# Effect of using Erbium and Diode LASERs on Alveolar Bone around Immediately placed Dental Implant retaining Mandibular Overdenture

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# Introduction

The oral cavity is the site of many biological functions, where the teeth, tongue, and lips articulate together to play an important role in verbal and non-verbal communication, and enhance the patient esthetics.[1]

For completely edentulous patients, complete maxillary and mandibular dentures are the treatment of choice. Studies revealed that due to lack of ideal supporting ridge with firmly adherent mucosa, 20-30% of denture wearers are not satisfied with their dentures. This is mainly in the form of chewing problems, pain and discomfort caused by their dentures poor retention and stability.[1,2]

Mandibular implant-retained overdenture with two implants placed in the interforaminal region is considered an effective treatment modality. It enhances the denture stability and retention, and more favorable for the patient.[3]

Brånemark states that for implant insertion after tooth extraction, complete alveolar bone healing must occur before placing a dental implant; but this process requires from 6 to 12 months, and during this period about 44% or even more of the crestal bone loss occurs as a consequence of bone resorption, so early implant insertion may preserve the alveolar anatomy and maintain the crestal bone, reduce the treatment time with less surgical procedures.[4]

Since the development of the ruby laser by Maiman in 1960 LASERs have become widely used in both medicine and dentistry. In the mid of 1990's sudden evolvement in dental LASERs began, especially for diode laser systems which quickly began to establish themselves as having proper size, and reasonable cost in relation to the other systems and also adaptable to many functions and activities especially for performing soft tissue applications.[5,6]

Several studies have suggested that low level LASER therapy (LLLT) has therapeutic effects on the tissue repair process, and these effects includes: increasing the proliferation of epithelial cells and fibroblast, enhancing collagen synthesis, the proliferation and maturation of the osteoblast, improving bone remodeling and repair; restoring nerve function after injury; normalizing the hormonal function, and reducing the inflammatory mediators which results in reduction of inflammation and edema; thus speeding the repair process.[7,8]

Several studies have suggested that LLLT has beneficial effects on bone repair, it enhances the osteoblastic activity, collagen formation, and increases the rate of bone deposition when applied during the initial stages of bone repair, when cell proliferation is predominant, so nowadays studies are directed to evaluate the effect of LLLT on dental implant osseointegration.[9]

Regarding peri-implant bone healing after titanium implant placement, previously published studies have shown more evident bone maturation and increased bone–implant contact (BIC) in the

LASER irradiated groups when compared with the control groups.[6,7,10]

Er,Cr:YSGG LASER is a good device that can be used to cut both bone and soft tissue as it is highly absorbed in water. On studying the effect of erbium LASER on bone when used to create bone defects, it was found that it increases the osteoblastic activity by stimulation of alkaline phosphatase enzyme and calcitonin gene immune-peptide reactive which enhance osseointegration and results in shorter healing periods when compared to bone defects caused by surgical bur.[11]

So this study aimed to evaluate the effect of using both diode and Er,Cr:YSGG LASERs on the rate of bone formation in the peri-implant gap around immediately placed dental implants.

# REVIEW OF LITERATURE

## Edentulism:

Edentulism as defined by the glossary of prosthodontics is the state of being edentulous without natural teeth. It is divided into two major categories: complete edentulism and partial edentulism.[12]

It is conservatively assumed that 10% of the world's population of 6 billion is partially or totally edentulous. Which means that there are millions of edentulous people worldwide who need treatment for a condition that can represent considerable disability.[13]

Over the last twenty years in most western countries the number of people retaining their natural teeth were increased and the percentage of edentulism was decreased, unlike the less developed countries where the rate of total edentulism is still increasing, because painful teeth are often extracted rather than treated conservatively.[14]

Country's socioeconomic situation can partially determine edentulism in addition to cultural and psychosocial factors as well. Regional disparities of the prevalence of edentulism are also marked, for example between rural and urban areas.[15]

Edentulism is the terminal outcome of a multifactorial process involving biological factors and patient-related factors.[16]

Dental diseases such as caries and periodontitis are among the most frequent risk factors. Poverty, ignorance and unhealthy hygienic habits such as smoking and alcoholism are also common risk factors. Systemic diseases such as diabetes and osteoporosis could also be counted as a risk factor. Given the large number of those diverse risk factors, one cannot single out one risk factor as the most threatening. [17]

## Problems related to edentulism:

An intimate relationship exists between the teeth and the alveolar process. The lack of mechanical stimulation resulting from the loss of teeth in the edentulous state results in loss of the bone mass. This is accompanied by a decrease in the bone trabeculae and bone density in the area in addition to loss of bone width followed by loss in bone height.[18]

Once teeth are lost, remodeling of the alveolar bone begins. Within a few weeks significant parts of the former tooth-bearing alveolar tissue are lost and the alveolar ridge loses vertical height as it rounds off, reducing the size of the denture bearing area, which in turn affects the face height and the facial appearance.[19] Additionally, the loss of alveolar bone height and width usually causes protrusion of the lower lip and chin and does other changes to the soft-tissue profile. [20]

Loss of bone in maxilla or mandible is not limited to the alveolar bone; also portions of the basal bone may be resorbed also, especially in the posterior aspect of the mandible where severe resorption may result in more than 80% bone loss.[18]

The marked reduction in the mandibular residual ridge compared to that of the maxillary residual ridge increased at the seven-year stage.[21]

This atrophy is progressive and has been reported to slow down to an annual rate of 0.05mm in the upper residual ridge and 0.20mm in the lower residual ridge 10 years after tooth extraction.[18]

The facial changes that naturally occur in relation to the aging process can be accelerated and potentiated by the loss of the teeth. Several esthetic consequences result from the loss of alveolar bone. The decrease in the facial height results in a collapsed vertical dimension causing several facial changes. The loss of labiomental angle and deepening of vertical lines in the area create a witch like appearance.[18]

As the vertical dimension progressively decreases, the occlusion evolves towards a pseudo-Class III malocclusion. As a result the chin rotates forward and creates a prognathic facial appearance. These conditions result in dropping of the corner of the mouth; and the patient appears unhappy when the mouth is at rest.[18]

Thinning of the vermillion border of the lips results from the poor lip support; this is related to bone resorption from the labial aspect of the premaxilla, and the loss of the muscle tone. Deepening of the nasolabial groove and the other vertical lines in the upper lip are related to normal aging process but it is accelerated with bone loss.[18]

As bone loses width, then height, then width, and then height again, the attached gingiva gradually decreases. A thin attached tissue usually lies over the advanced atrophic mandible or absent entirely.[18]

The tongue of the patient with edentulous ridges often enlarges to accommodate the space that was formerly occupied by teeth.[21]

As tooth loss occurs, masticatory efficiency declines, and the edentulous individuals tend to alter their dietary intake to compensate for the greater difficulty of eating certain foods.[22]

Edentulous people in fact lack specific nutrients and these nutritional deficiencies could ultimately result in an increase in the incidence of various health disorders.[22]

## Residual ridge resorption:

Maxillary and mandibular bony complexes are formed of several anatomical structures: basal bone forms the body of mandible and maxilla, alveolar process that develops following tooth eruption and contains the tooth alveolus, the bundle bone that