Journal of Biology and Today's World 2021, Vol.10, Issue 3, 001-002 **Short Communication**

Innovations of Laser Dentistry for Astronauts

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Abstract

A brief review of the available literature on laser has been performed within the framework of laser dentistry for astronauts. Consideration was paid to delicate tissue surgery, effects on bacteria, caries prevention and diagnosis, caries preparation, patient comfort, long-term pulp vitality, low-level laser therapy, endodontics of primary teeth, and dental traumatology.

Keywords: Laser • Dentistry • Microgravity • Astronomy • Efficacy

About the Study

Laser dentistry is the application of lasers to treat various dental diseases for astronauts. In 1989, it turned out to be industrially utilized in clinical dental practice for strategies including tooth tissue. However, laser dentistry offers a more convenient treatment choice for a range of dental procedures, including soft or hard tissue compared to non-laser or drill instruments [1,2]. LASER represents for Light Amplification by the stimulated emission of radiation. The instrument produces light energy in a minimal and central pillar [3]. This laser bar triggers a response when it hits the tissue, permitting the tissue to be taken out or reshaped. Laser dentistry is utilized in an assortment of strategies, including

- Treating gum disease
- Whitening teeth
- Treating hypersensitivity
- Treating tooth decay

Hard tissue lasers can penetrate the structure of teeth. Their wavelengths are absorbed by a combination of specific minerals found in teeth and water. Soft tissue lasers can be used and absorbed by hemoglobin and water. These lasers are used for the treatment of periodontitis, including activating tissue regrowth and killing bacteria during astronauts' missions [2].

The health issues of cosmonauts and astronauts are of great importance before launch and during space flight. As part of the astronaut selection process and during training, a wide range of medical examinations is carried out to ensure that each crew member is in the best possible state of health at the time of launch. Although the incidence of dental injuries has so far been minimal, they are expected to increase significantly during long missions to Mars, Moon, and beyond. The causes of dental injuries associated with dysfunction and severe pain are varied [4]. Replacing lost dental restorations and/or stabilizing broken jaws and teeth can be significant to prevent limit the loss of manpower, further damage to human health, and finally, ensure the success of the mission.

Discussion

We can divide lasers into two groups:

• Hard laser like CO_2 lasers, Nd: YAG lasers and Argon laser (Argon ions) which utilizing for surgical procedures.

• Soft laser like He-Ne lasers and Diode lasers which useful for bio stimulation and analgesia.

In newer classification which Professor Vipul Kumar Srivastava et al. proposed, lasers divided into two groups based on their clinical usage (Figure 1) [5,6].

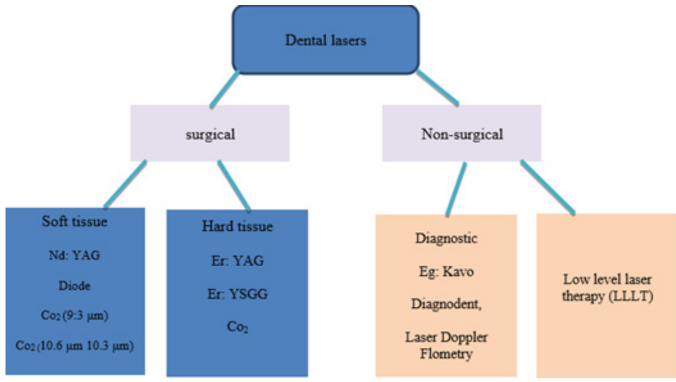

Figure 1. Classification of laser based on the clinical usage.

Er,Cr:YSGG, Er:YAG, and CO_2 (9.3 µm) are high power lasers which have use an air-water spray as a cooling system and they may produce aerosols but Nd: YAG, and CO_2 (10.3 µm and 10.6 µm) don't have any cooling systems they use topically in soft tissue surgery and dental decontaminant [6]. The optical properties of 9,300 nm and 9,600 nm CO_2 wavelengths are suitable for dental hard tissue treatment [7].

Every time a laser device is been used in a dental procedure, a High Vacuum Aspiration System (HVAC) must be pointed directly at the smoke or the air-water spray to reduce the spreading of aerosol particles [8]. It's most important in the close environment of space shuttle or International Space Station (ISS).

As per the new biosafety principles, considering about the impending danger of performing systems in asymptomatic or presymptomatic patients, a face shield should be worn by dental staff during dental strategies. The decision of a face shield should consider the space between the safeguard and the eyes; it should permit the right variation of the laser security glasses. The wellbeing glasses should be appropriately purified after each procedure. Also, a suitable individual Personal Protective Equipment (PPE) should be utilized to shield the dental specialist from breathing in the aerosolized particles and smoke that escapes from the air conditioning (HVAC) [9].

Dental emergencies during space travel are rare, but the number is expected to increase on longer missions. During flights to Mars or deep space, it is impossible to evacuate a wounded astronaut and return him to Earth for treatment. Additionally, communication gaps and delays will prevent personal communication with experts on Earth. The crew will have to independently treat all medical cases with the help of available personnel, resources, and equipment [3]. The potential risks to both the crew and mission will increase significantly with the increase in the duration and distance of future exploration missions to Mars and Moon and deep space. Emergency dental care is one of the many significant risks that need to be assessed in preparation for future long-term research missions.

In addition to intensive assessments, in-flight prevention strategies, and pre-flight examinations, procedures for treating dental emergencies will need to be implemented. Astronauts need to be trained appropriately, and procedures and equipment must be tested and developed. There are currently no technologies and procedures for maintaining and restoring teeth for long-term missions. The authors propose a lesser treatment and remotely supported dental treatment workflow with 3D technology combinations and with high-tech dental manufacturing. This strategy includes available resources both at the Earth and at the desired destination. The workflow has been tested during analog simulations of Mars and under normal laboratory conditions. During a parabolic flight, modeling the selected sequences in microgravity, the next logical step to validate the manned space flight procedure, refine it, and attract scientific and industrial partners [10].

Conclusion

It has gotten clear from a review of the writing that laser applications in laser dentistry for assortments have acquired expanding significance.

Laser innovation for hard tissue application and delicate tissue a medical procedure is at a high condition of refinement, having had quite a few years of advancement, up to right now, and further upgrades can happen. The field of laser-based photochemical responses holds extraordinary guarantees for extra applications, especially for focusing on explicit cells, microorganisms, or atoms. A further region of future development is relied upon to be a mix of symptomatic and remedial laser methods. Planning ahead, it is normal that particular laser innovations will become fundamental segments of contemporary dental practice over the course of the following decade.

References

1. Gross, A.J., & Hermann, T.R. “History of lasers.” *World J Urol* 25(2007): 217-220.
2. Fujiyama, K., et al. “Clinical effect of CO2 laser in reducing pain in orthodontics.” *Angle Orthod* 78(2008): 299-303.
3. Harashima, T., et al. “Morphological comparative study on ablation of dental hard tissue at cavity preparation by Er: YAG and Er, CR: YSGG lasers.” *Photomed Laser Surg* 23(2005): 52-55.
4. Misra, N., et al. “Efficacy of diode laser in the management of oral lichen planus.” *BMJ Case Rep* 15.10(2013): 260-269.
5. Yeragi, E., et al. “LASER physics and its application in dentistry; A review.” (2021).
6. Baggish, M.S., et al. “Presence of human immunodeficiency virus DNA in laser smoke.” *Lasers Surg Med* 11(1991): 197-203.
7. Luk, K., et al. “Use of carbon dioxide lasers in dentistry.” *Laser Dent Sci* 3(2019): 1-9.
8. Thamboo, A., et al. “Clinical evidence based review and recommendations of aerosol generating medical procedures in otolaryngology-head and neck surgery during the COVID-19 pandemic.” *J Otolaryngol Head Neck Surg* 49(2020): 28.
9. Howard, J., et al. “Face masks against COVID-19: An evidence review.” *Preprints.org* (2020).
10. Arora, H., et al. “Efficacy of He-Ne laser in the prevention and treatment of radiotherapy induced oral mucositis in oral cancer patients.” *Oral Surg Oral Med* 105.2(2008): 180-186.

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