Symposium 1

Orthodontic treatment for alveolar bone graft

서울대학교 치과대학 교정학교실
백승학

I. Introduction

Rationale of orthodontic treatment for the cleft patients
- To retain as many natural teeth as possible
- To promote normal maxillary growth as much as possible with dentofacial orthopedics
- To advance the maxilla rather than set back the mandible during orthognathic surgery
- To use implants for tooth replacement and as anchorage for dentofacial orthopedics

Cleft patients with a permanent osseous defect of the alveolar arch and maxilla
- Instability of the premaxilla in bilateral clefts
- Oronasal fistulae or mucosal recesses that impede oral hygiene
- Insufficient support of the alar base contributing to the nasal asymmetry
- The osseous defect makes the orthodontic tooth movement and gap closure impossible and necessitates a bridge in the dental arch

II. Orthodontic treatment for alveolar bone graft

1. Pre-ABG stages
   - Preparation for bone grafting
   - 7 to 8 years
   - Deferring treatment until the eruption of the permanent first molars and incisors is the better option

   The upper dental arch be prepared to get
   - Alignment of the permanent incisors
   - Mobile premaxilla in BCLP is stabilized with a heavy rect. aw for 3months post-operatively.
   - Orthodontic / orthopedic expansion to correct the post. cross bite prior to the bone grafting procedure, and the orthodontic appliance is worn for 3 months post-operatively to retain the arch form.
   - Mmaxillary protraction to correct maxillary antero-posterior deficiencies

- Better access for the surgeon at the time of the grafting procedure
- Any dentoalveolar relapse is corrected later.

2. Alveolar Bone Graft

Aims of alveolar bone graft

- Stabilization of the segment by restoration of the continuity (bony bridge) of the alveolar arch
- Closure of oronasal fistula and elimination of mucosal recesses
- Bony support to alar base in case with nasal asymmetry
- Support and eruption of teeth bordering the cleft
- Orthodontic gap closure to avoid fixed dental prostheses
- Reduce risk of periodontal pocketing and ultimate loss of the teeth adjacent to the cleft
- Utilize the erupting teeth as a potent stimulus for bone formation

ilium (Cancellous bone graft)

1. abundance of bone
2. easy accessibility
3. excellent potential for regeneration
4. does not interfere in the formation of the teeth adjacent to the cleft.

Classification of alveolar bone graft

- Primary
- Secondary
- Tertiary
- Timing of bone grafting :

1. determined by stage and sequence of dental development
2. not judged according to chronologic age

IBG results

- dramatic adaptation of the cancellous bone of the iliac crest to the host area,
- making it impossible to distinguish the mesial and distal limits of the cleft.
- canines migrate toward the occlusal plane through the grafted bone and create good periodontal condition. (72%)

Success of alveolar bone grafting as measured by

- Bone height
- Gingival health
- Space closure by orthodontic means

Alveolar bone grafting in patients with complete clefts: a comparative study between secondary and tertiary bone grafting.

- The best results of alveolar bone grafting in cases of secondary osteoplasty were obtained when the lateral incisor or canine had grown into the transplant and had led to a functional stress of the transplanted bone.
- Approximately good results were to be found in tertiary osteoplasty when the transplanted bone had been stressed functionally through a dental implant.
- Comparing the secondary with the tertiary osteoplasty, there was a trend of lower resorption in secondary osteoplasty.

Functional Loading and Gap Closure

- The functional stress introduction from the erupting canine to the grafted bone prevents resorption after orthodontic gap closures.
- In gap closure, the canine was moved into the graft between the 4th and 6th postoperative weeks.
- Resorption protection may be achieved through functional loading of the grafted bone.

Gap Opening and Inactivity Atrophy

- Functional loading is absent in cases of gap openings.
- inactivity atrophy : a possible cause forhigher resorption rates in interdental gap openings.
- Significantly lower resorption rates were found in orthodontic gap closures when compared with gap openings and prosthodontic treatment.

Effect of cuspid positioning in the cleft at the time of secondary alveolar bone grafting on eventual graft success.

- No significant correlations could be found between final graft success and the amount of cuspid crown exposed in the cleft at the time of grafting.
- Cuspid position could not be shown to be a significant factor in determining graft success.

Canine eruption after secondary alveolar bone graft

- 27% : spontaneous eruption of canine
- 17% : just surgical uncovering needed
- 56% : surgical exposure and orthodontic tx

The prognosis for canine eruption through a graft site

- is most favorable if the graft is performed at 1/4-1/2 canine root formation and when the patient is aged 9-12 years.

Bone grafting around a partially exposed tooth

- If the cementum is mechanically injured during the bone grafting procedure or is exposed by orthodontic treatment,
- the contact of the grafted bone to the exposed root surface occurs.
- Progressive root resorption on the cervical 1/3of roots of teeth adjacent to the cleft, especially canines.

Bone grafting around a partially exposed tooth

- Usually results in marked bone absorption and negative outcome
- Avoided by
  1. delicate surgical technique
  2. performing the operation at an age where the cervical region of the canine is still covered with bone

Effect of alveolar bone graft on the maxillary growth

- The capacity of erupting teeth to generate alveolar bone can be utilized to maintain the general growth in the maxillary growth.
- sagittal and transverse growth of the anterior maxilla has virtually ceased by the age of 8 to 9 years.
- ABG has no adverse effect on AP or vertical maxillary growth at 8-11 year old period

3. Post-ABG stages

- The post-graft observation period is very important and requires complete cooperation between the orthodontist and the surgeon.
- Observe the eruption path of the lateral incisor (MLI) or canine through the grafted area
- The cleft side MLI or canine has erupted spontaneously or forcefully
- Orthodontic or prosthodontic space closure
- Observe the eruption path of the lateral incisor (MLI) or canine through the grafted area (around 3 months)
- When the cleft side MLI or canine has erupted spontaneously or forcefully, orthodontic treatment is resumed to correct the position of the permanent teeth.
- The alignment of the permanent teeth follows different principles, depending on whether orthodontic or prosthodontic space closure is planned.

III. Conclusion

- Timing of the maxillary expansion
- Timing of the secondary bone grafts according to dental development stages has an influence on the long-term success.
- Bone grafting should be done when the canine (or lateral incisor) is in an early stage of eruption and that orthodontic uprighting of the medial incisor should be done after surgery.
- The optimal treatment sequence appears to be transversal expansion of the maxilla in the late mixed dentition, followed by bone grafting.
- Maxillary expansion must be retained until final orthodontic and prosthodontic treatment is carried out.
- Controlled dental eruptions or orthodontic gap closures reduce the graft resorption.

약력

서울대학교 치과대학 졸업(1998.2)
서울대학교 치과병원 교정과 인턴, 레지던트 수료(1991.2)
서울대학교 대학원 치의학석사 (치과교정학 전공,1991.2)
서울대학교 치과병원 교정과 임상강사(1994.5-1995.4)
서울대학교 대학원 치의학박사 (치과교정학 전공,1997.2)
서울대학교 치과대학 치과교정학교실 전임강사(1999.9-2001.3)
서울대학교 치과대학 치과교정학교실 조교수(2001.4-현재)
대한구순구개열학회 학술이사(2003.6-현재)
대한치과교정학회 교육이사(2004.4-현재)
서울대학교 치과병원 대외협력담당교수(2004.9-현재)
서울대학교 치과대학 학생부학장보(2005.1-현재)