.

Among the works [1,28,29] that showed statistically significant differences, Souza et al. [29] showed more solid results. However, it should be considered that this result might have been influenced by the subsequent anchoring used, which was not specified in the work.

Each study shows a specific rate of movement, however, this proves to be effective in some months and ineffective in others. Although Souza [30] has stated that the period of time is critical for the effectiveness of the laser therapy, the results of our meta-analysis contrasts with that statement. For the maxilla, there was a statistically significant influence of the laser in three months, but not in 1 and 2 months. For the mandible, there was a statistically significant influence of the laser in 1 month, but not in 2 and 3 months. Thus, it can be concluded that the period of time is not a determining factor regarding the acceleration of tooth movement.

Although the cumulative meta-analysis reveals the tendencies of the pooled results, it is suggested, due to some existing heterogeneities in the studies, that the results should be interpreted with caution. The main limitation of this meta-analysis is caused by the limited number of clinic randomized trials in well-designed humans, in order to define the optimal dose or density.

5. Conclusion

By conducting this systematic review and meta-analysis, it could be concluded that there is no evidence showing that the use of laser therapy may accelerate the induced tooth movement. Further controlled and randomized clinical studies with a larger sample are necessary to increase the strength of the evidence on the effects of using low intensity laser therapy to accelerate the induced tooth movement.

Table 6
Frequency of application, orthodontic movement rate and clinical outcomes of the eligible articles.

Author	Frequency of application	Orthodontic movement rate (mm)								Clinical outcome
		1 Month		2 Months		3 Months		4,5 Months		
		No Laser	Laser	No Laser	Laser	No Laser	Laser	No Laser	Laser	
Maxilla										
Cruz et al. [1]	0, 3°, 7°, 14°, 30°, 33°, 37°, 44° *Day			3.30 ± 0.24	4.39 ± 0.27					Statistical analysis revealed that laser therapy was efficient to accelerate induced dental movement
Doshi-Mehta and Bnad-Patil [28]	0°, 3°, 7°, 14°, 45°, 75°, 105°, 135° *Day					0.66 ± 0.55	1.43 ± 0.15	0.84 ± 0.21	1.17 ± 0.22	Statistical analysis revealed that laser therapy was efficient to accelerate induced dental movement
Kansal et al. [23]	1°, 3°, 7°, 14°, 21°, 28°, 35°, 42°, 49°, 56° *Day	1.76 ± 1.58	1.68 ± 1.20	3,30 ± 2,36	3,53 ± 2,30					Statistical analysis revealed that laser therapy was not efficient to accelerate induced dental movement
Souza [30]	30*, 60*, 90* *Day	0.65 ± 0.24	0.53 ± 0.43	1.52 ± 0.89	1.53 ± 0.70	1.50 ± 0.55	2.08 ± 1.33			Statistical analysis revealed that laser therapy was not efficient to accelerate induced dental movement
Pereira [31]	30*, 60*, 90* *Day	1.90 ± 0.71	2.27 ± 0.70	2.75 ± 1.42	3.05 ± 1.25	1.23 ± 1.35	1.35 ± 1.11			Statistical analysis revealed that laser therapy was not efficient to accelerate induced dental movement
Mandible										
Doshi-Mehta and Bnad-Patil [28]	0°, 3°, 7°, 14°, 45°, 75°, 105°, 135° *Day					0.63 ± 0.28	1.51 ± 0.18	0.75 ± 0.09	1.11 ± 0.17	Statistical analysis revealed that laser therapy was efficient to accelerate induced dental movement
Souza [30]	30*, 60*, 90* *Day	0.70 ± 0.69	1.99 ± 0.75	2.01 ± 0.93	1.95 ± 0.97	1.54 ± 1.32	1.46 ± 0.67			In the first month, the Statistical analysis revealed that laser therapy was efficient to accelerate induced dental movement
Pereira [31]	30*, 60*, 90* *Day	1.11 ± 0.36	2.01 ± 0.62	2.62 ± 1.36	2.30 ± 1.41	1.74 ± 1.35	1.70 ± 1.15			Statistical analysis revealed that laser therapy was not efficient to accelerate induced dental movement
Maxilla and mandible (combined results)										
Sousa et al. [29]	0°, 3°, 7°, 31°, 34°, 38°, 61°, 64°, 68° *Day	0.42 ± 0.29	1.16 ± 0.51	0.80 ± 0.49	2.05 ± 0.93	1.60 ± 0.63	3.09 ± 1.06			Statistical analysis revealed that laser therapy was efficient to accelerate induced dental movement
Doshi-Mehta and Bnad-Patil [28]	0°, 3°, 7°, 14°, 45°, 75°, 105°, 135° *Day					0.65 ± 0.18	1.46 ± 0.16	0.81 ± 0.18	1.15 ± 0.21	Statistical analysis revealed that laser therapy was efficient to accelerate induced dental movement

Table 7
Values obtained in the studies and results of the meta-analysis for the maxilla.

Period of time	Study	Average difference	Lower limit	Upper limit	p
1 month	Kansal et al. [23]	−0.08	−1.31	1.15	0899 ns
	Souza [30]	−0.12	−0.41	0.17	0419 ns
	Pereira [31]	0,37	−0.22	0.96	0218 ns
	Total	−0.01	−0.30	0.27	0933 ns
2 months	Cruz et al. [1]	1.09	0.88	1.30	<0001*
	Kansal et al. [23]	0.23	−1.81	2.27	0825 ns
	Souza [30]	0.01	−0.66	0.68	0977 ns
	Pereira [31]	0.30	−0.82	1.42	0599 ns
	Total	0.51	−0.23	1.25	0174 ns
3 months	Doshi-Mehta & Bnad-Patil [28]	0.32	0.04	0.60	0026*
	Souza [30]	0.58	−0.27	1.43	0181 ns
	Pereira [31]	0.12	−0.91	1.15	0820 ns
	Total	0.33	0.07	0.59	0012*

ns—not statistically significant effect.
* Statistically significant effect ($p < 0.05$).

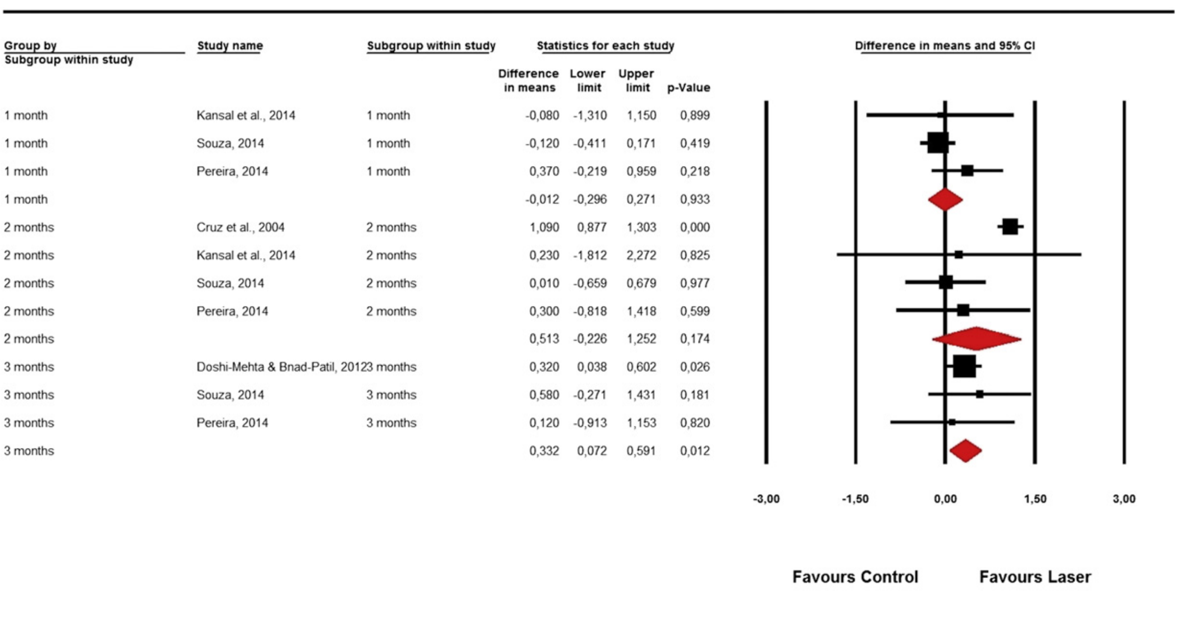

Fig. 2. Forest plots of comparison. LLLT months' subgroup—Maxilla.

Table 8
Values obtained in the studies and results of the meta-analysis for the mandible.

Period of time	Study	Average difference	Lower limit	Upper limit	p
1 month	Souza [30]	1.29	0.69	1.89	<0001*
	Pereira [31]	0.90	0.48	1.32	<0001*
	Total	1.03	0.67	1.40	<0001*
2 months	Souza [30]	−0.06	−0.85	0.73	0882 ns
	Pereira [31]	−0.32	−1.48	0.84	0588 ns
	Total	−0.14	−0.80	0.51	0668 ns
3 months	Doshi-Mehta & Bnad-Patil [28]	0.88	0.67	1.09	<0001*
	Souza [30]	−0.08	−0.95	0.79	0858 ns
	Pereira [31]	−0.04	−1.09	1.01	0940 ns
	Total	0.37	−0.38	1.13	0333 ns

ns—not statistically significant effect.
* Statistically significant effect ($p < 0.05$).

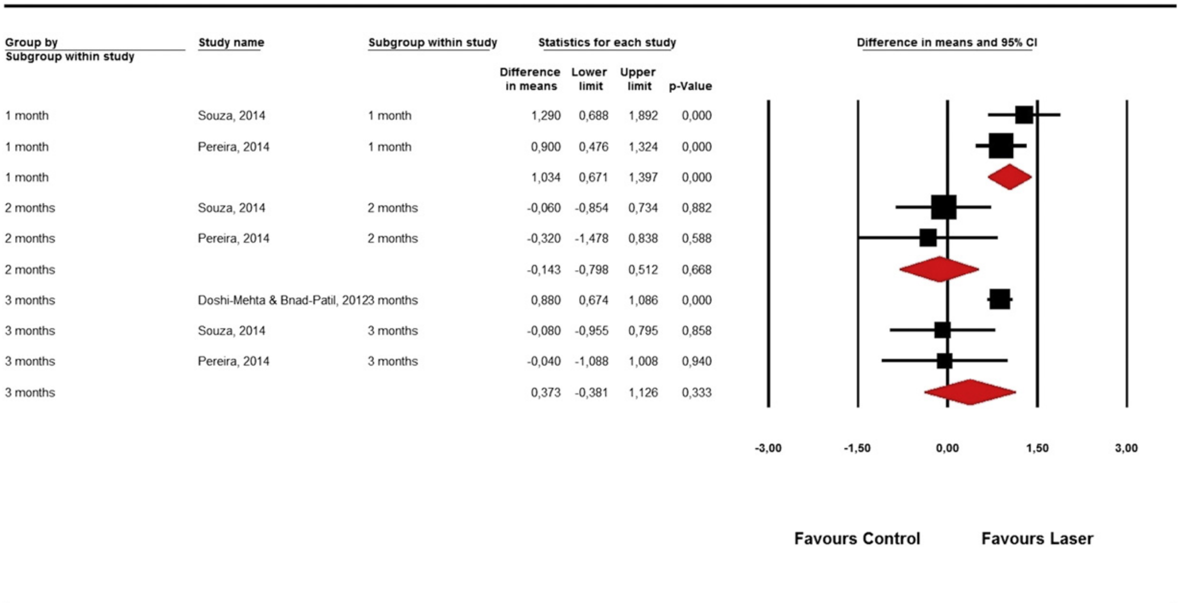

Fig. 3. Forest plots of comparison. LLLT months' subgroup—Mandible.

Conflict of interest

There is no conflict of interest.

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