CHAPTER 1

INTRODUCTION

1.1 Introduction

Orthodontic tooth movement causes remodelings in dental and periodontal tissues, including dental pulp, periodontal ligament (PDL), alveolar bone, and gingival. These remodeling depend on the magnitude, direction and duration of the applied force, and on the patient's age. The force-induced tissue strain produces local alterations in vascularity, as well as cellular and extracellular matrix reorganization, leading to synthesis and release of various neurotransmitters, cytokines, growth factors, colony-stimulating factors and metabolites of arachidonic acid.[1]

Orthodontic tooth movement has been defined as a result of the coupling of bone resorption and deposition at compressive and tensile sites, respectively, adjacent to the PDL.[2] Heavy orthodontic force produces hyalinization and ischemia in the PDL, thereby delaying tooth movement from undermining bone resorption starting at the adjacent bone marrow. The optimum orthodontic force magnitude should produce maximum rate of tooth movement with minimal tissue damage and with maximum patient's comfort. The optimum orthodontic force produces direct bone resorption at a distance from the PDL, thus increasing the rate of tooth movement.

The assessment of tooth movement includes clinical, histological, biomechanical, and biochemical assessments. Biochemical markers for bone formation and resorption provide a new and potentially important clinical tool for assessing and monitoring bone metabolism.[3] Furthermore, monitoring changes in

gingival crevicular fluid (GCF) constituents is a non-invasive and rapid biochemical method for evaluating metabolic changes in periodontal tissue and alveolar bone. Various biochemical markers have been used to assess bone remodeling and to monitor periodontal health.[4-12]

Glycosaminoglycans (GAGs) are polysaccharide components linked to the protein cores of proteoglycans, which are found in the extracellular matrix (ECM) of mineralized and other connective tissues. The character of connective tissue depends, to a large extent, on the relative proportions of ground substance and embedded fibrous proteins.[13] The major component of GAGs in alveolar bone is chondroitin sulfate (CS).[14] Previous study have demonstrated that the GAG levels in GCF reflect changes in alveolar bone and PDL associated with orthodontic tooth movement.[15] It has been shown that the CS levels in GCF is a candidate biomarker of deep periodontal tissue changes occurring around orthodontically moved teeth.[16-19] Expression of chondroitin-6-sulfate (C-6-S) near the bone surface corresponds well to the compressive force during tooth movement.[20] The Thailand Excellence Center for Tissue Engineering, Department of Biochemistry, Faculty of Medicine, Chiang Mai University, has produced a novel synthesized WF6 monoclonal antibody for CS detection.[21-23] In addition, a previous study showed that the detectable CS levels in GCF of moved canines were associated with the applied orthodontic forces.[24] The results of these studies indicated that the changes in CS levels in GCF should be monitored during orthodontic canine movement induced by ranges of force magnitude.

1.2 Purposes of this study

The purposes of this study were

1) To compare CS (WF6 epitope) levels in GCF with 70 and with 120 grams of orthodontic force during the movement of canine teeth.
2) To assess and compare the rate of canine movement with 70 to that with 120 grams of orthodontic force.

1.3 Anticipated benefits

The anticipated benefit of this study was to justify the correlation among CS (WF6 epitope) levels and force magnitude during orthodontic canine movement. Therefore, the CS (WF6 epitope) levels in GCF may be used as a biomarker and a diagnostic tool for monitoring orthodontic tooth movement. The orthodontist may use the knowledge from this study to select appropriate force magnitude for each particular patient during orthodontic canine movement. Furthermore, the correlation among CS (WF6 epitope) levels, force magnitude and the rate of canine movement may be assessed, and the results of this study may provide information for further studies on related topics.