

CHAPTER 1

INTRODUCTION

1.1 Historical Background

Nowadays, dental implant retained overdenture (IODs) has become a successful treatment in edentulous patients. The edentulous patients who lost all of teeth on mandibular arch, hence edentulous patients have insufficient masticatory efficiency and bone loss. It could be restored with complete dentures (CD) only in first decade. But from the patient feedback, complete denture has some problems in support, stability, and retention. Further in edentulous patients, the anterior area of mandibular is the position that the bone has the most deformations [1]. From the previous study to improve complete denture problems, Feine JS et al. proposed that the edentulous patients have problems adapting to their complete dentures, and especially to the mandibular prosthesis it difficult to eat many kind foods, those that are hard. And they reported that a 2-implant overdenture should become the first choice of treatment for the edentulous mandibular patients [2]. Because there were many evidences indicating that 2-implant overdentures (IODs) are better than using complete denture (CD) in many aspects. Lately, some studies were presented that using a single implant is adequate for overdenture retention and if placing multiple implants can get a high success rate (about 97% - 98%) overdenture supported [3-7]. The advantage of implant retained overdenture are better stability and retention than conventional and complete denture. And long-term survival rate of implant retained overdenture was high success rate and successful “osseointegration” with a small mean bone loss [8]. In 2012, the journal of dentistry proposed that when increment in dental implant number, the maximum strain value in peri-implant bone would decrease and the strain in the bone would be more widely distributed, chewing force was shared by dental implants. While the single dental implant most of the force was loaded on the mucosal area. This is the reason why single and two-implant overdentures are called “dental implant retained overdentures”, while

overdenture on more than three dental implants are called “dental implants-supported overdenture” [9].

Nevertheless, some patients whose alveolar ridges morphology cannot use normal-size or conventional dental implant because mandibular bone layer was dissolving or the abnormality of patient mandibular. Hence, mini dental implant (MDI) is the alternative treatment procedure. In term of MDIs, The Glossary of Oral and Maxillofacial Implants has defined MDI as “Implant fabricated of the same biocompatible materials as other implants but of smaller dimensions”.[10] MDIs will be used when the quantity and quality of alveolar bone is insufficient to accommodate the width of the implant. Nowadays, MDI is an alternative option from many choices to treat in clinical. In many previous clinical evidences, which reported that MDI retained/supported overdenture can improve quality of life, patient satisfaction, and chewing ability of edentulous patients [11-13]. Recently, in clinical studies, reported using of mandibular overdentures supported by more than two-dental implants do not induce to greater patient satisfaction in terms of denture and society. In 2012, the researchers found no clear difference in either clinical or radiographic outcomes between two-implant retained and four-implant-supported mandibular overdentures over a 10-year assessment period. Patients were evenly satisfied with their overdentures and a two-implant overdenture is advised for patients with complaints concerning retention and stability of the lower denture for cost-effectiveness [14].

In addition to treatment, the biomechanics in dental implant restorations are regarded as the transfer of excessive forces from the muscles of mastication to the opposing dentition, across the dental implant restoration and supporting bone. This can be a very challenging issue due to the involvement of highly irregular geometry, different biomaterials and their interactions. It is very difficult (if not impossible) to find an accurate quantitative solution of biomechanical responses by using a conventional mechanics approach. Finite element analysis (FEA), in the last four decades, has become the most prevalent numerical technique, which is used for approximately predicting physical phenomena that are governed in differentiation equations. More specifically, FEA has also been applied rapidly and extensively in the implant dentistry since 1976 [15]. Nevertheless, Chang et al. use 3D FEA to study in mechanical response

comparison in an implant overdenture retained by ball attachments on conventional regular and mini dental implants. They reported that the maximum bone strains were generated more around mini dental implants than in conventional size implants retained overdenture. Hence, this evidence was the precautions in mini dental implants using [16]. However, the survival rate of mini-implant supported mandibular complete dentures five month to four years is 91-96% [17]. Normally, 3D FEA was used to recheck or compare with photoelastic or strain gauge technique. The previous study set four MDIs were recommended for support loading with overdentures [11-13]. However, some authors suggested that using two MDIs were enough for the edentulous mandibular patients. Nevertheless, there is the limitation of data on clinical study regarding the number and position of MDI and load transmitted to the alveolar ridge in implant retained mandibular overdentures.

Hence, this study aimed on number and locations of MDIs to be placed for retained/supported mandibular overdentures to extend an understanding of the MDIs number on stress and strain distribution. Providing fundamental understanding of MDIs in regard to number and locations to be placed, based on a biomechanics approach, would assist dentists to decide their proper treatment plan. Developing finite element analysis protocol for demonstrating stress and strain distribution relate to number and locations of MDIs. This would lead to optimum treatment protocol for maintenance of MDI retained/supported overdentures.

1.2 Research objectives

To evaluate the effect of number and location of MDI on stress and strain distribution.

To perform the stress and strain distribution on each location of MDI-retain overdentures.

1.3 Educational advantages

The results will be useful for improving and founding the appropriate dental implant location and number in dentistry patients.

This study might be helping to develop a specific treatment plan for edentulous mandibular patients.