

How to Cite:

Alrebdi, A. (2022). Bibliometric assessment of laser therapy in dentinal hypersensitivity. *International Journal of Health Sciences*, 6(S3), 10747–10754. <https://doi.org/10.53730/ijhs.v6nS3.8419>

Bibliometric assessment of laser therapy in dentinal hypersensitivity

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Abstract--- The purpose of this study was to evaluate the bibliometric qualities and global trend among all publications on laser intervention in dentinal hypersensitivity. Methodology: A bibliometric search was conducted in the PubMed database from year 1980 to 2021. Collected data has been classified into two categories, were labeled using the competition's standard classification (SCR). The VOS viewer technique was used to establish systematic sceneries and assets on citation frequency, countries, journals, authors, and other information. Result: The geographical distribution of publications included 6 countries/regions and majority of authors were belongs to Brazil (4 articles) , followed by Turkey (2 articles), Europe (2 articles) and Sudan 1 article. Total of 44 authors contributed in 8 selected articles, maximum number of authors contribution was found in study done by Mayra de la Caridad Pérez et.al, followed by T.C.C.G.P. Ladalarido et al. Conclusion: There is a lack of interventional studies, including cohort studies and randomized controlled trials, it is necessary to include the laser and dentinal hypersensitivity population in high impact oral health investigations globally.

Keywords--- dentine hypersensitivity, hypersensitivity, laser, diode.

Introduction

The Lights Amplification by Stimulated Emission of Radiation (Lasers), Theodore Maiman, who had first invented the operating laser equipment in 1960, which emitted a dark red beam from a reddish crystal (1). Stern and Sognnaes (1964) and Goldman et al. (1964). were the pioneer scientists in exploring the possible applications of the laser in dentistry. Their trials focused on hard tooth structure by looking into the potential of using a ruby laser to minimize demineralization (2). Matsumoto et al. used laser therapy for the first time to treat dentine hypersensitivity in 1985 (3). A laser is a device that generates light via an optical amplification process that is based on the thermionic emission. Dental laser can

be distinguished by wavelength, power density, effective medium sort, and severity of subsequent exposure. Lasers arise in different sorts, and application use, with some lasers being endorsed for specific uses in dentistry, and more exact to soft or hard tissue. It has been used in a wide range from diagnosis to prevention and treatment, in such as caries detection, bleaching, restorative removal and curing, cavity preparation, dentinal hypersensitivity, nerve repair and regeneration, whereas soft tissue application includes wound healing, removal of hyperplastic tissue, gingivectomy, and crown lengthening (4).

Dentinal hypersensitivity (DH) and laser

Dentinal hypersensitivity (DH) is common acute extreme dental pain that cannot be regarded as any other type of dental disease. The symptom is induced by stimulating exposed dentinal tubules with thermal, tactile, chemical, and/or osmotic stimuli. The higher fluid flow within dentinal tubules creates intrapulpal pain which defined the hydrodynamic theory, devised by Brannstrom and Astrom in 1972 (5). As a consequence, the capabilities to block dentinal tubules and lower fluid movement in dentinal tubules or/and block pulpal nerve is considered as one of the requirements for the ultimate treatment of DH. A variety of topical reminishing agents have been used for the prevention and treatment, to desensitize the DH either at home or in the clinic. Varnish, liner, mouthwash, toothpaste, restorative materials, and dentinal adhesive are some of the materials and techniques which include potassium, calcium, and fluoride used to alleviate DH(6) . These treatments have indeed been proposed over the years , but none have demonstrated long-lasting efficacy in controlling DH symptoms (7-8).

When compared to traditional desensitizing topical agents, laser treatment, is safe, efficient with faster results and less exposure time, but it is a costly device (9). low-power lasers (diode lasers) may affect DH by decreasing dentinal fluid flow while high-power lasers (Nd: YAG and Er: YAG lasers) decrease dentinal tubules permeation primarily by sealing open tubules. Although, the findings in this systematic review were conflicting, the majority of them confirmed the therapeutic potential of laser in the prevention and treatment of DH symptoms. Some studies found no significant difference between laser and other desensitizing agents, and the majority of studies recommended greater success when merging both treatment strategies in the rapid and long-lasting outcome (10). The implant treatment is usually depending on the correct diagnosis of disease, throughout exclusion of any other possible dental pathological causes of pain. Starting from prevention to control the predisposing factors that are triggers DH. This includes patient advice on oral hygienic practices, diet, hazardous routines, or the necessary periodontal or orthodontic intervention needed (6). However, when deciding whether to integrate laser type into their practices, clinicians are anticipated to understand the fundamentals of laser physics and tissue interaction so that the appropriate laser device and parameter can be used to achieve the treatment goal safely and effectively (11).

Bibliometric is a significant indicator for assessing the productivity of books, articles and other publications, which is observing and evaluate of science's structure and progress (12). Bibliometric study can be used to trail advancement, allow entry to the impacts of publications and researchers, also correlate

theoretical act across nations and people in a particular research topic (13). The purpose of this study was to evaluate the bibliometric qualities and global trend among all publications on laser intervention in dentinal hypersensitivity.

Methodology

On Mar 15, 2022, a bibliometric search was conducted in the PubMed database, a systematic literature search was conducted using key aspects of Laser in dentinal hypersensitivity in the whole timeline history of PubMed. The PubMed database was selected for this research because of its extensive coverage, worldwide accessibility, and based on the keywords synonym for indexing and extracting data. Publications in English and readily accessible text were the inclusion criteria for study selection. Letters to the editor duplicated articles, and articles that were not fully accessible were all excluded. Journal, title, year of publication, authors, citations, impact factor, keywords, country, most cited publications, and research methods were all obtained. All chosen studies' topics and abstracts were assessed by two neutral authors. Full texts were inspected if the abstract did not provide enough details, and we returned to the third reviewer to set consensus at any conflicts about the articles. (Fig 1) Collected data has been classified into two categories, with the manually being converted to Microsoft Excel for statistical analysis. The main journals, countries, authors, institutions, and most cited articles were labeled using the competition's standard classification (SCR). The VOS viewer technique was used to establish systematic sceneries and assets on citation frequency, countries, journals, authors, and other information (van Eck and Waltman 2010).GunnMap 2 (<http://lert.co.nz/map/>) had been used to create the chart depicting the allocation of publications.(14) The following study designs were used: clinical control with or without randomization, case report, literature review, a systematic review (with or without meta-analysis), in vitro, and interventional study.

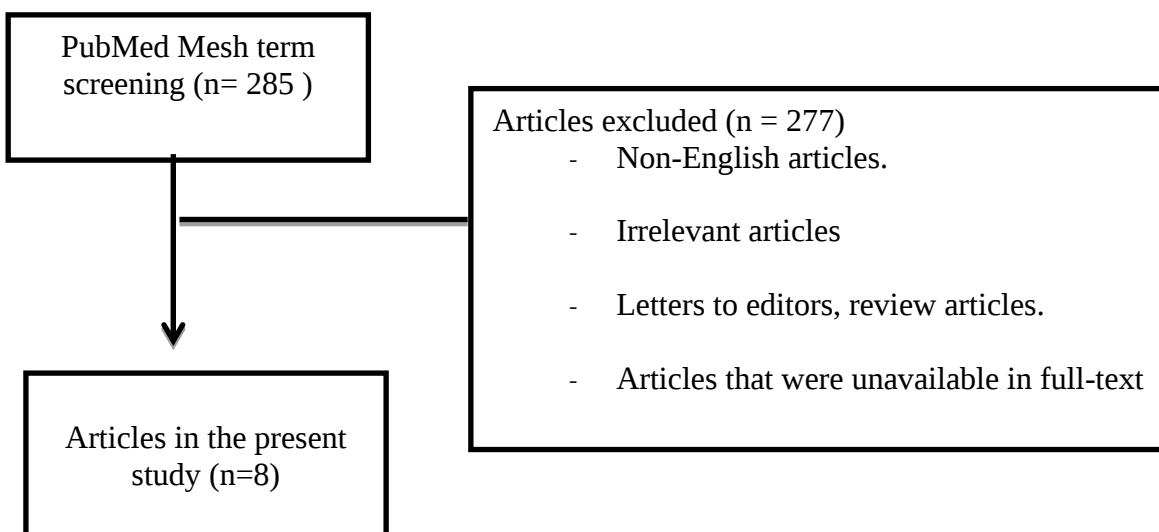


Figure 1. Flow chart for the selection studies

Evaluated by two independent investigators

Table 1

Topic	Number of full text articles	Country of Publication	Institution
Dentinal hypersensitivity (DH) and laser	1	Nigerian	Faculty of Dentistry, Bezmialem Vakif University, Istanbul, Turkey,
	2	Switzerland	Department of Oral Rehabilitation and Dental Emergencies, Faculty of Dentistry, "Victor Babes" University of Medicine and Pharmacy, P-ta Eftimie Murgu 2, 300041 Timisoara, Romania; ^[1] ^[2] ^[3] miron.mariana@umft.ro (M.M.); todea.darinca@umft.ro (C.T.); ^[1] ^[2] ^[3]
	3		Department of Restorative Dentistry/Special Laboratory of Lasers (LELO), School of Dentistry, University of São Paulo, Cidade Universitária, São Paulo, Brazil.
	4	Brazil	1Federal University of São Paulo – UNIFESP – EPM, São Paulo, SP, Brazil
	5		1Department of Periodontology, Dental Sciences Center, Gulhane Military Medical Academy, Ankara, Turkey.
	6	Brazil	School of Dentistry, Federal University of Pará, Belém, Pará, Brazil
	7	US, UK	School of Dentistry, Federal University of

Results

The present bibliometric analysis was done in the PubMed database, a systematic literature search was done using keywords Laser in dentinal hypersensitivity. There was no restriction regarding year of publication of study. The applied strategy generated 285 articles. After careful screening by AA, total of 8 articles were found suitable for bibliometric analysis. Total of 277 articles were excluded after applying exclusion criteria: non-English articles, irrelevant articles on dentinal hypersensitivity and oral health, letters to editors, review articles, and articles that were unavailable in full-text were excluded. The bibliometric data was grouped into various categories which were illustrated in Table 1. From 1980-2022, a total of 277 articles about dentinal hypersensitivity and use of laser were published and indexed in PubMed but as per our exclusion criteria only 8 articles were found eligible. The majority of them were published in last 10 years only one was published in year 2004. The geographical distribution of publications included 6 countries/regions and majority of authors belong to Brazil (4 articles), followed by Turkey (2 articles), Europe (2 articles) and Sudan 1 article. Total of 44 authors contributed in 8 selected articles, maximum number of authors contribution was found in study done by Mayra de la Caridad Pérez et al., followed by T.C.C.G.P. Ladalardo et al. (18) authors found to be more influential author and accounted for 211 citations, next significant contribution was belong to Anely Oliveira Lopes et al. (17) and Nada Tawfig Hashim et al. (22) There were 13 keywords used in the 8 selected articles. This analysis was performed based on the terms extracted from the title and abstract fields of retrieved publications. The term with the highest frequency was Dentine hypersensitivity, followed by laser therapy. Out of 8 selected studies, 6 studies were randomized control trial while 1 was observational and 1 was uncontrolled trial.

Discussion

As far as we can tell, this is the first bibliometric study that analyzed the distribution of worldwide research on Dentinal hypersensitivity and laser through the database available, published and indexed in PubMed (<https://pubmed.ncbi.nlm.nih.gov>). It is important to emphasize that there was no restriction of periodicals in the surveys carried out in this study. Our assessment of cerebral palsy and oral health publishing trends covered a 1980-2021. Various authors performed a bibliometric analysis but received a minor contribution from the fields. (23, 24, 25). There was a marked growth in the number of publications over the last few years for the evaluation of articles on laser and dental hypersensitivity.

In 2018, there was a greater number of productions one being a Randomized Controlled Clinical Trial entitled "Evaluation of the effectiveness of lasers in dentinal hypersensitivity. Recently, as a result of the improvement in the laser technology, the lasers have emerged as a new treatment alternative for DH. With the invention of earliest ruby laser, lasers have become a new treatment tool and various types of them have been developed and tested. (15) Lopes *et al.* [15] treated hypersensitive teeth only with GCA desensitizer, Nd:YAG laser, and Nd:YAG laser with the GCA desensitizer in their clinical study and concluded that Nd:YAG laser with GCA is effective, and the positive results were unaltered even 6 months after

the initial treatment. (15) High power laser which is outstanding in the literature and clinic, in cases of treatment for the reduction of pain in dentin hypersensitivity, is Nd:YAG laser (17) Studies in the literature, which compare the use of Nd:YAG laser with other types of equipment or desensitizing agents, have shown its superiority. Dilsiz et al. (2010) evaluated the effectiveness of Er:YAG, Er,Cr:YSGG and a low-level diode laser as dentin desensitizers and concluded that all of them can be used to reduce dentin hypersensitivity. (17) Comparisons between the Nd:YAG and Er:YAG lasers have also shown the superiority of Nd:YAG laser in reducing patients' pain and occluding tubules. (17) In addition, according to the literature, only Nd:YAG laser appears to have an additional analgesic effect when compared with the other high power lasers. (17)

In studies of a 660 nm diode laser versus sodium fluoride²⁰ and a 660 nm diode laser versus an 830 nm diode laser, DH was similarly improved with respect to baseline in both treatment groups. In a study comparing Nd:YAG and 685 nm lasers, significant improvement was seen in both groups, although significantly greater reduction of sensitivity was reported for the Nd:YAG group at 60 days. (20) Based on the results obtained in the treatment of 8 articles, Diode laser (810 nm) provided a decrease in cervical dentine hypersensitivity. The therapeutic immediate and late effects of the diode laser 810 nm with 60 seconds exposure duration were greater than those of the 810 nm with 30 seconds exposure duration. The main limitation of our study was to include only articles in English and only one database for resources (PubMed). PubMed citations, however, come from MEDLINE indexed journals, journals/manuscripts deposited in PMC, and NCBI Bookshelf <https://www.nlm.nih.gov/bsd/difference.html>. The results of this first study that addressed this issue demonstrated that there is a lack of high quality and well-designed clinical studies such as cohort studies and randomized controlled trial contributing to the future of laser in oral health research.

Conclusion

This current network analysis indicates that while there is expressive growth in the number of publications about effect of laser, in regards to dentinal hypersensitivity, there is a lack of mechanistic and comprehensive trial research. Therefore, because there is a lack of interventional studies, including cohort studies and randomized controlled trials, it is necessary to include the laser and dentinal hypersensitivity population in high impact oral health investigations globally.

Acknowledgment

The researcher would like to thank the Deanship of Scientific Research, Qassim University, for funding the publication of this project.

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