Diverse applications of lasers in dentistry

Recent literature

By Dr Igor Cernavin, Australia

When considering whether to work with lasers and in which field they could be applied, recent studies provide many application options and issues for practitioners to consider. The following presents some of the newest research on possible areas of application and further investigation.

Petrov et al. used a femtosecond laser with a high repetition rate, which is probably the future of lasers for hard-tissue removal to achieve fast and more precise ablation in dentine and enamel.2 They concluded that the ultra-fast femtosecond laser used in their work holds the promise of a significant drilling ability without collateral thermomechanical effects. It achieved high processing efficiency, overcome disadvantages of other laser systems reported, and can be used to develop an instrument for cavity preparation based on fast and precise ablation. Their further aim is to exceed the speed of conventional drilling instruments and thus to reduce the treatment time, which in turn will bring comfort to the patient.

Levine published an article on how to choose the right laser for one’s practice, which readers may find of interest.2

Hashimoto et al. investigated fluoridated hydroxyapatite for application as an implant coating for titanium bone substitute materials for dental implants.3 They concluded that fluoridated hydroxyapatite coatings are suitable for real-world implant applications.

Giannelis et al. carried out a double-blind, randomised, single-centre, split-mouth clinical trial investigating the efficacy of and patient-reported outcomes after one year of treatment of severe periodontitis with a laser and light-emitting diode (LED) procedure adjunctive to scaling and root planing.4

The review concentrated on randomised clinical trials involving paediatric and adult onco-logical patients, focusing on the prevention and treatment of oral complications.5 The studies included in the review emphasise the provision of Low Level Laser Therapy, among other interventions, to minimise the severity of oral problems in such patients.6

Tani et al. carried out an in vitro study that compared photo-biomodulation potential- ity using red (635 ± 5 nm) or near-infrared (808 ± 2 nm) diode lasers and vis-ir-blue (460 ± 5 nm) LED operating in a continuous wave with a 0.45 cm energy density, on hu- man osteoblast and mesenchymal stem cell viability, proliferation, adhesion and osteogenic differentiation.7 They concluded that all the ftygen laser had a potent oral therapeu-tic option for promoting/improving bone regeneration.8

Ghosh et al. carried out a systematic review of the evidence on the use of laser Doppler flowmetry in assessing pulp blood flow, this data is based on studies with a high level of bias and serious shortfalls in study design.9

More research is needed to study the effect of different laser Doppler flowmetry’s pa-rameters on its diagnostic accuracy and the true cut-off ratios by which a tooth could be diagnosed as having a normal pulp.10

Kaur et al. compared soft-tissue wound healing using diode lasers (808nm) versus the conventional scalpel approach as an uncovering technique during second-stage surgery for implants.11 They found that it can minimise surgical trauma, reduce the amount of anaesthetic required, improve viability during surgery owing to the absence of bleeding and eliminate postoperative discomfort.12

Efficiency in debonding porcelain laminate veneers was studied by Al-Balkhi et al. using several laser parameters and two different application modes of the Er:YAG laser (con-tact and non-contact mode).13 Their finding was that the Er:YAG laser is an effective tool in debonding porcelain laminar veneers. The non-contact application mode was more efficient in reducing debonding time than the contact application mode, but re-quired a higher change in pulp tempera-ture.14

Kellestanian et al. carried out a comprehen-sive review to assess the effectiveness of erbium lasers in the removal of all-ceramic fixed dental prostheses and found that the benefits of lasers over mechanical instru-mentation for crown removal encompassed efficient restoration retrievability without restoration or tooth surface damage and a relatively easier and more time-effective procedure with no prerequisite for anaes-thetic agents.15 It is, however, imperative for clinicians to be well trained and exhibit ade-quate knowledge regarding recommended power settings and laser-safety parameters with reference to interactions between light and different tissues and ceramics.16

Conclusion

By all means, laser technology has revolutionised dental practice, the emergence of new lasers, the advancement of new technologies, and the development of new applications has led to increased treatment efficacy and patient comfort. The use of lasers in dentistry continues to advance, and it is evident that dental professionals will continue to demonstrate an increased interest in the use of laser technology in the future.
Certificate & Diploma in Restorative Aesthetic Dentistry

From British Academy of Restorative Dentistry

DUBAI 2020-2022

Certificate | 4 Modules | 15 Days

Module 1 | 01-03 October 2020 | Prof. Paul Tipton & Dr. Adam Toft & Dr. Ashish Rayarel
Treatment Planning in Advanced Restorative Dentistry | The Principles of Occlusion in Advanced Restorative Dentistry
Tooth Preparation in Advanced Restorative Dentistry

Module 2 | 11-14 November 2020 | Prof. Paul Tipton & Dr. Matthew Holyoak & Dr. Adam Toft & Dr. Ashish Rayarel
Minimally Invasive Veneer Preparations | Master the Art of Composites Part 1 - Adhesion Composites & Anterior Composite Restorations
Master the Art of Composites Part 2 - Composite Veneers | Master the Art Composites Part 3 - Posterior Composites

Module 3 | February 2021 | Prof. Paul Tipton & Prof. James Prichard & Dr. Adam Toft & Dr. Ashish Rayarel
Enhance Your Expertise in Endo Part 1 | Enhance Your Expertise in Endo Part 2 | Occlusal Examination
Emax & Zirconia Anterior & Posterior Restorations

Module 4 | May 2021 | Prof. Paul Tipton & Dr. Hugo Grancho Pinto & Dr. Adam Toft & Dr. Ashish Rayarel
Bridge Design | Aesthetic Perio Connective Tissue Grafting | Aesthetic Perio Crown Lengthening | Modern Post and Core Techniques

Diploma | 4 Modules | 15 Days

Module 5 | September 2021 | Prof. Paul Tipton & Dr. Adam Toft & Dr. Ashish Rayarel
Bridge Preparation Techniques | Articulator selection in Restorative Dentistry | Porcelain Inlays & Onlays | Veneer Cementation Techniques Practical

Module 6 | November 2021 | Prof. Paul Tipton & Mr. Gary Jenkinson & Dr. Adam Toft & Dr. Ashish Rayarel
Smile Design, Composite Veneers, Anterior Tooth Anatomy & Lab Communications (Part 1 & 2) | TMD, It’s Diagnosis and Treatment | Adhesive Bridge Preparation Techniques

Module 7 | February 2022 | Prof. Edward Lynch & Prof. Adam Nulty & Dr. Adam Toft & Dr. Ashish Rayarel

Module 8 | May 2022 | Prof. Paul Tipton & Dr. Rami Haidar & Dr. Adam Toft & Dr. Ashish Rayarel
Occlusion Seminar, Treatment of the Worn Dentition, Vertical Dimension and Facial Aesthetics
Botox & Dermal Fillers – A Dental Facial Aesthetics Part 1 & 2

+971 528 423659 | p.mollov@cappmea.com
www.cappmea.com/capptipton
The effect of Er:YAG (Smart Power 2940D Plus, DEKA) and Er,Cr:YSGG (Waterlase iPlus, BIOLASE) lasers on the shear bond strength between orthodontic brackets and dental porcelain in comparison with conventional acid etching with 9% hydrofluoric acid (Ultradent Products) was investigated by Mirhashemi et al. They concluded that the laser groups the failures were mostly cohesive with the controls. They found that the Er:YAG laser with the specifications they used was not a suitable alternative to hydrofluoric acid etching. In the case of the Er,Cr:YSGG laser, although the conditioning outcome met the bond strength requirement for orthodontic brackets (6-8MPa) they concluded that the bond strength must be further improved by fine-tuning the irradiation parameters.

Yassaee et al. assessed the efficacy of an Er:YAG laser and pastes containing casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) with and without fluoride and their combination for prevention of white spot lesions in the enamel. They found that the Er:YAG laser was able to decrease demineralisation. It further proved to be a potential alternative to preventative dentistry and was more effective when combined with CPP-ACP paste. This would be useful especially for orthodontics.

Sarmadi et al. evaluated patients’ experiences of two excavation methods, the Er:YAG laser and rotary bur, and the time required with these methods, as well as objective assessments of quality and durability of restorations over a two-year period. Their conclusions were that the Er:YAG laser technique was more time-consuming than the rotary bur, but despite this, the laser technique caused less discomfort and was preferred as an excavation method by patients.

Li et al. carried out a meta-analysis to systematically evaluate the applications of Er:YAG lasers for the removal of caries and cavity preparation in children. They concluded that the time required for Er:YAG laser treatment was longer than that for the conventional mechanical method, but there was less pain associated with the Er:YAG laser treatment. There were no significant differences in the complete retention rate, marginal discoloration and marginal adaptation when compared with the conventional method.

Pinheiro et al. assessed the utility of dental acid etchants containing 37% phosphoric acid and methylene blue dye as a sensitising agent for photodynamic therapy to reduce Streptococcus mutans in dentinal caries. They concluded that this treatment can be used as a photosensitising agent for photodynamic therapy to reduce the S. mutans burden in dentinal caries.

Laser dentistry offers many application options and numerous research approaches that might be interesting to investigate or to stay up-to-date with for practitioners. This consideration of recent literature has shown that there is still much potential for the increased use and application of lasers in the different fields of dentistry.

About the Author

Dr Igor Cernavin
Prosthodontist
Honorary Senior Fellow at the University of Melbourne School of Medicine, Dentistry and Health Sciences
Director and Co-Founder of the Asia Pacific Institute of Dental Education and Research (AIDER)
Australian representative of WFLD
Private practice
274 Main Rd East
St Albans VIC 3021, Australia