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Laser-Aided for Pericoronal Bacterial Load Reduction and Operculectomy Healing of Impacted Mandibular Molar, Taif, KSA

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Abstract: Use of Laser operculectomy for impacted mandibular molar and reducing bacterial load, responsible for pericoronitis is increasingly done. Patients understudy were 50 pts. aged (19-35 yrs.), were divided into, 1st control group 25 pts. treated by conventional method and 2nd study group 25 pts. treated by Diode Laser method.Research work was passed for bacterial isolation and identification and total bacterial counting (CFUs/ml) and comparing healing process during operation period (1st, 3rd, 5th, 7th day). Bacterial isolates were facultative anaerobes (*Staph. aureus, CNS, Strept. viridans and Strept.mutans*) and anaerobes (*Prevotella, Fusobacterium, Actinomyces, Bacteriods and Lactobacillus species*). Main growth degrees were 100, 80, 50 and 30% for 1st group and 100, 50, 30 and 20% for 2nd group. CFUs/ml of 1st group were 3.2, 2.9, 2.3 and 1.9 x 10^4/ml, 2nd group 3.1, 2.4, 1.7 and 1.1 x 10^4/ml. Inflammation decreased in 1st group 96, 88, 60 and 28% and 2nd group as 92, 80, 48 and 16%. Pain decreased in 1st group 84, 76, 56 and 32% and in 2nd group 76, 60, 40 and 20%. Healing increased in 1st group 48, 64, 72 and 84% and in 2nd group as 60, 72, 80 and 96%. Laser method showed the reduction of bacterial load and CFUs/ml as antibacterial, facilitated elimination of pericoronitis symptoms and enhanced healing process and post-operative discomfort.

Key words: Laser · Pericoronal Flap · Impacted Mandibular Molar · Pericoronitis · Operculectomy · Conventional · Staph · Strept · CFUs/ml

INTRODUCTION

Most of endogenous anaerobes is a part of the normal oral flora, such as Gram-positive facultative cocci [1]. Periodontitis with impacted mandibular molar is a bacterial-related inflammatory disease which leads to the destruction of tooth-supporting tissues. Non-surgical treatment of such destructive periodontal diseases is based on the elimination of bacterial deposits adhered to tooth surfaces, primarily control performed by the patient, is efficient in treatment of periodontal diseases [2]. Micro-organisms isolated from impacted molars are 40% *Corynebacterium spp.* 80% *Prevotelladenticola* and 40% *Lactobacillus spp.* Besides obligate anaerobic bacteria, *Actinomyces spp.* a predominantly facultative anaerobic bacterium was isolated [3]. Pericoronal pockets revealed that micro-organisms are more often isolated from infected molars, normal oral flora can also act as pathogens and obligatory anaerobic, Gram negative species are normally found in periodontal pockets and on various oral surfaces, such as *Bacteriods*. Same bacterial species can be found concomitantly because highly contaminated saliva flows freely between anatomically close sites. *Strept.mutans*, *Lactobacillus* and *Prevotellaoralisi* are the causative pathogens of acute and chronic pericoronitis [4]. The predominant micro-flora in pericoronitis is anaerobic causing periodontitis. The isolates from pericoronitis are *Strept. spp., Actinomyces*, *Prevotella*, *Bacteroides*, *Fusobacterium*, *Campylobacter*, *Staph. Lactobacillus* and *Haemophilus.* The micro-flora in pericoronitis appeared similar to that of diseased periodontal pockets. Most microbes causing pericoronitis are obligatory anaerobic bacteria [5]. Facultative anaerobic isolates from impacted molars are *Strept. viridans, Corynebacterium spp. Haemophilus spp. Strept. mutans,* CNS*, Staph. aureus, Strept. pneumoniae, E. coli, Strept. pyogenes* and *Pseudomonas spp.* with incidence of 90.5, 60.8, 56.8, 52.7, 45.9, 25.7, 23, 23, 14.9 and 10.8% and the anaerobic isolates are *Prevotella spp.*, *Fusobacterium spp., Actinomyces spp., Bacteriods spp.,*

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Lactobacillus spp., Campylobacter spp. and *Clostridium spp.,* had incidence of 98.6, 90.5, 81.1, 81.1, 70.3, 54 and 41.9% respectively [6].

Laser beams aid in action of inactivation of bacterial cells accompanied by alterations of ultra-structure of the cells, e.g. disordered cell wall structure; elongated cells connected together without separation of the daughter cells and different low density areas in the cytoplasm [7]. Anionic and neutral photosensitizers arefound to bind efficiently to Gram positive bacteria to induce growth inhibition or killing by visible light [8]. Photodynamic inactivation of micro-organisms upon irradiation with light of an appropriate wavelength, the photosensitizer undergoes a transition from a low energy ground state to a higher energy triplet state, at which photosensitizer can react directly with bio-molecules to produce free radicals and/or radical ions (type I reaction), or with molecular oxygen to produce highly reactive singlet oxygen (type II reaction). There is a difference in susceptibility to this anti-bacterial effects between Gram positive and Gram negative bacteria [9]. There is a lethal effect of Laser radiation on micro-organisms associated with periodontitis [10]. Light from both high power and low power Lasers is to be effective in killing oral pathogenic bacteria, the bactericidal effects of photo toxicity are wavelength or dose-dependent to eliminate periodontal pathogens, e.g. *Actinobacillusactinomycetemcomitans, Fusobacteriumnucleatum, Porphyromonasgingivalis, Prevotellaintermedia* and *Strept. sanguis* [11]. Laser is an excellent soft tissue surgical tool, indicated for cutting and coagulating gingiva and oral mucosa and for soft tissue curettage or secular debridement. It also has a bactericidal effect. Pathogens were exposed to a HeNe Laser (632.8 nm, 30 mW), a 100mW Diode Laser (665 nm), (a 100 mW diode laser 830nm), in the presence or absence of methylene blue (MB) as the appropriate photosensitizer. All sub-gingival areas are infected with *P. gingivalis* and *F. nucleatum* [12]. Directphoto killing Gram negative bacteria is also possible. In recent years, different chemical classes of positively charged PS, including phthalocyanines and porphyrins, were successfully tested as photo inactivating agents against Gram positive and Gram negative bacteria [13]. It's possible to kill bacteria with low-power Laser light when bacteria are sensitized with MB or Toluidine blue as the appropriate photosensitizer. The inhibitory effects ofa super pulsed carbon dioxide Laser at low energy density on periodontopathic bacteria without any photosensitizerwas demonstrated [14]. Moreover, there is a significant suppression of *A. Actinomycetemcomitans*, an invasive bacterium that is associated with aggressive forms of periodontal disease that are not readily treated with conventional scaling and root planning. *A. Actinomycetemcomitans* is not only present on the diseased root surface, but it also invades the adjacent soft tissues, making it difficult to remove by mechanical periodontal instrumentation alone [15]. Diode Laser provides a non-antibiotic solution. *A. Actinomycetemcomitans* has also been found in atherosclerotic plaques and there has been an evidence to suggest that sub gingival *A. Actinomycetemcomitans* may be related to coronary heart disease. This makes it even more compelling to seek methods to control this aggressive pathogen [16]. Laser soft tissue treatment for pericoronal infections has the effect on CFUs which clear and help in reducing bacterial loads. Due to its characteristics, as well to other known advantages such as low cost and practicality, Diode Laser has been compared to the other Lasers and conventional methods [17]. It has been subject of a diversity of studies intended to evaluate its potential in relation to its biocompatibility [18]. There was a reduction in the number of total CFUs after laser irradiation. However, after 6 months the CFUs levels returned to values similar to baseline [19]. There was a statistically significant reduction in CFUs/ml of obligate anaerobes compared with the control group, Diode Laser was well tolerated by the patients, The bactericidal effect of the Diode Laser was clearly evident by greater reduction of CFUs/ml of obligate anaerobes in the test group than in the control group [20].

Diode lasers are very effective for soft tissue applications including incision, hemostasis and coagulationThe advantages of the laser include a bloodless operating field, minimal swelling and scarring and much less or no postsurgical pain [21]. The operculum covering the partially impacted molar may be superimposed by microbial infection, mixed infection of Gram positive and negative anaerobes may be the principal causative micro-organism for dental infections [22]. Odontogenic infections are not caused by a single organism, indeed, polymicrobial infections are frequently encountered and in some cases up to 6 different species have been isolated. The treatment of odontogenic infections is based on two fundamental elements: mechanical-surgical management and antibiotic therapy [23]. When Diode Laser surgical procedures are carried out, the surface produced heals favorably as an open wound, without the need for sutures or surgical

dressings.there is afaster and more comfortable wound healing [24-25]. Pericoronitis is an inflammatory and infectious condition that may accompany the clinical emergence of teeth. It generally does not arise in teeth that erupt normally; usually, it is seen in teeth that erupt very slowly or become impacted and it is most commonly affects the mandibular molar. Once the follicle of the tooth communicates with the oral cavity, it is thought that bacterial ingress into the follicular space initiating the infection [26]. Soft tissue dental Lasers have been introduced and employed successfully in a variety of dental applications. Laser was used as a surgical alternative treatment with several advantages including ease of use, hemostasis (coagulation during cutting), providing aseptic field, reduced postoperative discomfort such as: edema, pain and dysfunction. Carbon dioxide Laser has been used to treat soft tissue abnormalities in children, such as ankyloglossia and freenectomies. ND: YAG Laser has been utilized in the process of gum peeling to remove melatonin spots in the gingivae and it gave satisfactory results [27]. Soft tissue Diode Laser treatment is the recent treatment method used to excise the operculum overlying impacted molar for the incision of the mucoperiosteal flap during the surgical removal of the tooth, with minimal bleeding and postoperative discomfort. The aim of this research was for improvements of Diode Laser treatment for operculectomy of impacted molar in both pattern of follow up reduction of CFUs/ml and healing process.

MATERIALS AND METHODS

This research was conducted at Taif area. KSA, in period of (2013), randomly selection of complained patients of impacted mandibular molar and pericoronitis with a partially erupted molar were understudy from private and public dental clinics.Consent forms were filled by their guardians or their parents to approve their participation in the research study.The patients were selected understudy (No.=50) and aged (19-35yrs). The chief complaints were recorded as impacted mandibular molar with painful pericoronal flap. Understudy patients were differentiated into two groups, 1st control group 25 pts. were treated by using Scalpel Surgery method and 2nd study group 25 pts. were treated by Diode Laser method. Also in the same way pericoronal bacteria of operated impacted molar were isolated and identified, that will expose the bacterial load by growth degrees and total bacterial counts (CFUs/ml) patterns. Also dental healing process was followed. Data were collected and tabulated, statistical analysis was performed for all results expressed from the search work in bacterial and dental side [28]. The both searching patterns were carried out on both understudy groups at post operculectomy at1st, 3rd, 5th and 7thday of impacted molar operation.

Microbial Pattern

Bacterial Isolation and Identification: All collected specimens at 1st, 3rd, 5th and 7th day of operculectomy, were collected using sterile paper tips, for operatively impacted molar from pericoronal area. Specimens were seeded onto culture media at that moment, or placed immediately into an Eppendorff tube and kept deep-frozen carbon dioxideat (-70°C) until sent for analysis in Microbial Laboratory by standard methods [29]. Bacterial determination for total bacterial counts (CFUs)/ml was performed for understudy patients. Specimens were collected from operatively impacted molars from pericoronal area were transported in Robertson's cooked meat media to the Microbiology Laboratory within 1hr. of collection. Specimens were labeled and processed immediately. CFUs/ml of bacteria were calculated by: $y \times 10^{-d} \times 1/v$ (where d=dilution plated, v=volume plated and y=colony count on the plates, between 30 and 300) [30].

Dental Pattern: 1st group was made up as control group using conventional method (Surgery Scalpel by Bard Parker Blade number 15), 2nd group patients received irradiation method (Diode Laser Beams), for excising the operculum covering the partially impacted molars,or for incision of the mucoperioseal flap during surgery.

Follow up Pattern: Follow up of both groups was established in both sides, isolation and identification of bacteria, total bacterial count (CFUs/ml) and dental healing process, all at the assigned post-operative intervals to evaluate the outcomes of both methods to define the most beneficial method for the patient's cure [31]. Results of both treatment methods understudy groups were compared to assess the appropriate modality of treatment methods and the most accepted by the patients.

Data Analysis: The data recorded during the study period (2013) were entered into Microsoft Excel Sheet. Data were summarized and analyzed using SPSS version 16 computer program, analyzed using Epi Info version 6 statistical software and for further comparison Chi-square test was used at critical probability of $p<0.05$ [32].

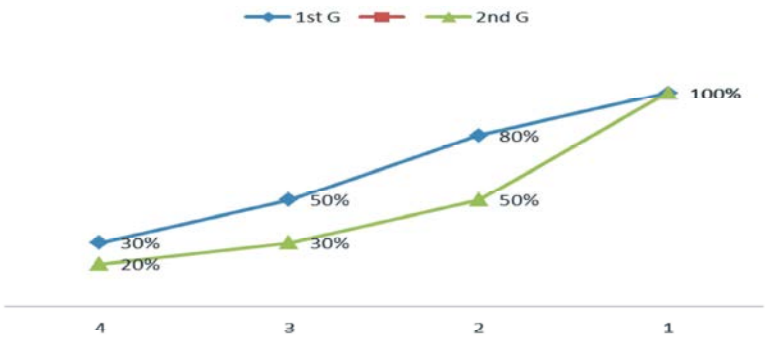

Fig. 1: Main bacterial growth degree after operculectomy for 1st and 2nd group understudy

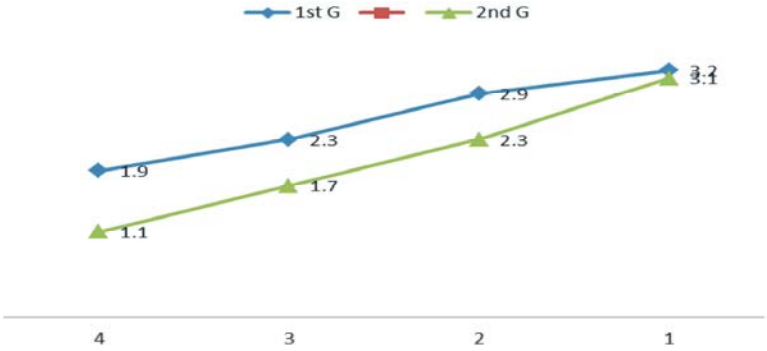

Fig. 2: Total bacterial count (CFUs)/ml after operculectomy for 1st and 2nd group understudy

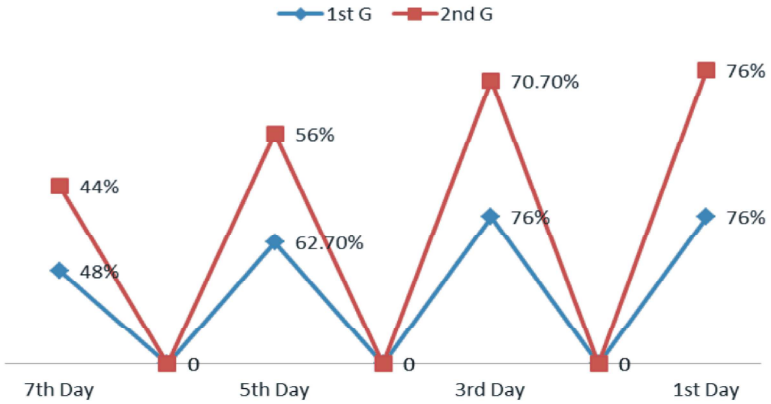

Fig. 3: Main incidence of healing process for 1st and 2nd group understudy

RESULTS

Table 1 and Fig.1 show main bacterial growth degree after operculectomy for 1st and 2nd group understudy. The main isolates were facultative anaerobes as (*Staph. aureus, CNS, Strept. viridans and mutans*), while anaerobes (*Prevotella, Fusobacterium, Actinomyces, Bacteriods and Lactobacillus species*). The main growth degrees were 100, 80, 50 and 30% for 1st group and 100, 50, 30 and 20% for 2nd group respectively.

Table 2 and Fig.2 show total bacterial count (CFUs)/ml after operculectomy for 1st and 2nd group understudy. CFUs/ml started as 3.2 and 3.1 x 10^4/ml in 1st and 2nd group, CFUs/ml were in 1st group as 3.2, 2.9, 2.3 and 1.9 x 10^4/ml, but in 2nd group were 3.1, 2.4, 1.7 and 1.1 x 10^4/ml. While the CFU/ml differences between 1st and 2nd group were 0.1, 0.5, 0.6 and 0.8 respectively.

Table 3 and Fig. 3 show incidence of healing process for 1st and 2nd group understudy, the degree of inflammation decreased, in 1st group 96, 88, 60 and 28%, while in 2nd group 92, 80, 48 and 16%,respectively. Degree of pain decreased,in 1st group 84, 76, 56 and 32%, while in 2nd group were 76, 60, 40 and 20% respectively.Degree of healing increased, in 1st group 48, 64, 72 and 84% and in 2nd group 60, 72, 80 and 96% respectively.

Table 1: Main bacterial growth degree after operculectomy for 1st and 2nd group understudy

	Observation days							
	1st day		3rd day		5th day		7th day	
Pericoronal observations days	1st *G.	2nd G.	1st G.	2nd G.	1st G.	2nd G.	1st G.	2nd G.
Facultative anaerobes bacteria:	*+++++	+++++	*++++	*+++	+++	*++	++	*+
-*Staph. aureus	(100%)	(100%)	(80%)	(60%)	(60%)	(40%)	(40%)	(20%)
-*CNS								
-*Strept. viridans								
-Strept. mutans								
Anaerobes bacteria:	+++++	+++++	++++	++	++	+	+	+
-Prevotella *spp.	(100%)	(100%)	(80%)	(40%)	(40%)	(20%)	(20%)	(20%)
-Fusobacterium spp.								
-Actinomyces spp.								
-Bacteriods spp.								
-Lactobacillus spp.								
Total bacterial growth	+++++	+++++	++++	+++	+++	++	++	+
	(100%)	(100%)	(80%)	(50%)	(50%)	(30%)	(30%)	(20%)

**Staph.: Staphylococcal, * CNS:Coagulase Negative Staph., *Strept.: Streptococcal, *G: Group, *+++++=100%, * ++++=80%, * +++=60%, * ++=40%, *+=20%.*

Table 2: Total bacterial count (CFUs)/ml after operculectomy for 1st and 2nd group understudy

	Observation day							
	1st day		3rd day		5th day		7th day	
Pericoronal observation day	1st *G.	2nd G.	1st G.	2nd G.	1st G.	2nd G.	1st G.	2nd G.
*CFUs/ml	3.2 x 10^4	3.1 x 10^4	2.9 x 10^4	2.3 x 10^4	2.3 x 10^4	1.7 x 10^4	1.9 x 10^4	1.1 x 10^4
Differences	0.1		0.6		0.6		0.8	

**G: Group, *CFUs/ml: Total Bacterial Counts per ml*

Table 3: Incidence of healing process for 1st and 2nd group understudy

	Observation day							
	1st day		3rd day		5th day		7th day	
Pericoronal observation day	1st *G. *No.(%)	2nd G. No.(%)	1st G. No.(%)	2nd G. No.(%)	1st G. No.(%)	2nd G. No.(%)	1st G. No.(%)	2nd G. No.(%)
*Inf.	24/25(96%)	23/25(92%)	22/25(88%)	20/25(80%)	15/25(60%)	12/25(48%)	7/25(28%)	4/25(16%)
Pain	21/25(84%)	19/25(76%)	19/25(76%)	15/25(60%)	14/25(56%)	10/25(40%)	8/25(32%)	5/25(20%)
Healing	12/25(48%)	15/25(60%)	16/25(64%)	18/25(72%)	18/25(72%)	20/25(80%)	21/25(84%)	24/25(96%)
Main %	76%	76%	76%	70.7%	62.7%	56%	48%	44%

**G: Group, *Inf.: Inflammation*

DISCUSSION

Table 1 and Fig.1 show main bacterial growth degree after operculectomy for 1st and 2ndgroup understudy. The main isolates were facultative anaerobes (*Staph. aureus, CNS, Strept. viridans and mutans*), while anaerobeswere (*Prevotella, Fusobacterium, Actinomyces, Bacteriods and Lactobacillus species*). The main growth degrees were 100, 80, 50 and 30% for 1stgroup and 100, 50, 30 and 20% for 2ndgroup respectively.Micro-organisms isolated from impacted molar were 40% for *Corynebacterium spp*. 80% *Prevotella spp.*and 40% *Lactobacillus spp*. a predominantly facultative anaerobes bacterium was isolated [3].Normal oral flora can also act as pathogens and obligatory anaerobic Gram negative species are normally found in periodontal pockets and on various oral surfaces, such as *Bacteriods* [4]. The predominant micro-flora in pericoronitis is anaerobic casing periodontitis, are *Strept.,Actinomyces, Prevotella,Bacteriods, Fusobacterium, Campylobacter, Staph. Lactobacillus,*and *Haemophilus spp.* The micro-flora in

pericoronitis appeared similar to that of diseased periodontal pockets. Most microbes causing pericoronitis are obligatory anaerobic bacteria [5]. Facultative anaerobic isolates from impacted molars were *Strept. viridans, Corynebacterium spp. Haemophilus spp. Strept. mutans, CNS, Staph. aureus, Strept. pneumoniae, E. coli, Strept. pyogenes* and *Pseudomonas spp.* with incidence of 90.5, 60.8, 56.8, 52.7, 45.9, 25.7, 23, 23, 14.9 and 10.8% and anaerobic isolates were *Prevotella spp. Fusobacterium spp. Actinomyces spp. Bacteriods spp. Lactobacillus spp. Campylobacter spp.* and *Clostridium spp.* had incidence of 98.6, 90.5, 81.1, 81.1, 70.3, 54 and 41.9% respectively [6].

Laser beams aid in the action of inactivation of bacterial cells accompanied by alterations of the ultra-structure of the cells, e.g. disordered cell wall structure; elongated cells connected together without separation of the daughter cells and different low density areas in the cytoplasm [7].Anionic and neutral photosensitizers were found to bind efficiently to Grampositive bacteria to induce growth inhibition or killing by visible light [8]. Laser soft tissue treatment for pericoronal infections has the effect on CFUs/ml in reducing bacterial loads. Due to its characteristics, as well to other known advantages such as low cost and practicality [17].Reduction in the number CFUs/ml after laser irradiation. However, CFUs/ml levels returned to values similar to baseline [19]. Reduction in CFUs/ml of obligate anaerobes in compared with the control group. The bactericidal effect of the Diode Laser was clearly evident by greater reduction of CFUs/ml of obligate anaerobes in the test group than in the control group [20].

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CONCLUSION

Diode Laser was well tolerated by the patients and it is more successful than conventional treatment methods. Diode Laser demonstrated decreasedall bacterial growth degrees and bacterial loadCFUs/ml, as well showed significant fast healing of soft tissue. Therefore, Diode Lasers treatment can form an integral part of periodontal therapy in the future.

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