

Dentists' Perception and Usage of Laser Technology in Taif Region, KSA.

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Abstract: Aim: This study aimed to know the degree of using and accepting laser technology in the dental field among dentists working in Taif, KSA. Methodology: A random sample of about 120 dentists working in different locations in Taif were included. A specially designed questionnaire was utilized for data gathering, which reflected some of the respondents' personal and scientific behavioral characteristics, and their acceptance of laser technology. The questionnaire included the following: the degree of acceptance of respondents to laser use in dental treatment, the availability of laser devices, the degree of awareness of respondents to the safety precautions during laser use, the acknowledgement level of respondents of laser uses in dentistry, and finally to know the obstacles which prevented the respondents from using laser. Results: showed that more than half of dentists 53% accepted laser strongly, laser devices were found in only 9% of clinics all over Taif, only 35% of dentists had good knowledge level of laser uses, 33% had high awareness level of safety laser precautions, and finally 70% of obstacles to the use of laser were due to insufficient training and knowledge level, followed by the variety of laser types 52%. Conclusion: laser application in dental procedures is not common in Taif at the present.

Date of Submission: 01-02-2019

Date of acceptance: 18-02-2019

I. Review of Literature:

Laser technology has invaded different fields of medicine and is now being introduced to dentistry where dramatic changes in this scope have been made. Certainly, however, today's lasers offer an opportunity to deliver hard and soft-tissue treatments that, allow the patient to have easier experience (1,2). Principally, the aid of surgical lasers in dentistry has introduced efficient cutting of dental hard tissue, hemostatic ablation of soft tissue and also the sterilizing effect through bacterial elimination. Less powerful, non-surgical lasers have been shown to modify cellular activity and enhance biochemical pathways associated with tissue healing, help in caries detection and assist in the curing of composite restorative materials.(3,4). In particular dentists should consider a number of factors when deciding whether to incorporate laser technology in their practice or not. First they should realize that there are various types of lasers, namely; soft tissue and hard tissue treatment lasers (2,5). In addition dentists should feel free to adopt a new technology if it can be better to satisfy patients' needs, but other factors such as expenses, and experience can limit its application. (2,6). This assessment involves looking at the final risk-benefit result. Ethically laser treatment must show efficacy and an accepted risk-benefit ratio for it to be put in public use (7,8). Therefore one should keep in mind that both efficacy and effectiveness are required for the greatest confidence to be warranted. The wavelength of the light is the primary determinant of the degree to which the light is absorbed by the target tissue (3,4). Lasers produce light energy within a narrow frequency range. For most practical purposes, the light produced by laser can be considered to be monochromatic. Typically lasers are named according to the active element within them that goes through the stimulated quantum transitions, which create the light (8,9). Once the light from dental lasers is absorbed by tissues, it is converted to heat. The thermal effects of this heat depend in a great extent, on tissue composition that is the amount of water and organic / inorganic components in the tissue. The duration of exposure results in temperature increases that may cause the tissue to change in structure and composition. These changes may range from de-naturation to vaporization and or carbonization and even melting followed by recrystallization in case of hard tissue (3).

Wavelengths used in Dentistry: Carbon Dioxide Lasers CO₂ laser:operates at a wavelength 10.6µm, they can be operated in gated or continuous waveform, and can be used of in a number of soft tissue applications (10,11).

Neodymium Yttrium Aluminum –Garnet (Nd: YAG) laser operates at a wavelength of 10.064µm in a high intensity waveform , like the CO₂ laser the Nd: YAG laser has almost the same soft tissue applications (12). In addition the Nd:YAG laser can be used to remove incipient enamel caries, although not efficient like the other types of lasers (13,14). Erbium-Yttrium : Aluminum –Garnet (Er:YAG) , this type of laser operates at a wavelength of 2.94µm.in a pulsed waveform. The FDA has cleared it for the use in cementum and bone and it has a variety of hard tissue applications such as; caries removal, cavity preparation both in enamel and dentine, and preparation of root canals,as well as ablation of implant biofilm (6,15-19)

Erbuim , Chromuim : Yttrium Selenium-Gallium –Garnet (Er,Cr:YSGG), operates at a wavelength of 2.78µm. with an extinction length in water 1.0µm. it has a pulsed waveform. This type of laser has several hard tissue applications , such as; enamel etching, caries removal, cavity preparation, invitro bone cutting without melting , or alteration of calcium – phosphorous ratio, and in root canal preparation (20,21). The most encountered advantages of Er.Cr:YSGG laser are that it produces rough surface in enamel and dentine without being cracked. In dentine no smear layer remains that means good bonding as well as it is safe for pulp.(22)

Argon Laser: it operates at a wavelength of 457-502 nanometers, using a pulsed or continuous waveform. Argon laser can be used in a variety of purposes including resin curing and teeth bleaching.The primary advantage of Argon laser is that , the laser operates at a wavelength that is absorbed by hemoglobin, which provides excellent hemostasis (23,24)

Holmium : Yttrium Aluminum Garnet or Ho:YAG , this type of laser operates at a wavelength of 2.1µm.and uses a pulsed waveform. It is used for soft tissue incision and ablation procedures. Its main advantages that it focuses on the surface effect on tissues. The Ho:YAG laser is less penetrating than the Nd:YAG laser, therefore it is faster in cutting soft tissue. Although it has antimicrobial effects, yet it must not be used to decontaminate implants as it may damage their surface (25).

Gallium-Arsenide or Diode Laser, this type of laser operates at a wavelength of 904 nanometer (nm) and uses a pulsed or continuous waveform. It has been proved to be successful in soft tissue incisions and ablations, such as: gingival troughing, esthetic gingival contouring, gingivectomy, freenectomy, treatment of ulcers, and depigmentation of gingiva or gum peeling (26-29)

Taif University is showing a special concern about the study of introducing laser technology within its health research and applied systems, by the use of soft tissue diode laser (softlase), and the (Biolase) devices. The matter which makes it necessary to construct a field study including a questionnaire to assess the degree of acceptance and interest of dentists to use the laser and whether is it beneficial in providing high quality treatment due to its well- known advantages over the conventional methods of treatment. The protocolwas approved by the Ethical CommitteeofTaif University.

Aim of the Work

- 1-To define the acceptance levels of respondents for laser technology in dental treatment.
- 2- To encounter the availability of laser devices within practices in Taif.
- 3-.To identify respondent's levels of knowledge and usage of laser technology.
- 4-To determine the degree of awareness of respondents to the safety precautions during laser using
- 5- To clarify the obstacles for laser technology application in dental treatment.

II. Materials and Methods:

A random sample of dentists working in Taif; whether in the University, or governmental centers or private dental clinics was taken. A specially designed questionnaire was used to collect data, and a pre-test was conducted to check its fulfillment to the research goals. The questionnaire was composed of identified factors reflecting respondents' characteristics, their experience and training levels in the field of lasers , their acceptance level to the introduction of such technology , the safety precautions to be followed, the obstacles for laser application, and their benefits from application of laser technology.

Research variables were measured by the following:

- 1- Acceptance levels of laser technology (high level=3, moderate level =2, low level=1)
- 2- The availability of laser devices all over Taif region.
- 3- knowledge level of the use of laser in Dentistry (Practice=3, to some extent=2, doesn't practice=1).
- 4-Respondents' awareness level towards safety precautions during the use of laser (knows=3, to some extent=2, doesn't know=1).

5- Obstacles which the respondents face to apply the modern technology.(financial, administrative, technical, risks)

III. Results

Response Rate:

From the selected 120 dentists , only 100 who completed the questionnaire form and returned them back and were valid for our survey .

I-Personal characteristics of the respondents:

The personal characteristics of the respondents were shown in Table(1). The majority of respondents (67%) were males. About half of the respondents (50%) have been practicing for more than 15 years, while 40% practiced more than 5 years. Furthermore, 71% are general practitioner, specialist 15%, first specialist 6%, and consultant 8% . Those who had attended laser training workshops were few only 9%. Regarding sources of information for laser technology; was from internet , scientific conferences , exhibitions ,books and scientific journals,dental college, and finally laser training programs.

The awareness levels of laser benefits, according to their levels were high 14%, moderate 22% and low levels 64%.

Personal characteristics				
1-Gender	n=67males	n=33 female		
2-Experience years	50 more than 15 years	40 more than 5 years	10 less than 5 years	
3-Qualifications	Consultants 8	First specialist 6	Specialist 15	General practitioner 71
4-Training programs	9 attended	91 not attended		
5- Sources of information	1-internet 2-conferences 3-exhibitions 4-texts 5-college 6-training programs	60% 40% 35% 30% 25% 20%		
6- Awareness level of laser benefits	High levels 14%	Moderate 22%	Low level 64%	

Table (1) Personal Characteristics

Dentists' acceptance levels of laser technology:II-

As shown in Table (2) 53% of respondents agreed strongly to the necessity of laser use in dental practice. 25 % had moderate levels, while 22% accepted with low levels.

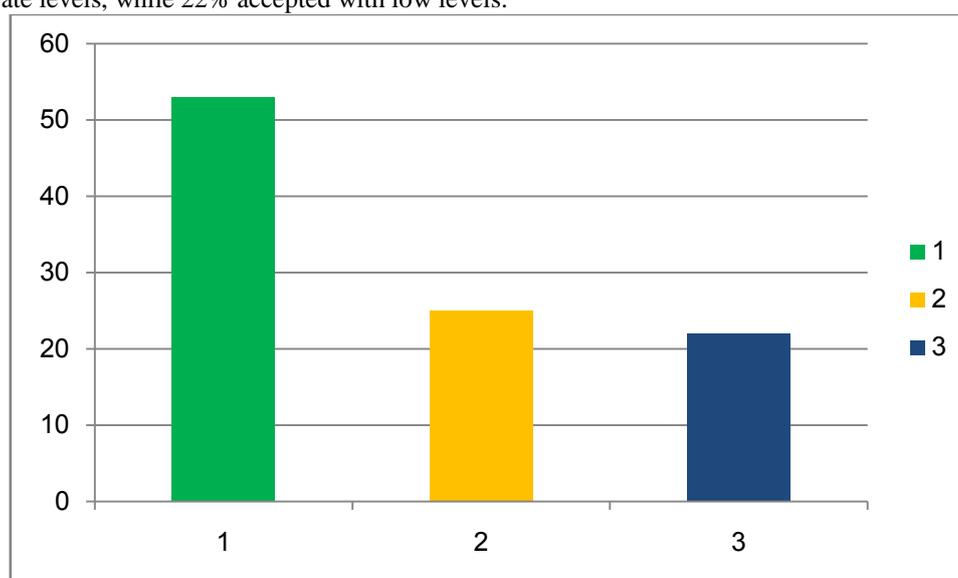


Fig. (2): Laser technology acceptance level

III-Availability of laser devices within dental practices:

Laser devices were found in 9% of dental centers included in the study, while going to be find in 11%, and is not present in 80%. Regarding the type of laser found is Soft tissue laser namely ; Diode laser, 66.6%, CO2 laser 33.4%.

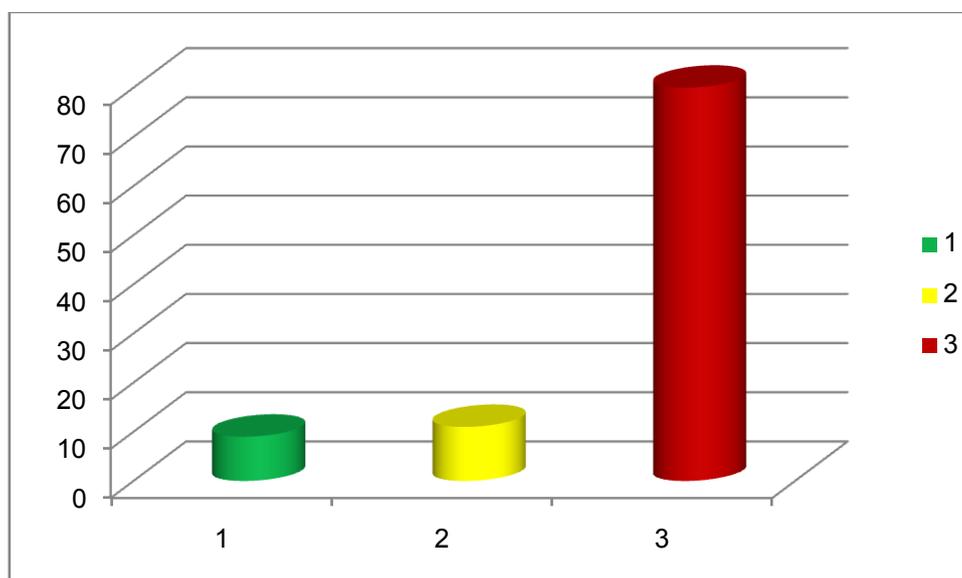
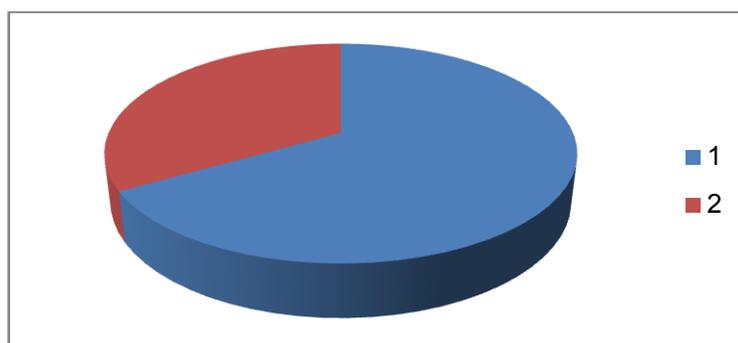


Fig.(3): availability of laser devices



Soft tissue laser was the only type available within dental centers in Taif region, 66.6% were the Diode laser devices, while 33.4% were the Carbon Dioxide laser device.

IV- Dentists' knowledge levels to the use of laser:

Results showed that 35% of respondents have a good knowledge level of laser use, while 45% have moderate level and only 20% have a low level of knowledge.

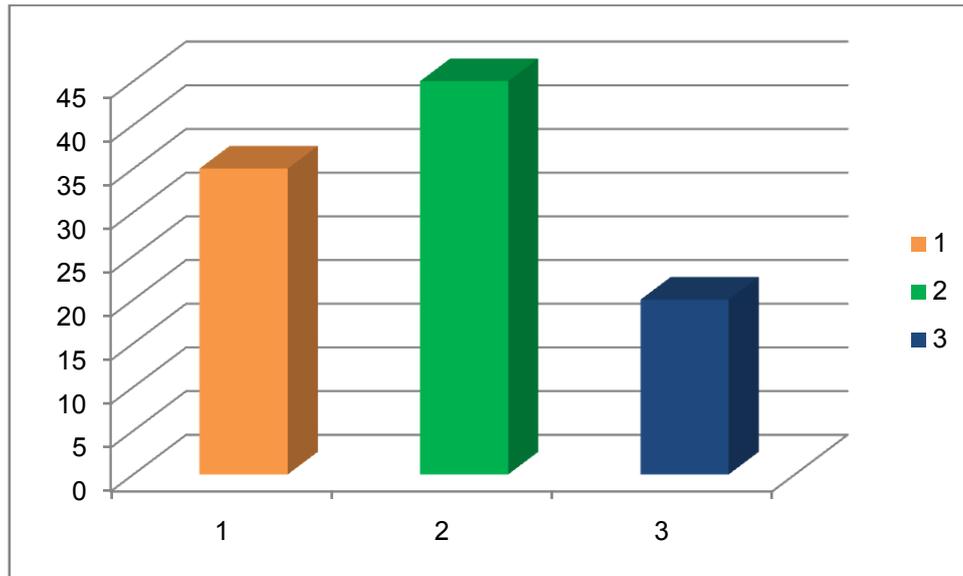


Fig. (4) Knowledge level for the use of laser

V-Respondents' Awareness Levels of safety precautions during laser usage:

As shown in figure (5) 33% of respondents have a high awareness level, while 27% have moderate level, and 40% have low awareness level of the safety laser precautions.

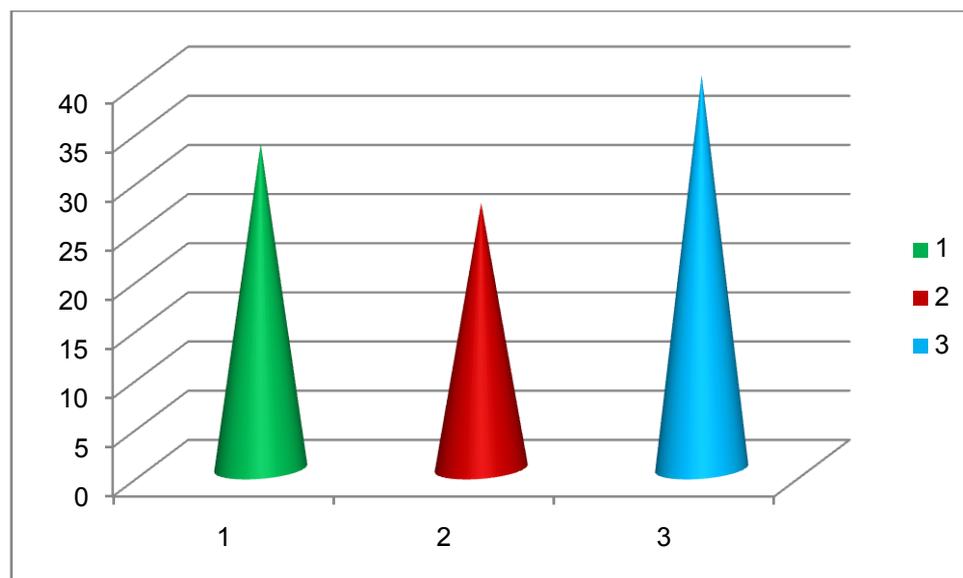


Fig.(5): showing the different awareness levels of laser safety precautions

VI- Obstacles for introducing and using laser technology in Taif Region:

The highest percentage was for the insufficient training and knowledge 70%, followed by obstacles related to the variations in types of laser devices 52%, then administrative obstacles 45%, absence of technical information 44%, financial obstacles 30%, and lastly fear of certain risks of laser using 25%. figure (6).

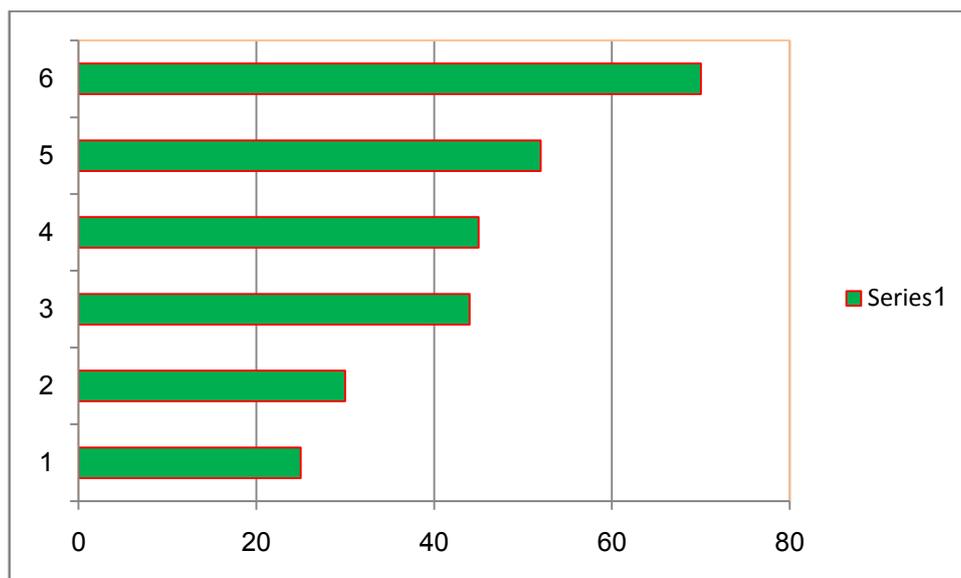


Fig.(6): Obstacles for introducing laser technology

IV. Discussion:

From our previous results, it was shown that more than half of dentists(53%) in Taif region are strongly accepting the introduction of laser in their dental practice.Regarding the awareness of laser benefits for the patients, dentists in general have reported positively towards dental laser, on the contrary a minor percentage of respondents, have claimed that patients would not benefit from laser application in dental procedure. This negative response might be due to the lack of knowledge and experience involving laser application in dental procedures. Those results were the same with what reported by Shing et al (2011)(30). Many types of lasers were not very familiar to the dentists and a big number didn't know any type of laser.Our study is in accordance with the research carried out by Bordea et al(2016)(8), Kravitz & Kusnoto(2008)(31) who indicated that the erbium and the diode lasers are the two most popular types of lasers that are used in Dentistry. Although in our study the most popular types are the diode and carbon dioxide lasers.

Tosun et al(2013)(32) and Jobair(2014)(33) reported that the knowledge about laser assisted treatment methods increases with the education level. Regarding sources of information the internet was the main source (60%), followed by attending conferences(40%), exhibitions (35%). Another possible reason was that it reflected the truth that dentists possessed a brief knowledge on dental laser only this was in accordance with previous studies in other countries (8,30&31). Since the trainings that the dentists had were mainly through lectures, the knowledge might not be as comprehensive as those acquired in courses or hands-on workshops. Considering the obstacles facing dentists in application of dental technology.It was found that the use of dental laser clinically, was not common in Taif (9%). There were similar hindering factors for the practicing dentists who were surveyed, and those not using dental laser but may consider using it in the near future and those who were not considering. This suggested that dentists have similar considerations when they make decisions in purchasing equipments, mainly being the lack of knowledge about laser application in dental procedures, and the cost of dental laser equipment, and this finding was the same with what was previously stated by other authors in other countries (8,30,32). Regarding the awareness of the risks encountered during laser usage and the safety precautions, only about one third of the respondents have high awareness level for the safety measures (33%), since it was considered something obligatory and not optional, there are some guidelines which must be followed during the utilizing of lasers (34,35) to guard against such hazards; ocular, respiratory, tissue damage, combustion , and electrical hazards(Gupta36, Saba37, Seifi38, Ekmekcioglu39).Finally, it was concluded that dentists in Taif, in general, showed a lack of knowledge about the different types of laser utilized in dentistry. This may be referred to lack of interest of dentists in laser physics, such that they were more focusing on the clinical applications.

V. Conclusions

More than half of respondents accepted the introduction of laser technology within their clinics. Less than one fifth of the dentists in Taif have been using laser in dental practices. Therefore, laser application in dental procedures is not common in Taif at present. The personal characteristics including additional dental qualifications, dental specialists, had positive relationships with dental laser usage in clinical practices. The majority of dentists who used dental laser had received training. Taif dentists' in-depth knowledge of laser

application in dental procedures was insufficient. The most hindering factor was the insufficient educational and training obstacles. In general, the awareness of Taif dentists towards benefits regarding laser application in dental procedures was positive.

VI. Recommendations

A similar survey should be re-conducted in five years time to discover if there will be an increase in the popularity in laser application in dental procedures and changes in dentists' attitudes towards dental laser. Response rate may be improved by conducting face-to-face interviews with dentists in future since more qualitative rather than quantitative questions can be asked.

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Prof. Mahitab Mahmoud Soliman” Perception and Usage of Laser Technology in Taif Region, KSA.” *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, vol. 18, no. 2, 2019, pp 74-81.