CHAPTER 1

INTRODUCTION

Statements of Problem

Some kind of oral & maxillofacial works always create bone defects such as enucleation of cyst or tumor resection. On the other hand, some works were the treatment of pre-existing bony defects such as alveolar clefts, sinus lift. Therefore, researchers in oral and maxillofacial surgery continuously strive to improve on current bone-grafting techniques and bone replacement materials. Although, the natural biological materials for bone defect repair, especially autografts were thought to be the best material from their osteoconductive and osteoinductive properties, the healing by phase I and II osteogenesis and their good tissue compatibility but the autografts also have strong disadvantages such as donor site morbidity and donor shortage. (Lew and Hinkle, 1992 : 922) Therefore, allografts were chosen for solving this problems but this material also has its own shortcomings such as immunologic response and transmitted disease risk. (Stevenson, 1999 : 544-546) Although the numerous synthetic bone substitutes such as hydroxyapatite, some kind of cements and polymers have been developed and proved to promote bone regeneration for several decades, there exists many disadvantages. For example, hydroxapatite are difficult to shape resulting in graft movement. Cements have inappropriate biodegradation, immune response and low tissue compatibility. (Cornell, 1999) Polymers are usually encapsulated and do not integrate with tissue. Finally the important disadvantages of this synthetic materials are the lack of ability to produce in our country and still have very expensive price.

Recently, a tissue engineering strategy has been suggested to create the bone substitute materials which act as the scaffold and induced osteogenesis. Chitosan is the product of the partial deacetylation of the naturally occurring polysaccharide chitin, which is found in the exoskeletons of insects and marine invertebrate. It is a biocopolymer comprising of glucosamine and *N*-acetylglucosamine which its structural

similarity to glycosaminoglycan in extracellular matrix of human hard tissue. Chitosan has been suggested to possess biological and material properties suitable for clinical application,for example, a wound healing agent, bandage material, skin grafting template, hemostatic agent and drug delivery vehicle. (Koide, 1998) It has been reported to be nontoxic and bioresorbable when used in human and animal models, specifically it has been explored a capacity to promote the growth of bone. (Kwunchit Oungbho, 1997a : 30-56; Lahiji, et al., 2000; Madihally and Matthew, 1999 : 1141; Muzzarelli, 1992; Weiner, 1992) In the present study, chitosan was designed as scaffolds for tissue-engineered bone formation by crosslinking with gelatin, which is a heterogenous mixture of water soluble proteins derived from hydrolysis of collagen. Gelatin has been reported to be a biodegradable and biocompatibility material ; especially, in gelatin sponge form has been found to be a carrier material for bone regeneration. (Higuchi, et al., 1999; Kinoshita, et al., 1997; Krebsbach, et al., 1997)

Kwunchit Oungbho (1997b : 152-199) suggested that chitosan-gelatin sponge is a biodegradable and biocompatibility porous matrice. Moreover, it was found to be a scaffold for fibroblast proliferation in *in vitro* study. (Kwunchit Oungbho, 1998) In this present work, we prepared the chitosan-gelatin sponge in our laboratory room and used as a scaffold for bone regeneration in rabbit calvarial bone defects. Recently, there still existed a little report of chitosan-gelatin sponge used in bone regeneration by in vivo study so it is a challenge for us to find the result of this study.