

Lasers in Dentistry: Where to Begin?

Shally Mahajan, Vipul Srivastava, and Donald J. Coluzzi

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Core Message

Lasers have emerged as high-technology instruments and very helpful tools in all aspects of our daily lives. They have been slowly incorporated by dentistry over the last three decades. Our patients have come to expect treatment that is high quality, minimally invasive, comfortable, and patient friendly. Fortunately, a practice that utilizes lasers can fulfill those goals. The purpose of this chapter is to discuss some of the benefits of adopting lasers into a dental practice, what the clinician must know before purchasing a laser, and concepts of revenue generation. Moreover, a practitioner who is apprehensive about adopting the technology should also find helpful information to help in making a decision.

1.1 Introduction

Light has always fascinated mankind for many centuries. There have been innumerable references to light being a source of healing and curing many diseases for ancient cultures. Many Roman homes featured solariums [1], while they and the neighboring Greeks took daily sunbaths. The use of light for photodynamic therapy enabled early civilizations to treat a variety of dermatologic conditions using photosynthesizer chemicals found in plants. Over 200 years ago, physicians in Europe offered similar therapy using both artificial and natural light [2, 3].

At present, laser *technology* has become associated within indispensable and diverse applications such as metrology, science and engineering, medicine, communications, art and entertainment, research work, defense, and astronomy. It is impossible to even imagine state-of-the-art physics, chemistry, biology, and medicine research without the use of radiation from various laser systems.

In 1989 the first laser model specifically designed for the dental profession became available for treating oral soft tissue. Since then, many different wavelengths have been introduced, and the practitioner can easily use them on both hard and soft tissues for both surgery and healing. This new technology greatly expands the scope of procedures while making them easier and more comfortable for patients. Encouraged by an ever-increasing evidence of the safe and effective use of lasers, there are a growing number of practitioners embracing the technology and appreciating how their patients can benefit.

The question in this chapter's title may be properly expanded into «why buy a laser and what do I need to know when I buy it?» The following sections should provide many details for that answer.

1.2 A Buyer's Guide for Choosing a Laser



While investigating a product for our personal use or a piece of equipment for our practice, several aspects should be considered. We check for the features, benefits, assets, and liabilities to help us make sure that we are paying the right value of the product. A well-thought-out decision leads to a better business operation and good management. Hasty decisions can lead to financial distress and instability in career and unnecessary emotional stress. Similarly, before investing in a laser, we can ask the following questions:

- ❓ *Is a laser worth the investment; in other words, is there value for the money?*
- ✔️ The first and foremost thing before buying a laser is to identify your practice goals because that will help you optimally understand the demands of your patient and how you would meet their expectations. Thus one response to the posed question is a multipart one: (1) Which procedures would I be able to perform with the laser that would produce beneficial results? (2) Can I

achieve a good return on my investment by an additional fee for the procedures that I already perform conventionally? (3) Are there new procedures I can perform? Another section of this chapter will discuss these points in detail. After that analysis, the answer about value should be very straightforward. In any case, and depending upon the various treatment applications, lasers are available in a variety of wavelengths, sizes, and competitive prices.

? *Where would I put the laser? What should be the room size for the laser unit to fit?*

- ✓ The answers to these questions depend on which wavelength will be used for the procedure you have planned. For example, lasers for hard tissue—tooth preparation and osseous surgery—have a relatively large footprint, approximately the size of a standard dental cart. These lasers have air, water, and main utility requirements similar to that cart so the room should accommodate those. Other lasers such as soft tissue diodes are smaller units and only need small plug in adapters from AC power mains or are battery driven. They can be placed on any available small flat surface. In fact, some of those units are compact to the point of being shaped like a thick pencil and are self-contained. Technological sophistication continues to be developed, but each unit will have its unique space requirements.

? *What is the laser's portability and ease of setup?*

- ✓ As a corollary to the previous paragraph, all lasers have a degree of portability. The large units all have wheels and the smaller units can be lifted with one hand. Some have a wireless foot control pedal and the others have multiple cables to connect. Nonetheless, any unit can be moved between operatory rooms. Setting up the laser follows prescribed steps. Along with various safety features, the start-up protocol takes very little time. The delivery systems have specific accessories that are simple to attach and the displays on main screen are easily readable. If there are buttons for presetting parameters, they can be customized for a particular procedure. Protective eyewear is essential for the surgical team and for the patient and any observer in the treatment area. These should be stored close at hand. Each of these steps should become routine so that the laser use becomes seamlessly integrated into any patient care where it's needed.

? *What's the quality of construction?*

- ✓ All of the units are manufactured for patient care with necessary industrial standards that regulate not only electrically powered devices but also dictate infection control requirements. The quality of construction on every laser should be very high, although some components will wear with normal use. A main concern of the practitioner is likely to be how comfortable the delivery system is to handle. Some devices have small flexible optical glass fibers, while other lasers have larger hollow tube assemblies. All terminate in a handpiece and some have small tips or tubes to direct the beam toward the target tissue. Your hand should not fatigue while performing lengthy procedures and the handpiece should be able to reach in all the areas of the mouth. You should be able to perform the range of clinical procedures desired with ease and precision.

? *What are the safety features?*

- ✓ All dental lasers are well equipped with built-in safety features subject to rigorous rules. Some examples of these features are an emergency stop button, emission port shutters to prevent laser emission until the correct delivery system is attached, covered foot switch to prevent accidental operation, an adjustable control panel to ensure correct emission parameters, audible or visual signs of laser emission, locked unit panels to prevent unauthorized access to internal components, key or password protection, and remote interlocks to minimize the risk of accidental exposure. Clearly, the practitioner must be familiar with these protective items, and a laser safety officer must be appointed to supervise the laser's operation.

? *What is the cost of operation?*

- ✓ Aside from the initial investment of the device, each procedure will have a cost while performing a procedure. Some items or accessories are single use. An example is a tip for a diode laser; these tips are available in multiple diameters and lengths. One tip can generally be used for one patient visit, although treatment of multiple areas may require more than one tip. Other components are designed as long lasting, but could require replacement. An example is the delivery system itself. Optical fibers can lose some transmissive capability over time; some handpieces have mirrors or other components that

degrade. Protective glasses can be scratched or damaged from repeated use. On the other hand, the active medium of the laser and other internal parts generally show little or no wear throughout the life of the laser. While the tip cost is a small percentage of the fee, other items can be a significant economic factor for the practice. In every case, the manufacturer should be able to service the unit and offer replacement parts when necessary.

? *How are the parts sterilized or disinfected?*

- ✓** It is extremely important to follow the manufacturer's instructions for infection control to prevent any cross contamination from patient to patient. Some components of a laser, especially those that are in direct contact with oral tissues, are either autoclavable or disposable. The handpiece is an example of the former, and the single use tips are disposable. Other areas like the control panel and the delivery system can be

protected with barriers and subsequently disinfected with standard spray on liquids. The protective safety glasses can also be disinfected.

1.3 Integrating a Laser into Your Practice

Lasers have provided a new cutting-edge technology to the dental world. It is truly amazing to think about how such an investment like this could have such a huge impact on clinical practice. Incorporating lasers into conventional therapies helps in better prognosis and treatment outcomes. Lasers began as alternatives for soft tissue oral surgery and have expanded into all aspects of dentistry: orthodontics, endodontics, oral and maxillofacial surgery, periodontics, aesthetic dentistry, restorative dentistry, prosthodontics, dental implantology, and pediatric dentistry. In addition, low-level lasers can be used as adjuncts to treat chronic pathologies and within photodynamic therapy to treat infectious disease.



Several factors are presented for consideration about how a laser can be incorporated into a practice:

- *Identify your practice.* The first and perhaps foremost concept before buying a laser is to identify how you practice. Your treatment planning is based on the patient's oral health conditions, and the goals of your care will help improve or maintain that health as well as meet their expectations. Your clinical experience and scope of practice usually determine which procedures
- *Analyze what procedures do you currently perform that can be assisted with laser technology.* A dental laser can help you provide a higher level of care. In restorative dental procedures, management of soft tissue is

you perform, and a list of those should be studied so that you can begin to choose a laser instrument. Likewise, you may have thought about the addition of other newer treatments that will expand your services. Those could affect the type of laser you purchase.

- *Analyze what procedures do you currently perform that can be assisted with laser technology.* A dental laser can help you provide a higher level of care. In restorative dental procedures, management of soft tissue is

simplified because the tedious and painful placement of retraction cord can be eliminated. Better impressions are possible for indirect restorations such as crowns and bridges, and clearer margins near the gingiva are revealed for optical scanning. Class V carious lesions can be prepared at or near the subgingival level with excellent hemostasis. This ensures an improved bond for composite materials and ultimately results in better aesthetics and a longer-lasting restoration. Two minutes of disinfection treatment of an aphthous ulcer brings immediate relief to the patient who may have been suffering for days. Excellent hemostasis can be achieved during minor surgical procedures like an immediate loading implant or second-stage implant uncovering.

- Not only is there a clean dry operating site, but the improved visualization will save time for the other steps of the treatment. All this will save your time. Also, by differentiating your practice, you'll attract a more educated client. Patients associate laser procedures as less invasive leading to a better overall dental experience and once treated will refer their families and friends. There is easy return of investment as the procedures are made simpler and easier.
- *Think about which procedures that you do not perform that you would like to provide if you had a laser.* Within your scope of practice, there are procedures that can be accomplished with dental lasers in your office that you previously may have referred to a specialist and/or did not offer to your patients. Of course, proper training is necessary before you begin any procedure and is especially important when you are attempting a new one. However, understanding the fundamentals of the wavelength and watching the interaction as it happens will provide clinical experience and confidence for the clinician to continue offer additional treatment options at chairside. Endodontic therapy can be aided by both laser debridement and pathogen reduction. Examples of laser soft tissue excisions are numerous: a removal of fibrous tissue in an irritation fibroma and epulis in the soft tissues of patients wearing removable prosthodontic appliances, operculectomy treatment of an unerupted tooth, a frenectomy to prevent further adult periodontal problems, releasing a tongue tie in infants, and revising the frenum in a child's diastema to aid proper tooth positioning. Oral surgical procedures such as oral sub-mucositis fibrosis, lichen planus, and leukoplakia can also be performed. Lasers can also be used for aesthetic enhancement of the patient's smile by minor recontouring of gingival tissue, laser tooth whitening, and removal of depigmentation in the soft tissues. Osseous crown lengthening for treatment of altered passive eruption or to obtain adequate tooth structure for a restoration can proceed with the all-tissue lasers [4]. During the initial alignment phase of orthodontic treatment, low-level laser therapy (LLLT) can be given to patient as it has shown to accelerate the tooth movement and also to relieve the discomfort that occurred during the initial arch-wire changes [5]. That

same effect, also known as photobiomodulation, can be used in patients with bruxism, temporomandibular joint disease, acute abscess areas, and many more applications [6]. One of the biggest hurdles while taking diagnostic records, impression making, or intraoral radiographs is gag reflex, which can be particularly strong in some patients. Low-level lasers are a boon in such cases; using lower doses of laser energy helps in minimizing the reflex [7]. When all these benefits are explained in detail, there is no doubt the patient will accept the planned treatment. The increased revenue also helps to satisfy a further return on the initial cost of the laser.

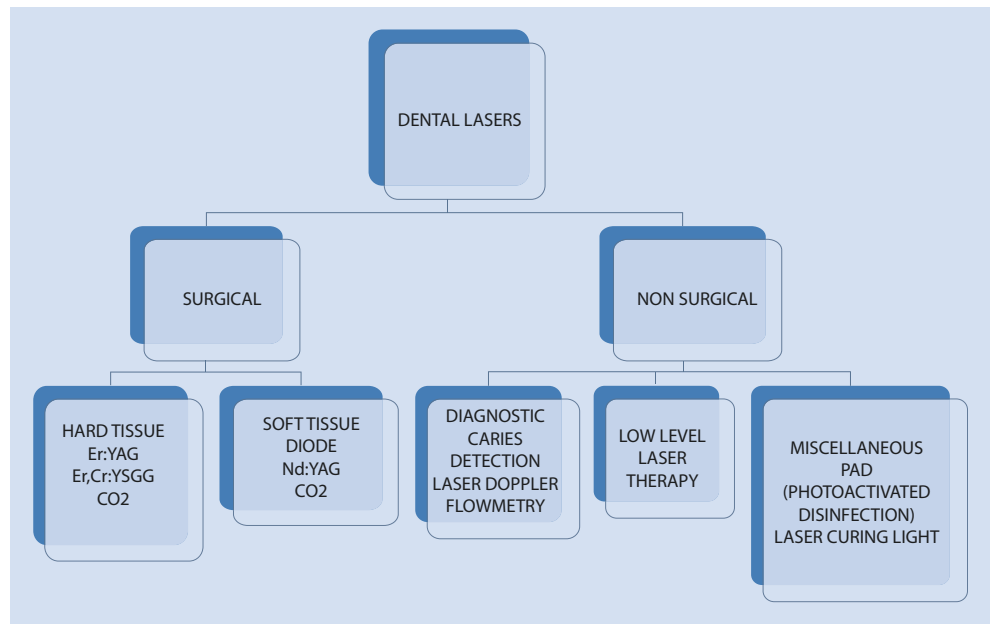
- *There are several choices of laser instruments.* There are many lasers available for purchase. Their availability can be dependent on regional regulations of sales and clearances, along with support of service and training. There are worldwide standard and consistent classifications so that basic choices can be made. A generic division describes dental lasers as either surgical or nonsurgical, and they are sometimes termed high level and low level, respectively. ■ Figure 1.1 shows a simple flowchart of the basic categories of those classifications.

After analyzing your practice's procedures, you can become familiar with how each available laser could be utilized.

- *Prioritize your clinical needs with respect to how a laser's use would be of benefit.*
 - In a modern dental office, a patient has certain expectations: treatment should be less painful, more precise, and less invasive with less bleeding, better healing, and fewer appointments. Fortunately, the practice of dentistry has been revolutionized and modernized so that our procedures have become more patient friendly. With the incorporation of this device, an anxious patient feels more confident, and there is noise-free or no vibration of the drill or smell of conventional dental care, with the fact that much of the treatment can be performed with «no anesthesia» or «needle-free» dentistry. These factors could transform patients who were resistant to conventional treatment into ones who readily accept treatment. Also in the future, we can expect more referrals to the practice, thus, proving lasers to be a safe investment and a true value for the money.

If your practice is focused on oral hygiene maintenance (sulfur debridement), prosthodontic or restorative tissue management (gingival troughing), or aesthetic procedures (crown recontouring, gingivectomy, gingival depigmentation, and laser whitening), a diode or a Nd:YAG laser would be ideal. The small-diameter fiber optic contact delivery can be safely used on soft tissue with minimal interaction with hard tissue. For the restorative practice and conservative dentistry, the erbium family (Er,Cr:YSGG, 2780 nm, and Er:YAG, 2940 nm) and the 9300 nm carbon dioxide lasers offer a wonderful alternative and adjunct to the dental bur. A specialty practice that is mainly focused on oral and maxillofacial surgical

Fig. 1.1 A graphic representation of the type of dental lasers. The surgical lasers have output power sufficient for incision, excision, ablation, and coagulation of dental tissues, whereas the nonsurgical lasers will not perform those procedures. A few surgical devices do have capabilities for low-level laser therapy



procedures, or periodontal surgery, the aforementioned tooth cutting lasers perform osseous surgery safely and rapidly while minimizing potential thermal damage to adjacent tissues and the blood supply. In addition to those instruments, the 10,600 nm carbon dioxide laser is often used for precise and rapid cutting during soft tissue surgery.

The clinician is constantly assessing and assimilating patient's needs and satisfaction while deciding on the proper treatment [8]. When choosing to add a laser to the procedure's protocol, certain wavelengths have advantages over others. To be clear, any of the available laser wavelengths are suitable for soft tissue treatment. But if the dentist treats both soft and hard tissues, only the erbium or the 9300 nm carbon dioxide instruments will provide necessary energy and tissue interaction for those dental procedures.

— *There is no single perfect laser wavelength.* Currently there are over two dozen indications for the use of the various dental wavelengths, as listed in the different manufacturer's operating manuals. There are often many discussions in the profession about which laser is the best, as well as debates about how all lasers are the same. It should be clear that although similarities exist, every laser wavelength has some unique properties compared to another. When asked the question about which laser is best, a proper answer could be the one you know how to use in your practice!

One thing which must not be forgotten is that there is «no perfect laser.» It is simply because the absorption characteristics of the photonic emission by a particular wavelength are different for the same tissues. Although every laser can be used for soft tissue surgery, a very fibrous area will be difficult to cut with a diode laser but will be easily incised with carbon dioxide. On the other hand, a diode can perform aesthetic

contouring of gingiva adjacent to a natural tooth without interacting with the healthy enamel, but the carbon dioxide wavelength could damage that same enamel. Erbium lasers are very highly absorbed by water, which allows the easy removal of a carious lesion. However, highly fluoridated enamel can be more challenging to ablate because of the minimal water content. In addition, the laser's output can be a factor during treatment. Some procedures need only minimum energy levels; an example would be when desensitizing an aphthous ulcer. Likewise, photobiomodulation effects are performed at power densities well below any threshold of surgical cutting. In contrast, tooth preparation requires very high peak powers and very short pulses for efficient removal of the mineralized material without thermal damage.

Therefore, before investing, all of the factors just discussed should help the clinician to identify what kind of laser is best suited for one's practice.

1.4 Sales, Training, and Company Support



The laser manufacturer is engaged in a highly competitive business with a limited market of purchasers. The sales team must be transparent and honest about their product's performance and avoid unrealistic assurances about everything from clinical efficacy to availability and shipping time for the device. The company's representatives should have a sound knowledge of the laser's operation so that they can initially demonstrate how the laser is set up along with knowing how to help in case of troubleshooting a problem. Customer support representatives should be available to answer questions and solve problems.

Training and continuing education opportunities must be available. Some companies have formed institutes that provide training for basic and advanced procedures, along with such features as educational resources, a discussion forum, examples of clinical cases, and other digital learning. Others sponsor courses and workshops during larger dental conferences.

It would be useful to know how long the particular device has been commercially available for purchase as well as to learn about the company's track record of efficiency, reliability, and service. Some companies have a global market, but local support in your country or state would be very desirable. Regional dental suppliers can also represent the company to provide sales and service. Since those suppliers already have a relationship with the dental practice, this could facilitate good support.

The operating manual enclosed with the laser is the guidebook for its use and describes the clinical procedures for which the device may be used. This is sometimes termed «indication for use» and simply means that there is solid evidence for safety and effectiveness, as opposed to «off-label» treatment. All sections should be well written. Instructions should include the range of operating parameters for each procedure for the wavelength's use. Those settings are always guidelines and suggestions for modification should be listed. Factors such as beam diameter versus output power, approximate time of exposure, and varying tissue interaction must be considered. The steps necessary for the assembly and disassembly of the delivery system should describe every detail. The care and maintenance of each component of the laser should be illustrated. Warnings, precautions, and troubleshooting procedures should be explained, along with contact information for support.

As previously mentioned, there are various accessories necessary for using a laser. These include delivery system tips, foot control pedals, keys, interlocks, and protective eye-wear. The initial and replacement cost of these items as well as any maintenance and availability should be noted. In some cases, accessories are optional and have additional costs.

Those can negate an initial attractive initial price of the laser itself. Likewise maintenance can be included for a period of time in the purchase, but a contract for service beyond that may incur a fee.

The warranty period should be clearly stated, and the dentist purchaser should thoroughly understand the terms and conditions. Lasers are designed for precision delivery of photonic energy, and the device is generally well constructed. However, any portion can be damaged with normal use and accidental breakage can occur. Warranty is a promise provided by the manufacturer to repair or replace the instrument if necessary within a specified time. That promise may stipulate what repairs are covered in specific circumstances.

The laser's operation is governed by software control of the internal components. Many companies offer updated versions of their software and may include them in the purchase price. Likewise some of the hardware may undergo modification, and it would be prudent to determine if any retrofitting or upgrades are appropriate and available for the model of laser purchased.

1.5 Education and Knowledge

A prudent question to ask is «how much training and do I need?» The simple answer is that you should continue to acquire knowledge all during your dental career. The elusive secret to success has always been to achieve better quality of patient care. That achievement can only be found with lifelong learning. It starts with the sessions offered by the laser manufacturer after purchase. Unfortunately some of these are simply didactic lectures available on playback media. Hands-on simulated exercises on animal tissue followed by over-the-shoulder supervised patient care are very superior learning methods. Whichever methods of initial training are taken, simple procedures performed with minimum power settings will help to overcome your fears and increase the level of your skills. Observing the rate of tissue interaction and the progress of reaching the treatment objective may appear to be at a slower pace than you first expected. Your patience will be rewarded; in fact, a slow sweeping motion for tissue removal is usually preferred. Moreover, you will avoid unnecessary thermal damage while precisely cutting and contouring tissue; and that will produce a successful outcome. That continuing journey toward mastering how a procedure is performed can bring you a lot of satisfaction. During that time, your range of comfort with all procedures will certainly increase.



For continuing education about the use of lasers in dentistry, a number of opportunities are available. Local study clubs and regional academies have regularly scheduled meetings where members can share information. Many major dental conferences feature presentations and workshop courses. There are university-affiliated programs which both offer information and assess competency. Advanced programs, fellowship, mastership, and MSc programs are offered in many countries. A document entitled «Curriculum Guidelines and Standards for Dental Laser Education» was developed in 1993 and is often used as a reference for these learning opportunities [9].

Finding a mentor would be a bonus for any laser clinician. There's no faster way to improve your skills and knowledge than to have someone to guide you as you work on your goals. That person should have the right attitude about teaching along with the experience to demonstrate the proper way to perform the procedure while correcting any of your deficiencies. Your confidence in delivering care will also increase. In addition, you can gain insights about new techniques and treatments.

Another question that can be asked is «what are the rules for laser use?» The response is that various regulatory agencies exist to ensure safe and efficacious use of lasers for the health and welfare of patients. The practitioner must have knowledge of those regulations and comply with their provisions. A review of those is presented here and will be detailed in ► Chap. 5 on laser safety.

- Regional or local bodies issue a license to practice dentistry to a properly qualified dentist. That award allows the dentist to offer dental care according to the scope of practice—i.e., the general or specialty services that are provided. That care is delivered in a manner that is based on the practitioner's training, education, and clinical experience. It should be remembered that «laser

dentistry» is not a recognized specialty; in contrast it is a description of using an instrument during a procedure.

- Certain agencies control the manufacturer and their products, but do not control the practice of dentistry. One example is the US Food and Drug Administration through its Center for Devices and Radiological Health that regulates the construction of the laser to ensure compliance with medical device legislation. That same agency awards the manufacturer a marketing clearance for a procedure which states that the treatment where the laser is used will be safe and effective.
- The International Electrotechnical Commission prepares and publishes international standards for all electrical, electronic, and related technologies that include regulations and conformity assessment for lasers in a similar manner to the Food and Drug Administration.
- Both of these organizations strongly influence regulatory agencies in other countries.
- Currently there is no common agreement about what defines a proper credential for a dental laser practitioner. Some local licensing jurisdictions have a course requirement. A small number of dental schools have introduced laser care into the predoctoral curriculum.

Evidence-based dental practice comprises an equal combination of the integration of clinically relevant scientific evidence, the clinician's experience, and the patient's treatment needs and experience. Regarding dental lasers, the peer-reviewed literature offers an abundance of studies, clinical cases, and meta-analysis. Some reviews proclaim controversies that exist with regard to superiority of incorporating lasers into the treatment protocol. However, many manuscripts using

controlled clinical studies do show effectiveness of these instruments. The laser practitioner should be familiar with as much of the literature, published articles, case reports, and scientific reviews that are readily available online or offline. Less reliable blogs and forums can offer information and networking about personal experiences. All of those resources contribute to evidence that has a place in the hierarchy of learning. The knowledge of how a particular wavelength would serve the purpose will be very beneficial to the success of your practice.

1.6 Investing in Your Team

Nurturing your employees is an important part of creating an engaged workforce. Invest in their personal and professional development and it will pay handsome dividends down the line by giving you a happy, capable, and productive team in an optimized practice. Your patients will immediately notice the professional and friendly atmosphere where you have created a healthy working environment with a caring and holistic approach toward their treatment.

Everyone on your staff from the receptionist and administrators at the front desk to the clinical team of assistants, hygienists, and other associated doctors must be educated about dental lasers.



With proper training and experience, they can answer any of the patient inquiries about how a laser might be used for treatment. They can increase the patients' awareness of the advantages and limitations of the technology. They can also address any apprehension about a procedure. Interestingly, many people are familiar with lasers because of previous medical procedures; and a few have expressed a misunderstanding about the word radiation as it represents the last letter in the laser acronym. Regarding the latter, a well-informed staff member can clarify the fact that dental lasers do indeed emit radiation in the thermal portion of the electromagnetic spectrum and not in the ionizing portion used for radiographs. The entire team would benefit by attending an introductory course about the use of lasers in

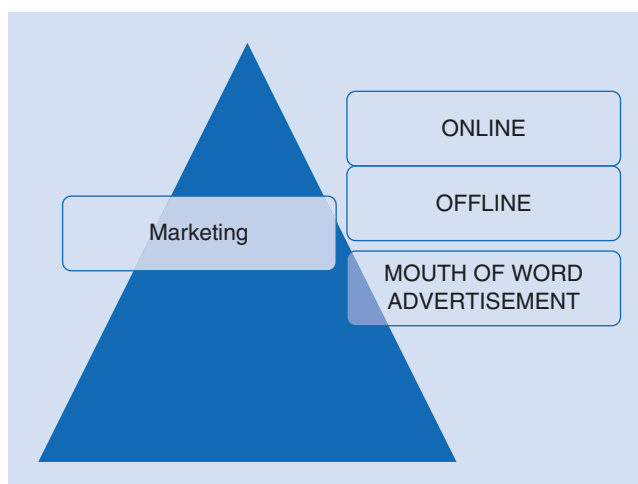
dentistry as well as being actively interested in other continuing education offerings.

1.7 Marketing

One of the secrets to a successful practice lies in its marketing. Marketing is a process by which a product or service is introduced and promoted to potential customers [10]. It is the best means to make people aware of the quality of service being provided. The overall marketing umbrella covers advertising, public relations, promotions, and sales.

There are mainly three methods of marketing, namely, online, offline, and word of mouth. The latter is sometimes termed «internal marketing.» Online marketing uses the Internet, e-mail, social networking websites, and blogs as online channels for delivering marketing content to the public. Offline marketing is disseminated through the «conventional» media: radio, television, and print ads. Word-of-mouth marketing is the best of the three approaches for any dental office. The starting point is that the staff or team must have knowledge of the practice. A written strategic plan composed of a vision, mission statement, goals, and objectives will certainly provide a framework for that knowledge. Each employee should be able to articulate the fact that the entire office constantly stays updated with current innovations and procures the latest technology to ensure the best treatment, care, in a comfortable environment. That in turn will clearly influence how the patient will speak about the practice, encouraging friends, neighbors, and relatives to seek dental care there.

For the best results, all three modalities should be incorporated in a marketing plan. For the first two portions, you also may consider promoters, publicists, and professional marketing outlets to support any of your large-scale promotion efforts. Obviously, a budget must be prepared so that the dollars necessary for any of the above are well spent. However, word-of-mouth marketing usually just involves spending some time inside the office to ensure a consistent and high standard of delivery of dental care.



Lasers can be an excellent marketing tool. In a surgical case, the dentist who utilizes a laser is no longer bound by conventional treatment that always involves injectable anesthesia, along with bleeding, and sutures. Instead the patient can be treated with the alternate laser technique that may require minimal or no anesthesia, with no bleeding, and minimal to no suturing. Similarly, for restorative dentistry, the traditional cavity preparation with rotary high- and low-speed drills and burs can give way to laser ablation of the carious lesion and preparation of the preparation margins. As an additional benefit, some of the treatment can be also performed with less anesthesia and more patient comfort.

Patients are becoming more techno-savvy these days, and because of that, they can spend an inordinate amount of time researching dental treatment options on various online portals with varying degrees of opinion and education. Nonetheless, they gain knowledge about their options; and they rarely oppose treatments with laser if given a choice. They know and understand that the technology is up to date and it can provide faster, more comfortable dental care while achieving those better results in less time.

1.8 Why Lasers in Dentistry

Lasers are in common use in every aspect of our lives, be it military, industrial, or medical. Now in its third decade, laser dentistry is no exception. The term laser itself evokes a positive response in patient's mind. Possibly because of prior experience with other medical procedures, the patient will associate the treatment performed with the instrument as very beneficial. Laser dental care can be quicker and more efficient along with markedly reduced pain, lack of bleeding, minimal need of anesthesia, and last but not the least minimal postoperative discomfort. The patients can resume their daily activities shortly after the treatment is rendered [11].

? *Why should I buy a laser?*

- ✓ The dental laser should become part of the practitioner's armamentarium. The photonic energy, with its unique properties of monochromatism and coherency, transmitted through an ergonomic delivery system, becomes a novel instrument for dental care. When used with proper knowledge, understanding, and correct training, it can function as an integral part of any dental treatment appointment. The clinician can have assurance that each laser procedure is being safely and easily performed without some of the disadvantages that were present when the scalpel or electro-surgery was used. Two examples can be listed: disinfection during a laser incision versus a bleeding scalpel cut and safe removal of tissue during laser implant fixture exposure versus certain damage with an

electrosurgical tip. In addition, for those who challenge themselves to constantly better their skills, a laser is a must «have» for them—not as a «gadget,» but as a surgical instrument.

? *What difference will it make for my patients and myself?*

- ✓ The incorporation of technology in dentistry has improved the way we serve our patients. Digitized radiographs are replacing traditional radiographs, diagnosis is done on 3D model of teeth and bone (CBCT) and single sitting root canals, and CAD/CAM technology is gaining popularity. All these advancements including lasers are being incorporated to improving the dental care provided to the patients on daily basis [12]. Dental pain is scored among the world's first ten phobias. In some patients, just the sight of dental chair, the whining noise of air rotor, or the white coat of a dentist can create panic attacks. Dental lasers make a huge difference in the life of such patients since they can reduce the level of stress and anxiety [13] and help a clinician to deliver the best of dentistry. As an added benefit, it has been shown that lasers can help to provide neural blockage leading to analgesic effect and anti-inflammatory effects [14].

? *Will it be income generating?*

- ✓ Dental lasers can help the practitioner to formulate treatment plans for the benefit of the patients. As mentioned previously, the existing procedures will be improved and new or previously referred treatments can be offered. The dentist may necessarily increase the fee schedule to reflect the additional cost of the laser purchase, but that adjustment should be explained by simply enumerating the benefits of using the instrument.
- ✓ The surgical procedures are generally shorter than traditional surgeries and are usually performed on an outpatient basis. Patients usually have less pain, swelling, and scarring than with traditional surgeries. This makes a huge difference in the quality of life of patient since there is usually no long recovery period. Just as important, the practitioner can be more efficient because the surgical appointment and necessary pre- and post-procedure protocol is less complex and time consuming. Thus there could be more time available for other patients which will in turn generate more revenue and help to grow the practice. An additional advantage is that multiple procedures may be performed during one visit, thus increasing production. It naturally follows that more patient's acceptance of a proposed treatment, coupled with a positive, comfortable, and healthy outcome, will result in confident referrals of new patients to the practice.

? *When should a laser be used?*

- ✓ The clinician should know the indications for the use of the laser. This textbook will describe all of those in detail. Continuing education will certainly provide suggested techniques and protocols. When reviewing the steps necessary for a procedure, there should be an analysis of how the laser could be used either as an adjunct or as monotherapy. Equally importantly, the instrument and all of the needed accessories should be easily obtained—within reach or stored close by—so that it can be inserted

into the procedure. As the clinician continues to utilize the laser, it will become essential in the armamentarium. For some treatments, it can be substituted for other instruments; in other procedures, it can be used adjunctively. Likewise, the experience of repeated use will result in confidence in delivering excellent patient care. Indeed, the laser will become the smart investment that was hoped for during purchase. ■ Figure 1.2 shows a small sampling of clinical procedures where a laser can be used. In every case depicted, the laser was used instead of conventional instrumentation.



■ **Fig. 1.2** a Preoperative view of hyperplastic tissue present during orthodontic therapy. b Postoperative view showing tissue removal, with more normal periodontium. c A preoperative view of a wide maxillary diastema with frenum involvement. d Photo depicting the healed frenum revision, gingivectomy, and good progression of orthodontic alignment. e A low-level laser is used for treatment of temporomand-

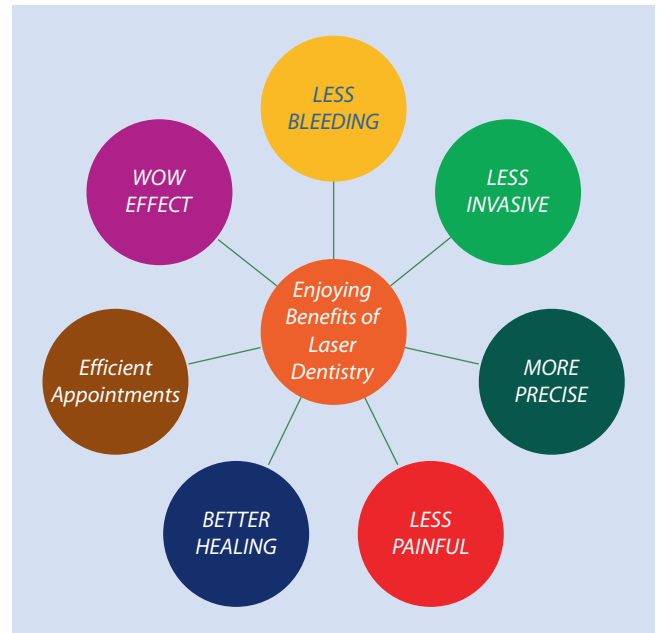
ibular joint inflammation. f Preoperative view of interproximal carious lesions. g Immediate postoperative view of the new restorations. Both teeth were prepared with the laser instead of the dental handpiece. h Preoperative view of pigmentation on the mucosa. i Postoperative view showing the pigment removed. j Preoperative view of a benign irritation fibroma. k Postoperative view showing healed area

1.9 Limitations of Laser Dentistry

If you are a proficient clinician using a laser, then you can see the almost limitless and enormous possibilities of using them for treatment. However, as with any instrumentation, certain considerations apply. The clinician should be very well trained to judge the disease to be treated. After proper selection of the case, an appropriate decision is to be made on what wavelength, power, or energy density will be used and will be dependent on the absorptive pattern of the target tissue. This of course implies a very thorough understanding of the fundamentals of laser physics, tissue interactions, and the safe use of the device.

There are some disadvantages to the currently available dental laser instruments. They are relatively high cost and require training. Most of the laser emission tips are end-cutting, although there are some radial firing ones available. Nonetheless, a majority of dental instruments are both side- and end-cutting. The laser practitioner will be necessarily required to employ a modification of clinical technique. A laser incision is by definition not as sharp edged as the one made with a scalpel. Furthermore, since sutures are seldom used compared to the one from a surgical blade, a laser wound heals by secondary intention. The patient must be given the appropriate postoperative instructions to correctly care for the area during healing. As mentioned, no single wavelength will optimally treat all dental disease. Accessibility to the surgical area can sometimes be a problem with some current delivery systems, and the clinician must prevent overheating the tissue while attempting to complete a procedure. One additional drawback of the erbium family and 9300 nm carbon dioxide lasers is the inability to remove defective metallic and cast porcelain restorations. Of course, this limitation in some cases could be quite beneficial when treating small areas of recurrent decay around otherwise sound restorations. Sometimes the slower pace of laser soft tissue surgery can lead to tissue charring or carbonization during any surgical procedure. This can be due to a combination of too much average power or moving the laser beam too slowly. Both of those can be corrected with experience. One aspect that should not be ignored is the production of the laser plume which is a by-product of vaporized water (steam), carbon and other harmful molecular particles, and possibly infectious cellular products, which combine to produce a malodorous scent. Maintaining the suction wand within 4 cm of the surgical site to remove as much of the plume as possible is recommended [15, 16].

1.10 Enjoying Benefits of Laser Dentistry



Over the time, the developments in the art and science of dentistry have provided us with the ability to allow the clinician to provide minimally invasive solutions to the patient's disease. From the incorporation of less invasive treatment of periodontitis to comprehensive cosmetic restorative treatment, the current standard is to conserve as much of the dentition and surrounding structure as possible. With the advancements in innovative materials and new and improved clinical techniques, that goal can be achieved. The rapid use of laser technology has gained popularity in various dental specialties and disciplines including endodontics, prosthodontics, oral and maxillofacial surgery, orthodontics, dental implantology, pediatric dentistry, aesthetic dentistry, and periodontics. It has revolutionized some treatment protocols and is certainly a practice-building tool.

The benefits enumerated above can transform a patient who was previously resistant to conventional treatment plans into a more relaxed and certainly cooperative one. Moreover, the fact is that dental practice can be very physically demanding and stressful during normal patient care. For more special needs patients such as those who are mentally and physically challenged, it is possible for the laser clinician to perform more procedures with efficiency and confidence, while conserving time and respecting the

patient's tolerance. Lasers are especially helpful in geriatric patients as it makes the procedure more tolerable and help them overcome some of the barriers in providing dental care to them including severe dental complexity, multiple medical conditions, and diminished functional status. Similarly, laser-assisted pediatric dental treatment can result in a happy, healthy, and trusting child whose parents will appreciate the gentle and efficient care.

In today's digital world, patients interact almost instantly with their multimedia friends, share their experiences and concerns, and better understand diagnoses and treatment options. They are more likely to accept recommendations for treatment, and they certainly are willing to invest in a procedure that they value and that is as comfortable as possible. If a patient's experiences with the laser are positive, then it will invite more referrals. In short, lasers can enable the dentist to render better quality dentistry [17].

Conclusion

We live in a fast-paced world. The practice of dentistry is constantly evolving and there are mainly two main reasons we change: one is that we want to strive to deliver the optimum treatment available for our patients; the other is that we want to keep abreast with the latest and best method to achieve that. Never stop learning or else we shall stop growing. In the present era, it is always important to improve your skills and abilities, and we should continue to learn so that we can continue to grow in knowledge as a lifelong pursuit. Willingness and openness to learn new things is the key to success. Whenever we think we are good, we can be even better.

The first step toward laser dentistry is to seek objective information on all aspects of the instrument and its uses. Eventually, the decision to purchase a laser should be based on sound scientific evidence; your own experience, knowledge, and training; and upon the patient's preference for treatment options.

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