CHAPTER I
INTRODUCTION

1.1 Statement and significance of the problem

Anchorage control is an important consideration in orthodontic treatment. Traditional anchorages include intra-oral anchorages, such as the palatal bar, the lingual arch, class II and class III elastics, the Nance arch, the utility arch, and the lip bumper, as well as extra-oral anchorages such as headgear. There are limitations to using the traditional anchorages, because anchored teeth move in response to force. The extra-oral anchorage requires patient compliance.[1] In addition, anchorage loss is a common problem encountered by orthodontists. Accordingly, temporary anchorage devices (TADs) have been introduced to overcome the limitation of these traditional anchorages. Creekmore and Eklund[2] first reported the use of a surgical vitalium bone screw as a temporary anchorage device to treat an orthodontic patient with deep impinging overbite.

Recently, the miniscrew implant, a type of temporary anchorage device, has been promoted as an improved biomechanical device in orthodontic treatment. The miniscrew implant offers many advantages, such as small size to facilitate placement in any area of alveolar bone, ease of placement and removal, independence of patient compliance, shortening treatment duration, and ability to withstand immediate loading with adequate anchorage support.[3-16] However, it is not clear whether the miniscrew implant remains stationary under orthodontic forces. Some studies have reported that the miniscrew implant is stable during orthodontic loading.[3,7,10,17,18] Controversially, mobility and displacement of the miniscrew implant, before and during orthodontic loading, have also been reported.[4,5,19,20] The failure rate of miniscrew implants ranges from 3 to 51%.[4,5,19-27]

Stability assessments of the miniscrew implant were previously based on stability assessments of dental implant, including clinical assessments,[19-21,28-41] histological assessments,[5,28,36,41-45] mechanical assessments,[4,36,46-52] and biochemical assessments.[30,53-63] Numerous investigations had focused on analysis of gingival

crevicular fluid (GCF) and peri-implant crevicular fluid (PICF). Several extracellular matrix components[30,53-57] that were derived from alveolar bone, i.e. glycosamonoglycans (GAGs),[58-62] were detected in GCF and PICF. Detected chondroitin-4-sulfate (C-4-S) and chondroitin-6-sulfate (C-6-S) are GAG components that were used to assess alveolar bone remodeling in periodontal disease[64,65] and alveolar bone resorption around dental implant.[60]

Our previous study, with collaboration of the Department of Biochemistry, Faculty of Medicine, Chiang Mai University, showed that, by using an enzyme-linked immunosorbent assay (ELISA) with a newly developed monoclonal antibody (mAb) WF6, the chondroitin sulfate (CS) epitope (WF6 epitope) could be precisely detected in GCF during orthodontic canine movement. This suggested that the levels changes of CS epitope (WF6 epitope) might be used as biomarker for alveolar bone resorption during orthodontic movement.[66]

The detection of CS epitope (WF6 epitope) levels in peri-miniscrew implant crevicular fluid (PMICF) during orthodontic treatment has never been investigated. So, the objective of this study was to monitor changes in level of CS epitope (WF6 epitope) in PMICF under orthodontic forces. It was speculated that the level changes of CS epitope (WF6 epitope) might reflect alveolar bone resorption around miniscrew implant, and might be used as a biomarker for assessing miniscrew implant stability.

1.2 Anticipated benefits

This study might be useful for developing a non-invasive chair-side diagnosis to assess deeper alveolar bone remodeling around the miniscrew implant under orthodontic forces. This assessment could not be obtained from current clinical indices. Furthermore, this study might be clinically useful for biological monitoring and predicting alveolar bone resorption around the miniscrew implant, and this may be useful to biochemically assess the stability of the miniscrew implant under orthodontic forces. The effectiveness of treatment could be improved by determining optimal force and duration pertaining to clinical usage of the miniscrew implant.