

CHAPTER 5

DISCUSSION

In complete cleft patients, almost all of them need alveolar bone grafting treatment to create a bonding section at the cleft area. This study was assessed using two dimension radiographs which routinely used to diagnosis and assessed bone availability for cleft patients. Although three dimensional computed tomography is superior in bone imaging, it is not commonly used during routine diagnosis for cleft patients due to its higher radiation exposure and costliness.⁶⁵ However, Feichtinger *et al.*⁶⁶ demonstrated that two dimensional radiographs were underestimated compared to axial computed tomography scan in unilateral complete cleft lip and palate patients. They found differences between two regions, hard palate and alveolar bone crest. In the hard palate area, extremely bone loss occurred in vertical dimension. In contrast, a significant bone loss was visible in bucco-palatal portion, whereas vertical dimension showed minor decrease. And they found 49.5 % of bone loss in first year and the transplants remained constant in the following two years. Waitzman *et al.*⁶⁷ revealed the disadvantages of computed tomography are high radiation dosage, high cost, artifacts and scanning noise and psychological stress of patient during procedure. All these parameters can influence the quality of the CT images and the subsequent 3D reconstructions. According to these reasons, conventional radiographs are routinely used in treatment planning and assessing bone level in cleft patients.

Many factors have been reported as potential influences on the grafted outcomes, for example, Van Der Meij *et al.*⁶⁸ claimed that cleft width was related to bone grafting remaining. They concluded that bone grafts in wider clefts were more prone to resorption than those with narrow ones. Long *et al.*⁴¹ revealed that some of cleft widths were created by presurgical orthodontic expansion and had little bearing on the success of alveolar bone grafting. Their analyses showed low correlation between cleft width and outcome of bone graft, and successful bone graft rate was similar in both unilateral and bilateral group. They also discussed that other characteristics of preoperation cleft area such as availability of neighboring soft tissue, eruption stage of distal segment teeth, periodontal status of adjacent teeth, type of material, surgical flap design and handling during grafting procedure and skill of surgeons. Their study found that all failed bone grafts received cancellous iliac crest bone and repositioning premaxilla at the time of bone graft with no different between unilateral and bilateral clefts.

Lilja *et al.*⁶⁹ revealed that facilitating eruption to the teeth adjacent to the cleft, such as lateral incisors and canines present into grafting area increased alveolar bony height level 4 years after surgical procedure. Optimal timing indicator to performing bone grafting procedure should be the use of thin bone covering the crown rather than the root formation degree.

The successful surgical outcome in terms of alveolar bone height is facilitated by treatment onset preferably during early mixed dentition and in presence of the lateral incisor.⁷⁰ Shashua *et al.*⁷¹ explained that when the lateral incisor was present in the cleft

area, a decision might be made to perform early grafting in order to salvage an additional tooth. However, tooth size, position and shape were important factors to keep the lateral. Gundlach *et al.*⁷² revealed that cancellous bone grafting in the cleft area between 7 to 8 years are the most favorable age interval, because the alveolar ridge has largely completed its final height by then and both maxillary development and growth itself is hardly disturbed. Boyne and Sands⁷³ were recommended that secondary bone grafting was carried out between 7 and 14 years of age in order to avoid disturbed growth. Bach and Woo⁷⁴ introduced allograft bone material to treated severe alveolar cleft defects in adult. Their repairs were accomplished with a guided bone regeneration technique without using any autogenous bone.

In this study, upper lip thickness showed the increasing value after alveolar bone grafting procedure. In 2005, Brock *et al.*⁷⁵ revealed lip thickness was influenced by incisors and hard tissue changes after orthodontic treatment. Their results shown ethnic did not influenced the lip thickness correlated to those treatment. Filho *et al.*⁶² suggested that lip repair has a significant influence on certain areas of the craniofacial complex, mainly the premaxilla and the upper incisors. Capellozza Filho *et al.*⁷⁶, 1996 have showed that primary surgeries reshape the maxilla but negatively influenced its growth in complete unilateral cleft lip and palate. Lip repair performed during the first months of life might be more noxious to maxillary sagittal and transverse growth than palate repair⁷⁷. Normando *et al.*⁷⁸ reported that cheiloplasty in cleft lip and alveolus patients is associated with osseous remodelling in the anterior alveolar region, without significant changes in anterior nasal spine or other areas of the maxilla.^{76,77} While isolated cleft

palate subjects palate repair does not promote significant changes in maxillary morphology and spatial position.⁷⁸ These mean lip reconstruction had more influence than those with palatal reconstruction.

The results of finite element showed the pressure from the upper lip had influenced the maxilla, but in Wen-Hua *et al.*⁷⁹ study, showed tongue and lower lip have had influencing on the maxilla. Their outcomes from the study for children with class III malocclusion suggest that no significantly different perioral force exists on the incisors at rest, even though the force from the lower lip are larger than those from the tongue. On the contrary, the lingual forces during swallowing are statistically higher than the labial pressure which may be due to the various tongue positions for patients with class III malocclusion, who the cleft patients always are.⁸⁰

Bone property were used in this study were static, as same as, many finite element studies. Many studies showed the bone properties were age-dependence. Tensile property decreased in yield and ultimate stress with increasing age, whereas, the compression were slightly decrease. Ultimate strain tension and compression were decreased with increasing age, while elastic modulus in tension and compression showed no significant age variation.⁸¹ Individual lower lip is stiffer than upper lip and the corresponding male lip is stiffer than the female lip.

The results of this study shows crest of the alveolar bone adjacent to the grafting area was bending by the lip force. Similar to the study of Zhou *et al.*⁶⁰ that force increasing on the non-cleft side while decreased on the cleft side. And these force led the

maxillary underdevelopment differ between cleft and non-cleft side. By the way, the maxilla models in their study are different from this study at the alveolar bone height. Zhou *et al.*'s models have different level between non-cleft and cleft side, but in this study have equal bone height in both sides.

Limitation of this study

The subjects in this study were only 10 patients from 214 total cleft patients in Maharaj Nakorn Chiang-Mai hospital, with complete data and radiographic records. The more subjects in the future may take more statistical power. The finite element model of lip and cleft maxilla were not ideal as realistic due to the musculature of lip muscle are complex musculature and individual cleft maxilla was unique. However, the results of this study take a benefit for the near future with the linkage between orthodontics and finite element study.