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Fundamentals of Dental Lasers: Science and Instruments	751
Donald J. Coluzzi	

This article provides the reader with an understanding of the essential physical science of a laser device. Various dental tissues have unique interactions with laser light, and the principles of safe and effective use of this unique instrument are presented. Each wavelength's applications for treatment are outlined.

The biologic Rationale for the Use of Lasers in Dentistry	771
Robert A. Convissar	

Dentists have a variety of wavelengths to choose from when purchasing a laser. Each wavelength has a unique interaction with the target tissues of the oral cavity. This article gives a rationale, grounded in sound biologic principles, for the use of different wavelengths in the oral cavity. Advantages and disadvantages of the various wavelengths for specific procedures are discussed.

Dental Laser Safety	795
Pamela J. Piccione	

The purpose of this article is to inform the reader about dental laser safety and to suggest practical guidelines. The laser safety officer plays a major role, ensuring that the instrument is used safely and effectively. With adequate precautions and proper training, dental lasers can be used to deliver excellent care.

Lasers in Endodontics

809

Adam Stabholz, Sharonit Sahar-Helft, and Joshua Moshonov

With the rapid development of laser technology, new lasers with a wide range of characteristics are now available and being used in various fields of dentistry. In the past two decades, much experience and knowledge has been gained. This article provides an overview of the current and possible future clinical applications of lasers in endodontics, including their use in alleviating dentinal hypersensitivity, modification of the dentin structure, pulp diagnosis, pulp capping and pulpotomy, cleaning and shaping of the root canal system, and endodontic surgery. Endodontic procedures for which conventional treatments cannot provide comparable results or are less effective are emphasized.

Lasers in Aesthetic Dentistry

833

Timothy C. Adams and Peter K. Pang

This article focuses on lasers and aesthetic dentistry and their unique parallel in history from their early development to their present day usage and application. The demand for aesthetic dentistry has had a major impact not only on treatment planning but also on the choice of materials, techniques, and equipment. It is this demand that has married the use of lasers with aesthetic dentistry. A short literature review on the five basic laser types precedes the basic premise of smile design and its critical importance in attaining the desirable aesthetic end result. A short review on biologic width and biologic zone reinforces their importance when manipulating gingival tissue. Four case reports highlight the use of diode, erbium, and carbon dioxide lasers. The end results show the power of proper treatment planning and the use of a smile design guide when using these instruments and confirm a conservative, aesthetic treatment without compromising the health and function of the patients.

Lasers in Contemporary Oral and Maxillofacial Surgery

861

Robert A. Strauss and Steven D. Fallon

The practice of oral and maxillofacial surgery has included the use of lasers since the 1960s. Over the past few decades, the use of lasers among oral and maxillofacial surgeons has grown dramatically. Their evolution within the specialty not only has enhanced current surgical options for treatment, but also contributed to a variety of new procedures that are now commonplace in oral and maxillofacial surgery. The management of patients with sleep apnea, temporomandibular joint derangements, dental implants, premalignant lesions, and posttraumatic facial scarring has improved significantly with the advent of laser surgery. As the number of laser systems grows and their technology becomes more advanced, a thorough understanding regarding the principles of their use is paramount to providing safe and effective patient care.

Lasers in Pediatric Dentistry

889

Lawrence A. Kotlow

Pediatric dentistry's mission in delivering care to our young patients is simple: provide optimal preventive, interceptive, and restorative dental care in a stress-free environment. Lasers such as argon, diode, Nd:YAG, CO₂, and now the erbium family enable minimally invasive dentistry for hard- and soft-tissue procedures. This article offers an understanding of treatment planning in the pediatric practice and demonstrates the procedures that dental lasers can perform on younger patients.

Lasers for Initial Periodontal Therapy

923

Nora Raffetto

With a greater understanding of the components that initiate the host into the downward spiral of periodontal disease, the clinician must look for better treatment and therapy options. Clinical observations and studies show good results, making incorporation of the laser into the first phase of nonsurgical periodontal therapy an excellent choice.

Lasers in Surgical Periodontics and Oral Medicine

937

Stuart Coletton

Surgical lasers rapidly are becoming part of the periodontal armamentarium. This article discusses the different lasers that are suitable for use on the soft tissues of the periodontium. Various laser-assisted periodontal surgical procedures and laser treatment of diseases of the oral mucosa are discussed.

Clinical Applications of Lasers During Removable Prosthetic Reconstruction

963

Gabi Kesler

The successful construction of removable full and partial dentures depends mainly on the preoperative evaluation of the supporting hard and soft tissue structures and their proper preparation. Stability, retention, function, and esthetics of removable prostheses may be enhanced by proper laser manipulation of the soft tissues and underlying osseous structure. Compared with conventional techniques, laser treatment has many advantages. More predictable postoperative healing results and shortened treatment time may be achieved when lasers are integrated into the treatment plan for construction of removable prosthetic devices.

The Use of Lasers in Fixed Prosthodontics

971

Steven Parker

The delivery of fixed prosthodontics demands of the clinician a responsible level of skill, accuracy, and predictability commensurate

with previous experience and ability. The patient often demands speed and cosmetics. The appropriate employment of laser wavelengths, when indicated and supported by scientific evidence, can enhance the applicable factors favorable to the clinician and patient.

Lasers in Dental Implantology

999

Emile Martin

The parallels in the expansion of implant dentistry and laser dentistry in clinical practice are apparent. As advocates for laser dentistry continue to seek new ways to use the technology and as more practitioners become involved in implant dentistry, it is logical to see the concurrent use of both technologies in clinical practice. This article provides data that clearly support the value of dental lasers in the practice of implant dentistry. The challenge for the practitioner is the same as for any other area of dentistry: knowing when, where, and what armamentarium to use in any given situation. Not all dental laser wavelengths are necessarily useful in every dental implant situation. After clinicians know the characteristics of the wavelengths available to them, the application of the technology to the specific situation certainly is warranted.

Erbium Lasers in Dentistry

1017

Glenn van As

Erbium hard tissue lasers have the capability to prepare enamel, dentin, caries, cementum, and bone in addition to cutting soft tissue. The ability of hard tissue lasers to reduce or eliminate vibrations, the audible whine of drills, microfractures, and some of the discomfort that many patients fear and commonly associate with high-speed handpieces is impressive. In addition, these lasers can be used with a reduced amount of local anesthetic for many procedures. Today, these instruments have evolved from their initial use for all classes of cavity preparations to their ability for removing soft tissue, their usefulness in the disinfection of bacteria within endodontic canals, and most recently, as an alternative to the high-speed handpiece for the removal of bone in oral and maxillofacial surgery. In addition, recent research has centered on the value of the erbium family of laser wavelengths in periodontics, including the removal of calculus.

Low-Level Laser Therapy in Dentistry

1061

Grace Sun and Jan Tunér

Low-level laser therapy (LLLT) is a newly developing technique in dentistry, although it has been used among medical, dental, physiotherapy, and veterinary professions in some parts of the world for decades. LLLT can offer tremendous therapeutic benefits to patients, such as accelerated wound healing and pain relief. There is much to be learned about the mechanisms, recognition of the therapeutic window, and how to properly use these cellular phenomena to reach the treatment goals.

Dental Laser Research: Selective Ablation of Caries, Calculus, and Microbial Plaque: From the Idea to the First In Vivo Investigation	1077
Peter Rechmann	

One of the current dental laser research tracks is selective ablation, which is the removal of disease while not harming adjacent healthy structures. This article describes the scientific path from the first basic laboratory study of the absorption characteristics of caries to selective ablation of bacteria, microbial plaque, and calculus with a blue laser and the first in vivo safety studies in dogs. This article is an example of a typical research path for future studies of the uses of lasers in dentistry.

Laser Dentistry Practice Management	1105
Gerald P. Weiner	

Laser treatment in promoting dental care is present in many areas and disciplines. The public has an expectation that their dentist should be up to date with the most modern and advanced care possible. The future of lasers in dentistry is promising. New applications and procedures are constantly being developed. Dentists who position themselves to provide and manage these new technologies stand to be rewarded from clinical and financial aspects. Proper practice management strategies are key to achieving this success.

Evaluating Dental Lasers: What the Clinician Should Know	1127
Terry D. Myers and John G. Sulewski	

According to the Institute for Advanced Dental Technologies, dental lasers have obtained approximately a 6% market penetration in the United States. Unfortunately, a small percentage of doctors have been disappointed with the technology. This article has been written as a guide for clinicians to use before purchasing a dental laser. It is the hope of the authors that this material will allow the clinicians to have a better appreciation of this technology and maximize its successful integration into practice.

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