CHAPTER V
DISCUSSION

Since the main component of glycosaminoglycans (GAGs) in alveolar bone is chondroitin sulfate (CS), its level in human gingival crevicular fluid (GCF) has been used to investigate alveolar bone remodeling as a result of periodontal disease[64,104] and orthodontic tooth movement.[66, 86, 91] For dental implant, several studies suggested that the CS level in peri-implant crevicular fluid (PICF) was also used for monitoring bone resorption and health status of dental implant.[58-62] For miniscrew implant, the studies on investigation of biochemical composition in peri-miniscrew implant (PMICF) under orthodontic force appear to be lacking. This study was directed to monitor the CS epitope (WF6 epitope) levels in PMICF under and without orthodontic forces.

Previous studies[66,104] demonstrated that C-6-S is present in the GCF by using ELISA method with monoclonal antibody (mAb) WF6. It has previously been suggested that the concentration of C-6-S in GCF might provide a means of monitoring the bone resorption for the period of orthodontic canine movement and a result of periodontal disease. In this study, the CS (epitope) levels in PMICF were investigated in a manner similar to those used for GCF in a previous study. We also found that the CS epitope (WF6 epitope) in PMICF both under and without orthodontic forces could be precisely detected.

Our previous study[66] revealed the correlation between high C-6-S levels, or resorptive phase of bone cycle and the orthodontic force in GCF of moving canine teeth. In addition, significant increase in C-6-S levels was detectable in GCF from patients with periodontal disease that involves breakdown of periodontal tissue, particularly alveolar bone resorption.[104] The result from the first part (Part I) of this study showed that the median CS epitope (WF6 epitope) level during the loaded period (four weeks) was significantly greater than that during the unloaded period ($P < .05$). This finding differs from the study of Sari and Uçar[63] which evaluated the IL-1β levels in PMICF during three weeks of orthodontic forces loading period. There

were no statistical differences in IL-1β levels of the PMICF during loaded for three weeks. The intergroup comparisons showed no statistically significant difference in IL-1β levels between the control (the antagonistic canines that were not moved distally) and the miniscrew implant groups. The possible explanation might due to the failure of two miniscrew implants during the loaded period in this study, meanwhile the miniscrew implants from the study of Sari and Uçar[63] remained stable throughout the study. However, the baseline about CS epitope (WF6 epitope) levels in GCF around teeth without orthodontic force in each patient was not performed in this study.

Freire et al[45] evaluated the influence of orthodontic load for 12 weeks on miniscrew implants. Evidence of bone neoformation at trabecular regions was observed in control and experimental groups. In addition, microscopic findings demonstrated that bone remodeling and osseointegration occurred around orthodontic screws under orthodontic loading were observed within 12 weeks.[41,80] Therefore, to assess the effect of orthodontic loading on the peri-miniscrew implant bone response and to monitor the peri-miniscrew implant biochemical compositions, the extension of the loaded period (nine weeks) in the second part (Part II) was performed.

In the second part (Part II), the medians CS epitope (WF6 epitope) levels between the unloaded and the loaded periods were not significantly different. This result indicated that orthodontic force on miniscrew implant might not affect the CS epitope (WF6 epitope) levels in PMICF. This also indicated that orthodontic force may have a little influence on initial bone modeling, subsequent remodeling and miniscrew implant anchorage stability, as reported in previous studies.[45,50,80]

It should be noted that, in this study, three miniscrew implants were considered failure after the application of orthodontic forces. Miniscrew implant losses after the application the orthodontic forces have been reported in the literature.[5] However, several studies[18,28,45,80] indicated that low magnitude static forces were not detrimental to the stability of the miniscrew implant. Therefore, the 50g of static forced that was applied to miniscrew implant in this study might not affect stability of the miniscrew implant. A possible explanation for this observation was a trauma from the miniscrew placement procedures.[45] Pre-drilling hole were performed before the miniscrew

implant insertion in this study might decreased the contact regions between miniscrew implants and surrounding bone.[41,45,82]

Interestingly, the levels of CS epitope (WF6 epitope) from failed miniscrew implants were dramatically high 14 days prior to the miniscrew implant failure. We assumed that the elevations of CS epitope (WF6 epitope) level before the failure of the miniscrew implant may be associated with bone resorption around the miniscrew implant. In agreement with earlier studies[58,60,61], GAG constituents, particularly CS was found in peri-implant crevicular fluid. The high CS levels were a potential marker for adverse tissue responses, and markedly bone resorption. However, the result of this study should be interpreted with caution due to the limitation of sample size, and the only one bone resorption marker was used in this study. We suggested that different biomarker should be used to evaluate the surrounding bone status of the miniscrew implant.

Limitation of the study

1. As a result of the specified criteria for the volunteer, a small sample size and the only one bone resorption marker was used.
2. A difference of bone quantity and bone quality in each patient is difficult to be controlled, and they vary among patients. Rate of bone remodeling around the miniscrew implant under orthodontic forces may be different in any point of PMICF collection in each patient.
3. The base line about CS epitope (WF6 epitope) levels in GCF around teeth without orthodontic force in each patient did not perform in our present study. A profile of CS epitope (WF6 epitope) levels in GCF without orthodontic forces will give us a baseline condition of bone remodeling.

Suggestions for further study

In our present study, only CS epitope (WF6 epitope) levels in PMICF was investigated. For further investigation of alveolar bone resorption around miniscrew implant under orthodontic force, the CS epitope (WF6 epitope) levels in GCF together with in PMICF under orthodontic forces in same patient should be monitored. The profile of CS epitope (WF6 epitope) levels in both GCF and PMICF will explicit

difference of bone remodeling between around the miniscrew implant and around the orthodontically moved teeth. An observation of clinical parameter or histomorphometric analysis may be used to strengthen the biochemical analysis of bone response around miniscrew implant under orthodontic forces. The early recognition of the miniscrew implant status by using the analysis of extracellular matrix ingredient in PMICF will permit clinicians to prevent predicted failure of the miniscrew implant, and to increase treatment success.