



Effectiveness of Various Types of LASER Therapy during In-Office Teeth Bleaching: A Systematic Review

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ABSTRACT:

Background: Vital bleaching is most requested cosmetic dental procedure asked by patients who seek pleasing smile. Laser helps to reduce the stain and helps in teeth whitening.

Aim: To investigate the effect of laser therapy induced by teeth bleaching.

Methodology: A Literature review was performed using PubMed, Medline, PMC, Grey literature, Cochrane, Prospero, Wiley online library using MeSH term laser and teeth bleaching. Of a total 1658 appeared from various sources; all articles were screened and 14 were related to the research question and 5 were selected for the study. This review was reported according to PRISMA guidelines.

Result: In the five studies of our systematic review shows that laser used in the case of teeth bleaching with higher concentration of hydrogen peroxide produced better result and comparatively lesser sensitivity than any other bleaching agents or lesser concentration of hydrogen peroxide.

Conclusion: Clinical trials suggests that laser used in bleaching the tooth has better efficacy on tooth surface which resulted in lesser sensitivity and better tooth color, at the same time effectiveness of the treatment is same as that of the normal procedure.

KEYWORDS: Hydrogen peroxide, Laser, Sensitivity, Teeth bleaching.

INTRODUCTION

The term bleaching defines about changing color substances within tooth structure and also makes teeth lighter than its natural color[1]. Bleaching plays an important role in esthetics and helps to remove extrinsic and intrinsic stains[2]. Extrinsic stains result in accumulation of chromatogenic food substances on external tooth surfaces, poor oral hygiene and tobacco use. Intrinsic stains caused by aging, ingestion of chromatogenic food and drinks, tobacco usage, enamel micro cracks, tetracycline medication, excessive fluoride ingestion, jaundice in infants, porphyria, dental caries, restorations and thinning of enamel layer[3]. Discoloration can occur due to breakup of chromophore, and destruction of one or more of double bonds within conjugated system involved[4]. Bleaching agents which are used commonly in in-office bleaching are hydrogen peroxide and carbamide peroxide. Among these two, hydrogen peroxide is the most common agent used for bleaching procedure[5].

Bleaching procedure is economical, simple and effective treatment. It comprises of few techniques in application of the agent. They are:

- In office bleaching



- Night guard or home applied
- Over the counter systems.

Application of these bleaching techniques is dependent on peroxide and its concentration. At home bleaching, agents contain low concentration than in-office bleaching. Fast result and short application time makes patient to request for in-office technique[6]. During bleaching procedure some changes have been reported, which includes limitations and adverse effects on tooth surfaces such as changes in surface roughness, a reduction in fracture toughness, alteration of calcium/phosphate ratio, erosion, decrease in abrasion resistance and formation of depressions, morphological alteration in enamel structures and rod destruction, changes in chemical composition of tooth include demineralization, damage to cellular DNA, enamel susceptible to carious attack, increase tooth sensitivity, loss of enamel prism core, protein denaturation in enamel, decrease of proportion of minerals to protein and reducing strength of hydrogen bonds in enamel molecules[7,8].

The mechanism of action of bleaching agent is that it breaks down one or more double bonds of dyes that stain the teeth. Pigments that is located in enamel and dentin which are broken down by reactive oxygen species such as hydroxyl radicals and oxygen from bleaching agents. Through oxide-reducing agent, the pigmented molecules are divided into smaller molecules, which absorb more light and dentin structure diffuses it promoting lighter tooth appearance[9].

Laser target interaction depending on its optical properties includes:

1. Absorption
2. Transmission
3. Reflection
4. Scattering.

With the use of light source (LED/laser), in office bleaching technique have been performed to analyze the color change of tooth surface and teeth sensitivity. This light source has been used along with 35% hydrogen peroxide to achieve the result [4] and light sources that are recommended are for this procedure are halogen lamps, light emitting diodes, plasma arc lamps, ultraviolet light sources and several types of lasers [10].

MATERIALS AND METHODS

Objective of the study:

- To evaluate the use of laser in teeth bleaching.
- Study design:
- Systematic review done on teeth bleaching using laser.

Study strategy:

The following electronic databases were used to find articles on laser used in teeth bleaching, PubMed, PMC, Medline, Cochrane, Prospero, Grey literature, Wiley online library. Each database was searched to find an articles using Mesh representation.

Inclusion criteria:

1. Original articles.
2. In vivo studies.
3. The articles are emphasized in the efficacy of laser in teeth bleaching.
4. In-office bleaching techniques and split mouth design.
5. Clinical trials.
6. Hydrogen peroxide used as bleaching agent.
7. Articles year of study included from 2014 onwards.

Exclusion criteria:

1. Review articles.
2. Articles whose abstract are only readable.
3. Studies which are not emphasizing on laser in teeth bleaching.
4. Articles which has no source to open it.



Search engine:

1. PubMed
2. MEDLINE
3. Cochrane
4. PubMed Central
5. Grey literature
6. Prospero
7. Wiley online library

RESULTS

The search yield 1658 records, and out of which 14 full text articles were independently assessed. Among the potentially assessed articles five were included.

Figure 1 shows the flow diagram of the reports that were identified, screened, assessed for eligibility, excluded and included in the review. It shows that total 1658 articles were yielded by searching different databases. After removing duplicates and others, a total of 5 articles fulfilling the inclusion criteria were included in the study

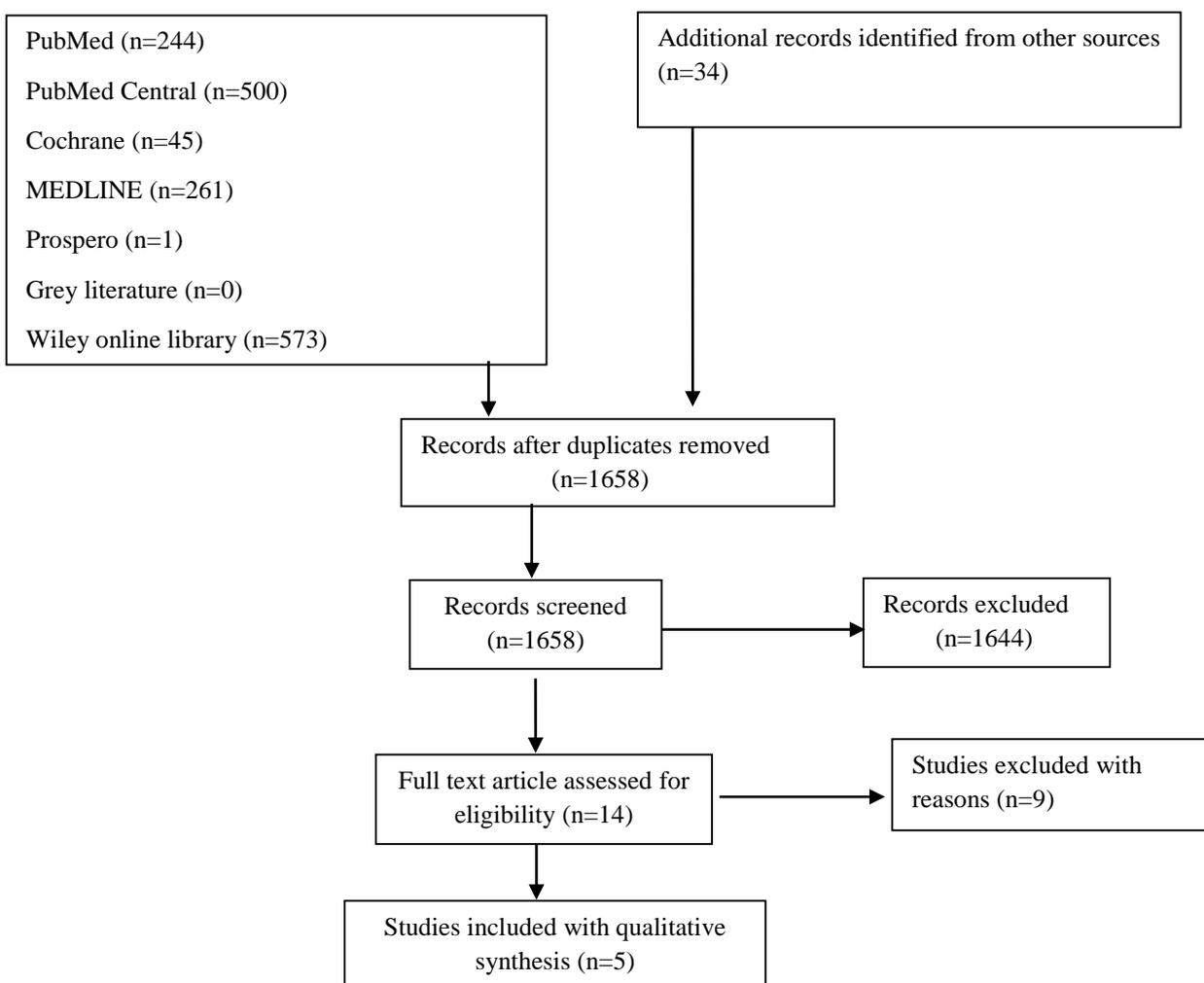


Figure 1: Flow diagram showing the number of studies identified, screened, assessed for eligibility, excluded and included in systematic review



Table 1: Review of articles on laser used in teeth bleaching

S.NO	AUTHOR	YEAR	PATIENT SELECTION	PREPARATION	INTERVENTION
1.	Mondelli R[11]	2018	20 volunteers were divided into two groups and four subgroups.	Split mouth in office bleaching technique using Hybrid Light (HL), Lase Peroxide Sensy (LPS), Whiteness hydrogen peroxide (WHP) and hydrogen peroxide (HP).	Group 1 subgroup 1-35% LPS with 35% HP. Group 1 subgroup 2-35% WHP with 35% HP. Group 2 subgroup 1-35% LPS + HL with 35%HP. Group 2 subgroup 2-25% LPS + HL with 25% HP.
2.	Moosavi H[12]	2016	66 patients were divided into three groups.	In office bleaching technique using low level red laser (LLRL) or low level infrared laser (LLIL) or placebo.	Group 1-received irradiation from LLRL (660nm). Group 2-subjected to LLIL (810nm). Group 3-placebo.
3.	Bortolatto JF[13]	2016	48 volunteers divided in 2 groups.	In office bleaching technique using 6%HP or 35% H_2O_2 .	Group 1-6% HP with hybrid LED/laser light. Group 2-35% HP with hybrid LED/ laser light.
4.	De Freitas PM[14]	2016	22 volunteers divided in 2 groups.	In split mouth technique using 35% H_2O_2 or 35% H_2O_2 with laser.	Group 1-Bleaching done using 35% H_2O_2 . Group 2-Bleaching done using 35% H_2O_2 with laser/ LED.
5.	De Almeida Farhat PB[15]	2014	16 volunteers divided into 2 groups.	In randomized, blinded and split technique study with GL activated with LED or GLL activated with LED-laser.	Group 1-GL with LED Group 2-GLL with LED-laser.

Table 1 shows the review of articles on treatment using laser in teeth bleaching. It shows the interventions in all five studies included 35% H_2O_2 and laser has been used by Mondelli R, Moosavi H, Bortolatto JF, De Freitas PM and De Almeida Farhat PB. All have shown positive outcome. The results are discussed below.

Table 2: Review of articles on laser used in teeth bleaching and results

S.NO	AUTHOR	YEAR	PATIENT SELECTION	PREPARATION	RESULTS
1.	Mondelli R[11]	2018	20 volunteers were divided into two groups and four subgroups.	Split mouth in office bleaching technique using Hybrid Light (HL), Lase Peroxide Sensy (LPS), Whiteness hydrogen peroxide (WHP) and hydrogen peroxide (HP).	Group 1 bleaching without HL showed increase in sensitivity and group 2 bleaching with HL showed lesser sensitivity.
2.	Moosavi H [12]	2016	66 patients were divided into three groups.	In office bleaching technique using low level red laser (LLRL) or low level infrared laser (LLIL) or placebo.	Low level laser therapy with group 2 reduces the intensity of tooth sensitivity after in-office bleaching.



3.	Bortolato JF[13]	2016	48 volunteers divided in 2 groups.	In office bleaching technique using 6% H ₂ O ₂ containing nanoparticles of nitrogen doped titanium oxide or 35% H ₂ O ₂ .	Group 1 has reduced efficacy compared to 35%HP group 2 that produced lesser sensitivity.
4.	De Freitas PM[14]	2016	22 volunteers divided in 2 groups.	In split mouth technique using 35% H ₂ O ₂ or 35% H ₂ O ₂ with laser.	Group 2 showed mild to moderate sensitivity while group 1 showed moderate sensitivity.
5.	De Almeida Farhat PB [15]	2014	16 volunteers divided into 2 groups.	In randomized, blinded and split technique study with GL activated with LED or GLL activated with LED-laser.	Intensity of sensitivity was similar for both group 1 and 2 at different periods.

Table 2 shows the review of articles on treatment using laser in teeth bleaching. It shows results yielded in all five studies included Mondelli R, Moosavi H, Bortolato JF, De Freitas PM and De Almeida Farhat PB study showed that sensitivity after using laser have been reduced and this shows positive result and can be used for teeth bleaching.

Table 3: Assessment of risk of bias in the included studies

S.NO	AUTHOR NAME	RANDOM SEQUENCE GENERATION	ALLOCATION CONCEALMENT	SELECTIVE REPORTING	OTHER BIAS	BLINDING OF PARTICIPANTS AND PERSONNEL	BLINDING OF OUTCOME ASSESSMENT	INCOMPLETE OUTCOME DATA
1.	Mondelli R[11]	+	?	+	?	+	+	+
2.	Moosavi H[12]	+	?	+	+	+	?	?
3.	Bortolato JF[13]	+	-	+	+	+	+	+
4.	De Freitas PM [14]	?	?	-	?	?	?	?
5.	De Almeida Farhat PB [15]	?	?	?	?	?	?	?

+ =low risk of bias, - =high risk of bias, ? =unclear risk of bias

DISCUSSION

Laser is widely used commonly used in industries but nowadays it is not only used in industries but also in medical fields, including dental medicine. In dentistry, laser is used commonly in cavity preparation, also in all endodontic treatments, caries prevention, pulp capping and pulpotomy, periodontal therapy, dentin hypersensitivity, tooth bleaching and oral surgery[16]. Vital teeth bleaching are one of the most cosmetic dental procedures asked by patients to remove the discoloration, who seek a more pleasing smile. It is widely used to correct tooth discoloration and produce pleasing smile. Discoloration is caused by extrinsic, intrinsic and internalized stains[5,17].

Extrinsic stains are due to tea, coffee, tobacco, some foods such as blueberries and red wine. Intrinsic satins are due to systemic conditions, use of medications like minocycline after the permanent teeth have erupted or use of tetracycline during the



teeth development, childhood diseases, infection or trauma to tooth or natural age changes[5] Tooth sensitivity and adverse effects are reduced by clinician with several approaches reported by patients subjected to in-office bleaching procedures. The use of low concentration of peroxide produced lesser effect comparatively with higher concentration[18].

Results showed that mean surface roughness of teeth before and after bleaching was clearly evident and differentiated in all individuals after using the procedure and it is not an issue because it is common[19].

Mondelli et al has discussed in his study that using hybrid light for the bleaching procedure resulted in lower degree of sensitivity and the other factors were same as that of the procedure which was preceded without hybrid light and hence the procedure can be well accomplished better to color change stability with high concentration of the bleaching agents [11].

Moosavi et al has discussed in his study that effect of low level laser therapy by the procedure of in-office bleaching which is used with infrared diode laser could be recommended to reduce the intensity of the tooth sensitivity after applying it to the individuals and hence LLLT with infrared diode laser was effective procedure [12].

Bortolato JF et al discussed in his study that using 6% H₂O₂ containing nanoparticles of doped nitrogen titanium oxide with in-office bleaching procedure have results less tooth sensitivity. But the efficacy of in-office bleaching was reduced when compared to protocol in-office bleaching where bleaching agent was used in higher concentration of about 35% [13].

De Freitas PM et al discussed on his clinical trial suggests that hybrid light source (LED/Laser) led to a higher temperature variation on enamel surface during bleaching with 35% H₂O₂ was used for the bleaching procedure but this did not produce better influence and hence normal temperature is suitable and applicable for the procedure used with laser[14].

De Almeida Farhat et al discussed that efficacy of LED-laser when used with high concentration of bleaching agent produced lesser sensitivity comparatively with all other factors[15].

Laser used in bleaching procedure produces same efficacy as in normal bleaching procedure. But when it is used with variation in the concentration of the bleaching agents with higher value of concentration it produced better results and has better efficacy. Hydrogen peroxide is most commonly used agent in these procedures and hence when it is used in higher concentration in all the clinical trials above has produced lesser sensitivity and improved tooth shade.

CONCLUSION

Laser that is used as a light source for bleaching procedure is a conventional method which is economical, simple and effective treatment procedure. This systematic review shows that laser used in teeth bleaching produced better result and reduced sensitivity.

Conflicts of interest: No conflict of interest of any nature or kind of product, service or company presented in this article.

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Ethical Approval: The study was approved by the institutional committee

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