Lasers in Periodontics

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Abstract— Aim: *This review aims at opening the clinical professionals eyes to various possibilities for the usage of laser that is innovative skill in the field of periodontics.* ***Background:*** *There is no doubt regarding clinical application of laser, but for best management and for effective clinical protocols literature should be supported by basic and clinical research and evidence.* ***Review Results:*** *In this review there is a collection of data from scientific papers clinically relevant to the periodontitis providing description of parameters of lasers, its effect on soft tissue, history of use laser in periodontics in particular as well as various use of laser in the field of periodontics .****Conclusion:*** *Laser is a promising auxillary tool in periodontics but further evidence is required to have effective clinical effect.* ***Clinical Significance:*** *Less of thermal damage, less bleeding and uneventful healing is the clinical significance of laser when used on soft tissues.*

Keywords— Laser, Periodontics, Soft tissue.

I. INTRODUCTION

Knowledge regarding thermal effect of laser is essential as it is essential in deciding when cutting, coagulation and ablation of tissues when a laser is applied in health sciences and periodontics [1]. Recently the usage of laser irradiation for biostimulation of periodontal tissues have developed popularity where the consequence are centred on cellular mechanism additional to rise in temperature [1] . Lasers are categorized into 2 wide-ranging classifications, conferring to their power: high power laser and low power laser [2]. High power laser also known as surgical laser are frequently used for periodontal surgery [2] while low power laser is used in photobiomodulation, photodynamic therapy in periodontics [2].

Laser system that involves thermal interaction, like high power lasers where heat is produced in nearly all irradiated circumstances and which gets transformed into measured temperature increase in a precise area of biological tissues can be a beneficial device for numerous techniques in periodontics [3]. Possible microstructural and physical changes in biological tissues occurs when laser irradiate tissue structure [4]. Er:YAG (2940nm) , Diode Laser (810nm) , Nd :YAG(1064nm),Co2 (9300nm, 9600nm) are most frequently used high power laser in periodontics [5] . High power lasers are mostly studied in periodontics but effectiveness of many of these applications are still unclear [6].

High power laser is used widely for surgical clinical procedures like gingivectomy, frenectomy, recontouring of gingival tissues, removal of melanin pigmentation, proximal wedges. Ablation of soft tissues with effective haemostasis and reduction of bacterial burden is the major advantage of high power laser.[5]Non- surgical treatment are mostly done using high power lasers , but there is uncertainity of effectiveness of the lasers used [6] .

Low level laser can be repairing the bone as it can promote positive biomodulatory outcome [7] Photochemical and photophysical properties of low level laser are essential tools which helps stimulation of bone. In vivo and In vitro studies has evidence stimulation of bone using low level laser [7].

Bone defect in periodontum due to periodontitis may be enormous for spontaneous and physiological repair.[7]Treatment protocol to ameliorate bone repair includes numerous approaches which comprises of bone grafts, of late removal of necrotic or pathological bone is done using low level laser [7] .The mechanism of outcome of low level laser is compound and challenging to appreciate [7].

II. HISTORICAL BACKGROUND

Earlier suggested lasers which were intended to be used for handling soft tissues in the field of periodontics were CO_2 (10600nm), ND: YAG (1064nm) and semi-conductor diode (800-980nm) lasers [5].Laser which was accepted for clinical use by US food and drug administration (FDA) IN 1976 was CO2 laser [8].Recently lasers which are specified for soft tissue surgery, management of mineralised tissues and radicular scraping is ER:YAG (2940nm).

III. DISCUSSION

3.a. Clinical Application of lasers

Appropriate wavelength of laser is used to be determined first when lasers are used on target tissues. Other features

or parameters which must be considered is outpower, repetition rate, energy density (fluence) and whether laser is to be operated in continuous or pulsed mode [9]. When tissues need biomodulation with no rise in temperature low power laser is used [9]. When tissues have to be incised or vaporisation or coagulation is required high power laser is to be used [9].

Laser only ablate the target tissues, thus less damage to adjacent tissue and decreased complication of target tissue, wound healing is optimised.This are the few benefits of using laser in periodontal surgery. Lasers are widely used in the field of periodontal esthetics as it is capable of removing the tissues precisely and conservatively [10,11].Studies has shown that when CO2 laser is used there is only superficial necrosis of the tissues, there is more of heat which is liberated engrossed by water, also energy gets transformed into heat and henceforth slight diffusion and dispersion into soft tissue [10] .ER:YAG laser is also effective in causing undesirable damage to adjacent hard tissues as it gets effectively absorbed [10].Procedures like frenectomy, recontouring of the gingival tissues, gingivectomy are widely done using lasers .Hemostasis of surgical area, reducing the need for suture are major benefit using lasers for the above mentioned procedure[11] .Flap surgeries are done using high power lasers [12] lasers like $C0_2$, ND: YAG, ER: YAG and of lately Er,Cr:YSGG is used for non-surgical management of periodontal diseases. When laser was used for scraping the root surface carbonization and melting of irradiated tissues was seen [5].Regarding removal of pathogenic bacteria and reduction of periodontal pathogens from root surfaces high power lasers are studied. Clinical study employing this laser have evidenced not be effective in removing mineralised bacterial deposits [5]. No scientific evidence has demonstrated been demonstrated with this laser after used as monotherapy or in combination to be superior to conventional modalities of periodontal therapy [13,14] .Some clinical study have verified a decrease of periodontal pathogenic microorganism with a high power laser though other study has not established a larger decrease of periodontal pathogens [15,16] .

Depigmentation of gingiva are cosmetic therapy which can be done using various methods like gingivectomy, electrosurgery, cryosurgery, chemical agents like 90% phenol, and 95% alcohol, abrasion with diamond bur [17].Of lately laser must been used to ablate cells containing melanin pigments [18] . Effective management of periodontal tissue without producing major thermal side effects is done using erbium-doped: yttrium-aluminium-granet laser as the laser energy is extremely captivated by water [19] .Studies have proved high absorption of water and less tissue degeneration and thin surface interaction in Er:YAG laser as compared to CO_2 laser and Nd:YAG laser [19] .Of lately Er:YAG has added growing importance and recognition since it effectively removes melanin hyperpigmentation [20,21] .

Non-invasive therapy like antimicrobial photodynamic therapy is accomplished of treating perimplantitis and also capable of eliminating periodontopathic bacteria [22]. In vivo lessons established that photodynamic therapy to be effective in controlling and treating periodontal disease [23],also histomorphometric analysis has shown control of alveolar bone loss [24,25] .Controversial results of effectiveness of use of a photodynamic therapy in humans is produced, meta analyses has demonstrated that a photodynamic therapy is not greater to conventional periodontal treatment [26] ,conversely of lately a meta analyses has concluded that use of photo dynamic remedy as an adjuvant to conventional periodontal therapy provided beneficial effect [27].Hence it is opined to do more microbiological and longitudinal studies to check evidence of efficacy of a photodynamic therapy as an substitute to SRP [27] .

Bone loss is a most important problem in periodontium , ample amount of healing may not happen if there is incomplete blood supply, mechanical stability or competition with high proliferating tissue [28] The use of accurate and suitable parameters has been revealed effective in promoting positive biomodulatory effect [28] .The result of our studies has shown that bone irradiated with infrared wavelengths displays amplified osteoblastic proliferation, bone neoformation and collagen deposition when linked to non- irradiated bone [28] . High cellular proliferation is seen when treatment is accepted out at early stage, also vascular response has been suggested as a positive response to treatment using low level laser therapy [28] .But it quiet remains uncertain if bone stimulation by laser light is a overall result or if it is the isolated stimulation of osteoblasts that is answerable for the outcome [28].

Peri-implant mucositis and peri- implantitis are two major implant diseases caused due to host tissue inflammatory reaction around implant tissues [29].Microbial colonization plays a major role in this condition [29].Mechanical debridement and chemical treatment followed by several maintenance strategies are the recent treatment protocol proposed [30] .Plastic currettes are used to do mechanical debridement as this avoids roughening the metal surface which may favour bacterial colonization [31] but only mechanical debridement is proved inefficient on the roughened surface of implants . Thus usage of diverse lasers has been planned for both cleaning and decontamination of implant surface. There are controversial studies demonstrating the result of using lasers .In vitro studies study have considered CO2 and

diode laser and ER:YAG laser appropriate for instrumentation of implant surface based on energy dependent format whereas Nd:YAG laser resulted in extensive melting and damage to the porous titanium surface coating [31].Beneficial bactericidal effect is reported when CO2 and Er:YAG lasers are used [32].CO2 nor diode laser remained in effect in eliminating dental calculus [33].In contrast ER: YAG laser competently ablate dental calculus devoid of producing thermal side effects [33].

IV. CONCLUSION

CO2, ND:YAG , diode, Er:YAG and Er,Cr:YSGG laser possibly will be used carefully for soft tissue surgeries in periodontics, through advantage of a lesser amount of bleeding, condensed microbial burden and better postoperative ease. Presently at hand there is inadequate evidence to upkeep clinical use of laser for non-surgical periodontal therapy. In difference laser is being widely used for minor surgical procedures like frenectomy, depigmentation, gingivectomy and has proved longer benefit. Additionally, in spite of the presence of limited controlled studies, for better clinical efficacy more research is required in this field.

V. CLINICAL SIGNIFICANCE

Laser has proved to be an promising auxillary tool for periodontal surgery as treating soft tissue using laser causes less thermal damage, photobiomodualtion, less bleeding and pain. Main clinical significance of laser is its application in perioesthetic as there is uneventful wound healing.

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