

CHAPTER 1

Introduction

1.1 Principles and rationales

Anterior open bite is generally classified, according to its etiologies, into two major types: 1) dental open bite; 2) skeletal open bite (1). Skeletal open bite is a complicated problem that is associated with unfavorable craniofacial growth patterns, including hyperdivergent growth pattern, posterior or clockwise rotation of the mandible, and excessive vertical growth of the craniofacial skeleton. In severe skeletal open bite cases, orthognathic surgery with orthodontic treatment is required to correct the vertical skeletal discrepancy. In mild skeletal open bite cases, conventional orthodontic treatment can be utilized to camouflage the vertical skeletal discrepancy. Posterior tooth intrusion in conventional orthodontic treatment is aimed to cause counter-clockwise rotation of the mandible. Temporary anchorage devices (TADs), such as miniplates, or miniscrew implants, play an important role as a skeletal anchorage for maxillary or mandibular posterior tooth intrusion.

Miniscrew implants have been widely used to achieve absolute anchorage because of easier placement, less trauma during placement, lower cost and smaller size than when other TADs are used (2, 3). The goals of miniscrew implant placement are effective biomechanics for desired tooth movement, and good retention and stability of miniscrew implants without damaging vital anatomical structures. Determination of miniscrew implant size, length and placement site depends on the appliance design, biomechanics, important anatomical structures, and quality and quantity of surrounding bone. Several factors influence the success rate of miniscrew implant placement. Previous studies (4, 5) have shown that the cortical bone thickness has a strong impact on the primary stability and success rate of miniscrew implants.

Moon *et al.* (6) have reported a significant reduction in interradicular miniscrew implant success in the buccal maxillary region with open vertical skeletal configurations,

and suggested that the reduction was associated with high Frankfort-mandibular plane and low upper gonial angles. The reduction was related to the quality and quantity of dento-alveolar bone. Several studies (7, 8) have found thinner dento-alveolar ridges and thinner alveolar cortical bone in patients with open vertical skeletal configurations than in those with deep vertical skeletal configurations. Therefore, the risk of miniscrew implant failure might increase after miniscrew implant placement in the maxillary and mandibular alveolar bone in open vertical skeletal configuration cases. Moreover, there are some problems pertaining to interradicular miniscrew implant placement, including the risk of dental root damage, and miniscrew implant fracture due to limited miniscrew implant dimensions.

The palate is an alternative region for miniscrew implant placement to provide skeletal anchorage for maxillary posterior tooth intrusion, especially for treatment of skeletal open bite. Previous studies (9, 10) have suggested that the stability of palatal miniscrew implants is due to dense palatal bone, enough palatal cortical bone thickness and few vital anatomical structures. Furthermore, the thickness of the palatal mucosa is claimed to be suitable for the biomechanical stability of miniscrew implants. Currently, the palatal bone thickness in patients with normal vertical skeletal configuration has been studied for locating the most appropriate miniscrew implant placement site. However, there is still lack of knowledge about the palatal bone thickness, both total palatal bone and palatal cortical bone thickness, in Thai patients with open vertical skeletal configuration, and whether there are differences in the palatal bone thickness between patients with normal and those with open vertical skeletal configurations.

Accordingly, the purpose of this study was to measure and compare both palatal bone and palatal cortical bone thickness in Thai patients exhibiting normal overbite with normal vertical skeletal configuration to that in Thai patients exhibiting anterior open bite with open vertical skeletal configuration, using cone-beam computed tomography (CBCT). This investigation should provide a reliable guide for selecting palatal miniscrew implant placement sites and for the lengths of palatal miniscrew implants for orthodontic treatment of skeletal open bite, especially during maxillary posterior tooth intrusion.

1.2 Purposes of the study

1. To measure and compare the palatal bone thickness in Thai patients exhibiting normal overbite with normal vertical skeletal configuration to that in Thai patients exhibiting anterior open bite with open vertical skeletal configuration.

2. To measure and compare the palatal cortical bone thickness in Thai patients exhibiting normal overbite with normal vertical skeletal configuration to that in Thai patients exhibiting anterior open bite with open vertical skeletal configuration.

1.3 Research hypothesis

1. There are significant differences in the palatal bone thickness between Thai patients exhibiting normal overbite with normal vertical skeletal configuration and those exhibiting anterior open bite with open vertical skeletal configuration.

2. There are significant differences in the palatal cortical bone thickness between Thai patients exhibiting normal overbite with normal vertical skeletal configuration and those exhibiting anterior open bite with open vertical skeletal configuration.

1.4 Research designs and procedures

This study was a retrospective study. Thirty CBCT images of patients were divided into two groups: normal and open vertical skeletal configurations. The palatal bone thickness and the palatal cortical bone thickness were measured.

1.5 Expecting benefit and goal

The benefit of this study is to suggest the palatal miniscrew implant placement sites and lengths for Thai patients exhibiting anterior open bite with open vertical skeletal configuration. Suitable placement sites and implant lengths lead to successful palatal miniscrew implant placement and skeletal anchorage for maxillary posterior tooth intrusion, during skeletal open bite treatment. Furthermore, the results of this study might provide information for further studies on related topics.