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CASE REPORT

Management of Arch Size Discrepancy due to Congenitally Missing Lateral Incisors with Combination of Orthodontic Treatment and Implant Dentistry

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Figure 1a-b. a) Pre-operative intra-oral photograph of patient with maxillary lateral incisor agenesis (MLIA). b) Post-operative 2 year follow-up.

Case History

Maxillary lateral incisor agenesis (MLIA) is a condition where a patient may present with one or two congenitally missing maxillary lateral incisor. The objective of this case report is to present a case where orthodontics treatment is combined with implant surgery to correct severe arch size discrepancy caused by MLIA. (Fig. 1a-b)

A 28 year old Hispanic male patient presented with history of prior orthodontic treatment which did not address the congenitally missing lateral incisor. Consequently, it failed to yield favorable result. Intra-oral exam revealed the following: 1) MLIA; 2) arch size discrepancy resulting in anterior and posterior crossbite; 3) missing lower left first molar and lower-right second molar; 4) class III anterior relationship with an extensive underbite. (Fig. 2a-b)

Figure 2a-b. Pre-operative intra-oral photograph of the patient. a) Maxillary occlusal view. b) Mandibular occlusal view.

Treatment Planning & Methods

Orthodontic

When a patient presents with MLIA, a decision has to be made whether to close the lateral incisor space or to open up the space for lateral incisor restoration. Space closure may be achieved by mesial repositioning of canines (Canine Substitution), followed by teeth recontouring. Space opening followed by implant restoration is indicated for patients whose maxillary incisors need to be protruded, to correct anterior crossbite, to gain upper lip support, and to obtain Angle Class I.[1] Selecting the appropriate treatment approach is not as simple as it sounds, but rather, include many factors including: patient's age, facial growth pattern, profile, smile line, occlusal scheme, spacing, tooth anatomy, alveolar bone quality and quantity, gingival display, and biotype.[2]

There are multiple restorative options that exist for the replacement of the congenitally missing lateral incisor. The best treatment option would be space formation followed by single-tooth implant restoration due to its predictability, conservative nature, and long-term success rates compared to other restoration methods.

The amount of space required for restoration can be determined with Bolton Analysis which involves dividing the sum of the mesiodistal width of the mandibular six anterior teeth by the sum of the mesiodistal width of the maxillary six anterior teeth. The ideal ratio comes out to be 0.78 and can be used to calculate the ideal missing tooth dimension which is 5-7mm in usual cases. The diagnostic wax-pattern seems to be the most predictable means to assess the required optimal space which is also in the range of 5-7mm.[3] After determining the space needed for restoration, the space required for implant fixture must be determined. Dr. Tarnow recommends to allow between 1.5mm and 2mm of space between the implant platform and the adjacent teeth for the development of the papilla. If narrow implant is 3mm in diameter, required minimum space would be 6mm. For example, if the edentulous space measures 7mm and a minimum of 3mm is needed for papilla formation (1.5mm on each side), then that leaves the surgeon an adequate amount of space (4mm) for the implant fixture. But if the edentulous space only measures 5mm, then there would be insufficient space for both a traditional narrow platform implant and papilla formation.[4] If minimum space of 6mm is not obtained, a compromise has to be made and the patient should be properly informed. Establishing space in the interradicular area must be also addressed during the orthodontic phase. The minimum space between the roots is generally 5mm. This amount of space will allow the implant to be surrounded by 0.75mm and 1mm of bone, which is sufficient for long-term osseointegration.[5] During the space opening aspect of orthodontic treatment, it is imperative to obtain translation movement instead of tipping, since the canine root apex inevitably lags behind the crown when distalized. (Fig. 3a-h)

Implant Surgery

When treatment planning for the implant surgery, the bone volume in the surgical site is typically deficient due to lack of development and eruption of a permanent lateral incisor. The ideal condition may be obtained when the permanent canine erupts mesially, next to the central incisor.[6] After eruption, the canine can be distalized orthodontically, and establish a proper buccopalatal alveolar ridge width.[7]

Series of Clinical Views

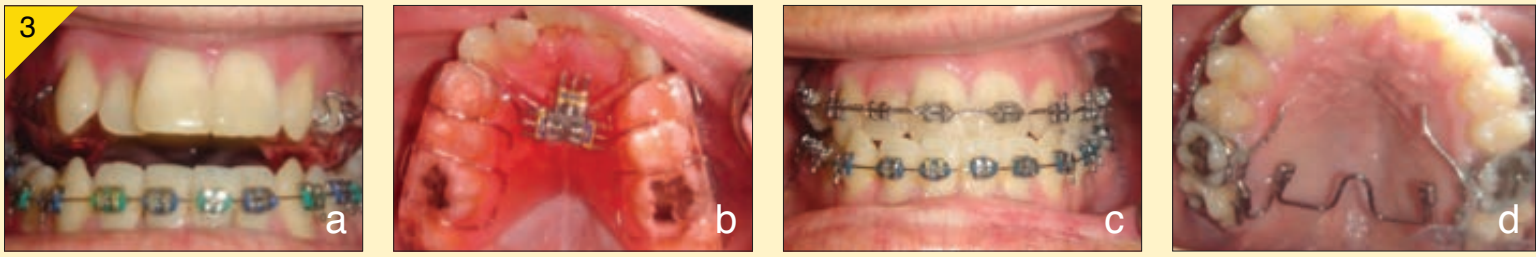

Figure 6a-h. Series of Clinical Follow-ups. a-b) 1 month anterior & maxillary occlusal view. c-d) 12 months anterior & maxillary occlusal view.

Even in this ideal condition, bone loss can occur at the implant site after space opening. *Uribe et al.* reported a 17–25% decrease in bone width at the ridge after space opening, resulting in a bone loss of approximately 1.1mm.[8] (Fig. 4)

Figure 4. Deficient of bone volume in the surgical site due to lack of development of a permanent lateral incisor.

Due to inevitable nature of bone loss, horizontal ridge augmentation must be considered during implant surgery. Several horizontal ridge augmentation techniques, e.g. ridge splitting and block grafts, have been tested and proven. Although these techniques are successful, treatment time is significantly increased and patients need to endure additional surgical procedures. Therefore, this case utilized the Sandwich Technique Bone Graft during the dental implant placement surgery. After placing the dental implant ideally in a prosthetically driven position, a buccal dehiscence was observed.

The fact that dehiscence was formed within the bony envelope, the survival of the bone graft seemed favorable. Sandwich technique was utilized by placing autogenous bone graft harvested from the osteotomy site on the exposed implant surface (inner layer) followed by a outer layer of bovine xenograft.[9]

A collagen membrane was trimmed and used to contain the bone grafts as well as to exclude unwanted epithelial cells and connective tissue fibroblasts. Tension-free primary closure was subsequently obtained. Six months later, mature regenerated bone was found on the buccal surface of the implant at surgical re-entry. (Fig. 5a-c)

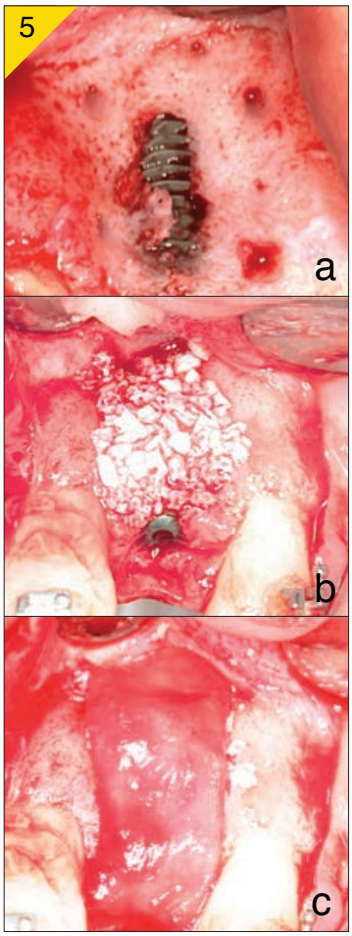

Figure 5a-c. Sandwich Technique Bone Graft. a) Implant thread exposure after prosthetically driven implant placement. b) Sandwich Technique Bone Graft using layer of autogeneous bone graft then layering bovine xenograft for volume. c) A collagen membrane layered to exclude connective tissue fibroblasts on grafted site.

e-f) 24 months anterior & maxillary occlusal view.

g-h) 42 months anterior & maxillary occlusal view. (Finish)

Conclusion

Arch size discrepancy due to MLIA can be corrected with extensive treatment planning which involves expanding the arch, opening up the space for implant site, and performing Sandwich Technique Bone Graft during implant surgery. It is safe to conclude that combination of orthodontic treatment and implant surgery is a viable option to manage patients with MLIA. (Fig. 6a-b)

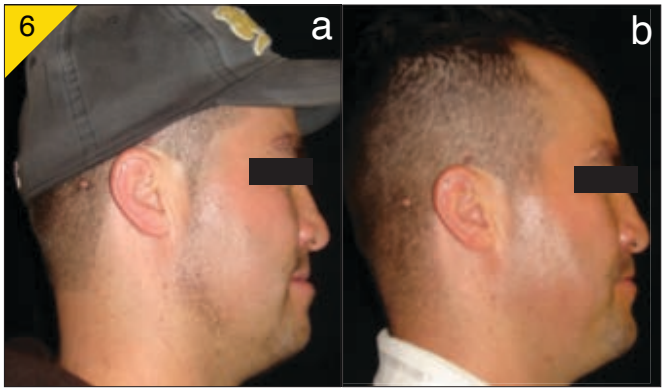

Figure 6a-b. Profile view. a) Pre-operative view. b) 2 years Post-operative view.

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