UC Irvine

UC Irvine Previously Published Works

Title

The soft laser: therapeutic tool or popular placebo?

Permalink

<https://escholarship.org/uc/item/24h584m3>

Journal

Oral surgery, oral medicine, and oral pathology, 66(6)

ISSN

0030-4220

Author

Wilder-Smith, P

Publication Date

1988-12-01

DOI

10.1016/0030-4220(88)90311-8

Copyright Information

This work is made available under the terms of a Creative Commons Attribution License, available at <https://creativecommons.org/licenses/by/4.0/>

Peer reviewed

The soft laser: Therapeutic tool or popular placebo?

*Petra Wilder-Smith, Dr med dent, BDS (Hons), LDS RCS Eng,
Heidelberg, West Germany*

DEPARTMENT OF CONSERVATIVE AND PREVENTIVE DENTISTRY, UNIVERSITY OF HEIDELBERG DENTAL SCHOOL

Because of the alleged effectiveness of soft laser therapy in the treatment of a wide range of medical and dental conditions, it is becoming increasingly popular with both patients and practitioners. It was the purpose of this study to assess soft laser treatment of hypersensitive dentin, gingivitis, pulp-capped teeth, herpes labialis, and nausea. Clinical trials demonstrated no advantage in augmenting or replacing conventional treatment of these conditions with soft laser therapy, despite its positive effect on patient attitude toward treatment.

(ORAL SURG ORAL MED ORAL PATHOL 1988;66:654-8)

The use of soft lasers to augment conventional dental therapy has increased dramatically in recent years. They have been credited with a wide range of biologic effects* including:

- increased pain tolerance due to changes in cell membrane potential.
- vasodilation, leading to improved metabolism.
- earlier resolution of edema.
- immunostimulation.
- accelerated intracellular metabolism, e.g., activation of enzymes.
- overall stimulation of wound healing by selectively influencing connective tissue metabolism.

Soft laser therapy has been recommended for diverse dental conditions, including the following:

- alveolitis.
- oral ulceration.
- periodontal disease.
- herpes labialis.
- pericoronitis.
- pulpitis.
- hypersensitive dentin.
- nausea induced by dental procedures.

The therapy has also been used as an anticariogenic measure.

However, there is a dearth of reports in the literature on controlled in vivo studies of soft laser effectiveness in dentistry.

It was the purpose of this investigation to assess the therapeutic and analgesic effects of soft laser treatment on (1) hypersensitive dentin, (2) gingivitis, (3) pulp-capped teeth, (4) herpes labialis, and (5) nausea induced by dental procedures.

*See references 1, 2, 5, 13, 16, 19, 21, 22.

MATERIAL AND METHODS

A Voco PL 2 S Helium-Neon laser (Voco Chemie GmbH, Cuxhaven, West Germany) (output 6 mW, laser group 3 A) provided a constant or pulsed beam of coherent, bundled, monochromatic light (wavelength, 632.8 nm). During treatment, protective eyeglasses were worn by the operator and the patient.

The informed consent of all patients was obtained after the nature of the procedure, as well as possible discomforts and risks, had been fully explained. All soft laser treatment was carried out in accordance with the guidelines that have been published by Voco.²⁰

Hypersensitive teeth

In 20 patients, 97 hypersensitive, but otherwise sound, teeth that reacted to cold air from the three-way syringe received soft laser therapy (2.5 minutes at 5 Hz) for 3 consecutive days. After each soft laser treatment, patients were questioned about symptoms, and their response to cold air from the three-way syringe was evaluated as strong, mild, or minimal.

One week, 1 month after treatment, hypersensitivity was reassessed in the same way. No other remedies were applied to the teeth during the course of these investigations, and a regular dentifrice was used by the patients.

Gingivitis

The periodontia of 84 teeth in 10 healthy patients with gingivitis (sulcus bleeding index [SBI] >1,¹⁴ periodontal bone loss <10% and mobility <1) were investigated.

Fig. 1. Percentage of teeth with diminished hypersensitivity.

After initial assessment, all teeth underwent routine scaling and polishing procedures. Oral hygiene instructions were given by the operator.

With each of the patients, a second operator randomly selected one half of the periodontal units for soft laser therapy. On days 0, 1, 3, and 7, the designated areas were treated for 4 minutes (2 minutes constant beam, 2 minutes pulsed beam at 5 Hz). All other therapy was excluded during this time. SBI readings were taken by the first operator on days 0, 3, 7, and 30. The first operator was not informed which areas received soft laser treatment, and separate records were kept.

Direct pulp capping

In thirty patients between the ages of 18 and 37 years, thirty vital teeth with a pulpal exposure of less than 1 mm in diameter underwent standard direct pulp-capping procedures with the use of Dycal (L.D. Caulk Company, Dentsply International Incorporated, Milford, Delaware). A soft laser beam was directed at the pulp-capped site for 3 minutes (2 minutes constant beam, 1 minute pulsed beam at 5 Hz), and then appropriate amalgam restorations were placed in the teeth. Soft laser treatment was repeated during the following 2 days. At 1 week, 2 weeks, and 3 months after treatment, patients were questioned about symptoms; in addition, electric and thermal vitality tests were undertaken at these times.

Herpes labialis

Twenty patients complaining of prickling and burning sensations and demonstrating reddening

and/or swelling of the lip consistent with the early stages of herpes labialis received soft laser therapy on 3 consecutive days (2 minutes constant beam, 1 minute pulsed beam at 5 Hz).

Before and after each treatment session was conducted and for 8 additional days after soft laser therapy, signs and symptoms were recorded. Patients were informed that this treatment was intended to alleviate their symptoms; no other remedies were applied to the lesions during the course of these investigations.

Nausea

In 20 patients who experienced nausea during routine dental procedures, a constant soft laser beam of 3 minutes duration was applied to the appropriate acupuncture point on the chin.²⁰

Ten of the patients were told that this treatment would alleviate their nausea; the remainder consented to undergo soft laser therapy without being aware of its exact intended effect. Patient response was assessed by (1) measuring how far back on the palate a dental mirror was tolerated before and after soft laser therapy, and (2) assessing any change in patient response to the dental procedure that originally induced nausea.

RESULTS

Hypersensitive teeth

Patients described diminished sensitivity in 17 of 97 teeth after initial soft laser treatment (Fig. 1). After repetition of the therapy 1 day later, only 9 teeth were considered to be less sensitive by the patients; after a third soft laser treatment, this figure

Fig. 2. Effects of soft-laser treatment on gingivitis.

rose to 12. One week after therapy, this number fell to 6; 1 month later, 5 teeth were still considered less sensitive by the patients.

Clinical assessment by means of a cold stimulus showed an improvement in 4 teeth at the first visit and an improvement in 5 and 3 teeth at the second and third visits, respectively. One week after treatment, 6 teeth demonstrated reduced sensitivity; 1 month after treatment, this figure had fallen to 4.

Gingivitis

Before scaling and polishing procedures, the average SBI of the 84 teeth investigated measured 2.8 (Fig. 2). It decreased to 2.1 after three days and to 1.6 after seven days in the 42 teeth receiving additional laser therapy. At the one month recall visit, SBI measured 0.9.

In the control group, an SBI of 2.3 three days after professional tooth cleaning improved to 1.4 after seven days and registered 1.1 one month later. There was no significant difference between the two groups ($p > 0.1$).

Direct pulp capping

Of the 30 teeth investigated, all gave a positive response to electric and thermal vitality testing 2 weeks, as well as 2 months, after treatment. One patient complained of pain elicited by cold stimuli 10

days after capping procedures; the course of laser treatment was repeated and symptoms subsided completely. All other teeth remained asymptomatic throughout the observation period.

Herpes labialis

The labial lesions seemed to develop as usual, taking 6 to 11 days to heal. Neither patients nor assessors observed any divergence from the usual course of symptoms of the herpetic lesion.

Nausea

After soft laser therapy, 6 of the 10 fully informed patients were able to accept dental treatment that had previously evoked nausea, and on average, a dental mirror was tolerated approximately 1 cm further back on the palate than before. In the patients unaware of the purpose of soft laser therapy, none demonstrated any change in their tolerance of either a dental mirror placed on the palate or of dental treatment.

DISCUSSION

In setting up and evaluating this study, it was difficult to establish objective assessment and control criteria. Thus, a classic double-blind format was not feasible.

Hypersensitive teeth

It was interesting to note the discrepancies between the reduction in hypersensitivity reported by the patients and the insignificant improvement demonstrated by them in the clinic. One explanation might be that the cold air from the three-way syringe provided a stimulus more aggressive than normal events experienced by the patients. Alternatively, the possibility of a placebo effect must be taken into consideration, especially since the reports of the patients were more positive after their first laser treatment, whereas normally one would expect the cumulative effect of any therapy to provide a gradual improvement from visit to visit.

The elimination of hypersensitivity in 4 out of 97 teeth after 1 month compares poorly with the success rates of conventional therapies providing physical blockage of dentinal tubules by means of various varnishes and sealers. Recently, a group of authors^{11,18} reported the successful treatment of hypersensitive dentin with laser light 632.8 and 780 nm in wavelength. However, the energy levels provided by these lasers are too low to produce any changes in mineralized tooth substance or to affect the pulp in any histologically apparent fashion,¹² so that there, too, subjective factors cannot be excluded.

Gingivitis

No significant difference could be established between the periodontal units that received soft laser therapy and those that did not. In this investigation, each patient served as his or her own control, so that a fairly accurate level of comparison was possible. Thus, it can be said with a good degree of certainty that soft laser therapy provided no additional benefit in the treatment of gingivitis.

Laser light of this sort does not seem to inhibit pathogenic organisms,⁷ and its immunostimulatory action remains to be reproducibly confirmed,^{13,15} so perhaps these results are not overly surprising.

An *in vitro* study on periodontal healing,¹⁶ in which 904 nm laser emission was used, also failed to determine a histologic or a macroscopic effect of soft laser treatment, although numerous other investigations have demonstrated soft laser stimulation of collagen production in human skin and in fibroblasts.^{1,8} In these studies, the He-Ne-soft laser promoted healing to a far greater extent in patients with chronic conditions than in patients with acute lesions. Perhaps this provides a partial explanation for the reports by a few authors^{2,9,13,14} of successful

soft laser treatment for a wide range of periodontal problems. However, the method documentation, and especially the assessment and control of their subjects, appears slightly problematic; also, the extent to which any additional conventional treatment was provided remains unclear.

Direct pulp capping

The condition of the 30 teeth was good throughout the 2-month observation period.

Since the response and the prognosis of directly pulp-capped teeth are so unpredictable, it is difficult to evaluate the role played by the soft laser in this favorable outcome, especially since the very nature of the investigation precluded the establishment of standardized conditions and of a control group.

In animal experiments, soft lasers produce no histologic changes in the pulp,¹² and no anti-inflammatory effect has been reported; in any case, only a minimal fraction of the laser beam reaches the pulp because of absorption, reflection, and scattering.¹⁹

Herpes labialis

It was impossible to quantify the effect of soft laser therapy on these lesions and to set up controlled groups for direct comparison. However, both patients and the assessor thought that no obvious change in the usual course or symptoms of herpetic lesions could be established. Comparable results have been reported² with the infrared soft laser with a wavelength of 904 nm.

Little is known about any antiviral effects of the soft laser; certainly, we could find no evidence of either curative or palliative properties in these investigations.

Nausea

This investigation illustrates the psychogenic factor involved in nausea as a response to dental procedures. Six of the ten patients informed about soft laser therapy were better able to tolerate dental procedures and tactile stimulation of the palate, whereas those with neutral expectations showed no improvement whatsoever. The soft laser appears to show some promise in other areas of pain treatment and acupuncture⁶; however, our investigation did not provide any further information on this aspect.

The clinical ineffectiveness of soft laser therapy demonstrated in this investigation and in other fields of medicine^{3,4,16} appears to contradict the positive results of various *in vitro* and animal experiments

described in the literature.^{1,3,19} Thus, the question arises whether laboratory results are applicable to human beings in this field of work. A survey of approximately 40 animal studies showed a wide spectrum of reactions,^{3,19} which could be linked to a multitude of factors including dissimilar tissue structure and color, individual light absorption/reflection properties, and different dose-effectiveness relationships and susceptibility to light of different wavelengths.

In summary, we could find no benefit in augmenting conventional treatment of a wide range of dental conditions with soft laser therapy. However, patient response was favorable, and thus the soft laser assisted in establishment of psychological acceptance of dental procedures.

REFERENCES

1. Abergel RP, Meeker CA, Lam TS, Dwyer RM, Lesavoy MA, Uitto J. Control of connective tissue metabolism by lasers: recent developments and future prospects. *J Am Acad Dermatol* 1984;11:1142-50.
2. von Ahlften U, Anders A. Erfahrungen bei der Behandlung aphtöser und herpetiformer Mundschleimhauterkrankungen mit einem neuen Infrarotlaser. *Quintess* 1987;5:927-9.
3. Brunner R, Haina D, Landthaler M, Waidelich W, Braun-Falco O. Applications of laser light of low power density. Experimental and clinical investigations. *Curr Probl Dermat* 1985;15:111-6.
4. Brunner R, Landthaler M, Haina D, Waidelich W, Braun-Falco O. Experimentelle Untersuchungen zum Einfluß von Laserlicht niedriger Leistungsdichte auf die Epidermisregeneration. In: Waidelich W, ed. *Optoelektronik in der Medizin—Laser 83*. Berlin: Springer-Verlag, 1984.
5. Gamaleya NF. Laser biomedical research in the USSR. In Walbarsht ML, ed. *Laser applications in medicine and biology*. Vol. 3:1-173. New York: Plenum Press, 1977.
6. Grasser H, Museta H, Barth HH. Die Laserakupunktur bei Schmerzen im Gesichts- und Kopfbereich. *Dtsch Z Akupunktur* 1985;28:122.
7. Hubacek J, Cerna I. Wachstumsbeeinflussung einiger Mikroben durch He-Ne-Laser. *Acta Univ Palacky Olomouc Fac Med* 1984;107:321-6.
8. Kana JS, Hutschenreuter G, Haina D, Waidelich W. Effect of low-power density laser radiation on healing of open wounds in rats. *Arch Surg* 1981;116:293-6.
9. Kunin AA. Use of the He-Ne-laser in treating periodontal diseases. *Stomatologiya (Mosk)* 1983;62:26-7.
10. Laufer G, Haber S. Numerical analysis of the thermochemical tooth damage induced by laser radiation. *J Biomech Eng* 1985;107:234-9.
11. Matsumoto K, Funai H, Wakabayashi H, Oyoama T. Study of the treatment of hypersensitive dentine by GaAlAs laser diode. *Jpn J Cons Dent* 1985;28:54.
12. Matsumoto K, Wakabayashi H, Punato A, Shirasuga T. Pathohistologic findings of dental pulp irradiated by GaAlAs laser diode. *Jpn J Cons Dent* 1985;28:95-7.
13. Mester E, Mester AP, Mester A. The biomedical effects of laser application. *Lasers Surg Med* 1985;5:31-9.
14. Mühlemann HR, Son S. Gingival sulcus bleeding—a leading symptom in gingivitis. *Helv Odontol Acta* 1971;15:107-13.
15. Passarella S, Casamassima E, Quaglianella E, Caretto G, Jirillo E. Analysis of lymphocyte-salmonella interaction and effect of lymphocyte irradiation by helium-neon laser. *Biochem Biophys Res Commun* 1985;130:546-52.
16. Passi P, Terribile Wiel Marin V, Miotti F, et al. Gli effetti della luce laser 904 nm su lesioni indotte nella mandibola del ratto. *Riv Ital Stomatol* 1984;53:449-56.
17. Santoianni P, Monfrecola G, Martellotta D, Ayala F. Inadequate effect of helium-neon laser on venous leg ulcers. *Photodermatol* 1984;1:245-9.
18. Senda A, Gomi A, Tani T, et al. A clinical study on "Soft Laser 632". A He-Ne low energy medical laser. *Aichi-Gakuin J Dent Sci* 1985;23:773-80.
19. Visser H, Krüger W. Gibt es abgesicherte Wirkungen der Soft-Laser bei der Parodontalbehandlung. *Dtsch Zahnärztl Z* 1987;42:442-4.
20. Voco Information, Voco Chemie GmbH, 2190 Cuxhaven West Germany.
21. Yamada K. Study on caries prevention by laser irradiation in pediatric dentistry. *Shoni Shikagaku Zasshi* 1985;23:575-91.
22. Zhou Yo-Cheng. An advanced clinical trial with laser acupuncture anesthesia for minor operations in the oromaxillofacial region. *Lasers Surg Med* 1984;4:297-303.

Reprint requests to:

Dr. Petra Wilder-Smith
Department of Conservative and Preventive Dentistry
University of Heidelberg Dental School
Im Neuenheimer Feld 400
D-6900, West Germany