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Case Report

Modern Conservative Restoration of the Missing Maxillary Lateral Incisor-Case Report of a Young Adult

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Abstract

Management of maxillary lateral incisor agenesis (MLIA) in the adolescent and young adult patient can pose a challenge for clinicians. Aesthetics is critical in maintaining an individual's confidence during this highly social period of life. Treatment options include canine lateralisation, conventional fixed dental bridge, resin-bonded fixed dental prosthesis or implant supported prosthesis. These may act as either the final permanent solution or as a transitional means of space maintenance and aesthetic rehabilitation prior placement of implant-supported prosthesis; once growth has been completed. This case report focuses on the treatment of MLIA in a young adult (the author's daughter) utilising a modified Maryland bridge with bilateral crescent wings made of a lithium disilicate ceramic.

Keywords: *Missing Lateral Incisor Agenesis; Lithium Disilicate; Conservative; Aesthetic Dentistry*

Introduction

Tooth agenesis, the failure of tooth formation, mostly affects the third molars, second premolars and permanent lateral incisors respectively.

Prevalence of maxillary lateral incisor agenesis (MLIA) ranges from 1 - 3% [1]. MLIA has been suggested to display an autosomal-dominant trait with incomplete penetrance and is of the same phenotype as peg-shaped maxillary lateral incisors [2]. Thus, children of parents with peg-shaped laterals inherit an increased chance of MLIA; evident in the author's young adult daughter whose management is the lion's share of this case report.

For each MLIA case an individualized treatment approach is required to achieve the patient's and dentist's goals. This should take into consideration the clinician's skill, pattern of MLIA (uni or bilateral), the patient's age, expectations, maintenance and cost. Treatment ranges from minimal to more invasive options. Typically the most conservative option is orthodontic space closure with canine lateralisation. The alternative treatment options for MLIA are conventional fixed dental bridges or a resin-bonded fixed dental prosthesis. Conventional fixed dental prosthetics are more invasive, requiring up to 72% of crown weight preparation [3]. Resin bonded dental solutions are more conservative (fibre-reinforced composite resin bridges) but pose a challenge in replicating natural anatomy. While overall survival of fibre-reinforced composite resin bridge is 94.5% at 4.8 years, long-term performance requires further investigation [4]. Likewise, composites have increased tendency to display future surface changes, staining and chipping plus it requires some artistic skills from the operator. Another option, the Cantilever bridge, made of metal or ceramic often requires significant preparation and may risk the vitality of the pulp in young adults. Implant-supported prosthetics provide optimal long-term results but require full gingival and alveolar maturation as well as skeletal growth completion. The author wanted a minimally invasive solution in the transitionary period until an implant-supported prosthetic with bone/soft tissue grafting can be completed. As a result, a resin-bonded fixed dental prosthesis was selected. IPS e.max,

a lithium disilicate ceramic, provides an ideal aesthetic outcome with reduced microleakage due to the reliable micromechanical retention and chemical bonding [5].

Case Report

Multidisciplinary treatment

The author's now 19-year-old daughter desired an aesthetic solution for the gap in her front teeth. She has right-sided MLIA (Figure 1a and 1b).

Figure 1a and 1b: Post orthodontic phase (frontal view).

Phase of treatment:

1. Adolescent orthodontics:
   - Teeth positioned in a Class I occlusal scheme. A space was created for future prosthesis.
   - Opening overjet space (Figure 2) allowed clearance of the bridge.
   - Bilateral crescent design of bridge wings reduce occlusal stresses and thus fracture risk [6].
2. Minimal tooth preparation needed as the path of insertion was orthodontically created and crescent wings provide the prosthetic's retention (Figure 3 and 8).
3. Intra-Oral 3D Scan.
4. Collaborative design discussions with Cerami Dental Lab (Melbourne, Australia) around crafting Modified Maryland bridge with bilateral crescent wings (Figure 3 and 8).
5. Cerami Dental Lab prepared the wing bonded areas with 5% hydrofluoric acid, 20 seconds.
6. Bridge was assessed preoperatively to ensure desired outcome achieved.
7. Prior cementation intaglio surfaces (wings) coated with silane coupling agent, Bis-Silane (Bisco).
8. Enamel prepared with Aquacare air abrasion aluminium oxide 29 microns.
   - Combination of air abrasion and chemical etching significantly reduces microleakage risk and staining [7].
9. Ultra-etch (Ultradent) 35% phosphoric acid for 15 seconds, washed and dried to frosted appearance.
10. Scotchbond Universal Adhesive (3M) rubbed 20 seconds, gentle air dried 5 seconds to dissolve the solvent, light cured 10 seconds.
11. RelyX Ultimate Adhesive Resin Cement applied on the bridge.
12. Modified Maryland bridge with bilateral crescent wings was seated and excess cement removed (Figure 4).
    - Light cured through glycerin barrier solution to remove cement's oxygen inhibition layer, thus, prevent future staining.
13. Occlusion evaluated
    - Ensure minimal contact with the pontic during excursive movement is achieved.
14. Polish enamel-bridge interface using 3M Sof-Lex (Figure 5, 6 and 7).
15. Oral hygiene instructions and six monthly follow-up.

Figure 2: Post orthodontic phase (lateral view).

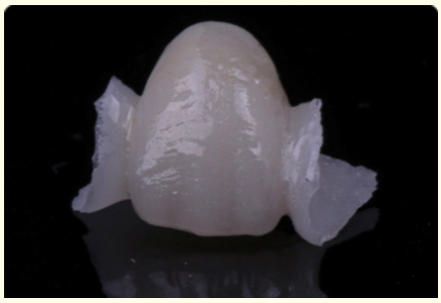

Figure 3: Modified Maryland bridge with bilateral crescent wings.

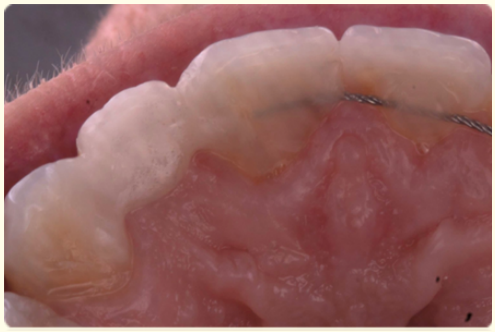

Figure 4: Palatal view.

Figure 5a and 5b: Post bridge insertion (frontal view).

Figure 6: Post bridge insertion (lateral view).

Figure 7: Final outcome.

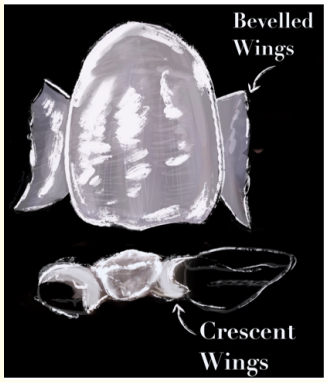

Figure 8: Crescent wings design.

Discussion

Careful case-selection based on individual aims and objectives are required to reach the ideal patient-centred treatment. According to Kokich and Kinzer (2005) canine lateralisation may be considered in two malocclusion types. The first is in Angle Class II malocclusion whereby no crowding in the mandible is present. Here the molars retain a Class II relationship with the first maxillary premolars attaining the canine Class I position. The other malocclusion is Angle Class I with mandibular crowding that necessitates extractions. In either case, anterior group function is designed for lateral excursion [8]. However, canine lateralisation was rejected to prevent occlusal shift and loss of canine guidance, resulting in potential future occlusal wear. In addition, to camouflage the canine as a lateral incisor significant enameloplasty may be required with the risk of dentinal hypersensitivity.

At the conclusion of orthodontic space opening a fibre-reinforced composite resin bridge was previously attempted, but subsequently replaced with the ceramic bridge in order to achieve a higher aesthetic outcome.

In order to preserve as much tooth structure and leave alternative treatment options available for the future, a modified Maryland bridge with bilateral crescent wings was designed. The crescent wings have four main roles (Figure 7). Firstly, they decrease palatal bulk. This reduces force accumulation and prevents debonding.

Often, the large surface area of the adjacent teeth, in this case the mesial of the canine, is not utilised for their adhesive potential. Thus, the crescent design simultaneously increases the surface area to greaten retention, resistance and bond strength. Further, the wings improve aesthetics closing gingival embrasures and prevent black triangles. Finally, the modified Maryland bride ensures space maintenance between the central incisor and the canine for future implant. This crescent design required no tooth preparation as clearance and path of insertion was created in the orthodontic phase, allowing enamel preservation. Given this no-preparation approach, the 2 mm lithium disilicate (IPS e.max) wings tapered to a feather-edge margin. Concerns in the dental world exist around the fragility of the feather-edge and tissue response to overcontouring the emergence profile. However, lithium disilicate failures more often occur from adhesive bond failure to dentine (80.7%) as opposed to cohesive ceramic failure (3%) [9]. To overcome this, the entire fitting surfaces were contained to enamel in order to significantly maximise bond strength when compared to dentine; median shear bond strengthens of around 24 MPa and 11 MPa respectively [9].

When considering the thickness of lithium disilicate, no statistical difference in fracture resistance was reported between minimal (0.5 mm margin) and traditional e.max crown preparations (1.0 mm margin), 1229 N and 1499 N respectively [10]. Further, Lithium disilicate occlusal veneers of 0.6 mm thickness can resist up to 800 N of force [11]. This is enough to withstand the average maximum biting force of males (778 N) and females (481 N) aged 18 years respectively (similar age range as the case report) [12]. As such a minimal thickness IPS e.max design was used to prevent over-contouring and the associated periodontal response.

An implant-supported prosthetic with bone grafting will complete the definitive phase of treatment but is on hold until complete skeletal maturity. Girls typically complete vertical growth at 18 years, while boys at a later age [13]. Yet depending on the type of facial growth (brachyfacial, mesiofacial or dolichofacial) maxillary incisors still move on average 6 mm downwards and 2.5 mm forwards between 9-25 years of age [14]. Given these changes it is advisable to delay implant placement in order to avoid infraocclusion.

Conclusion

Conservative treatment tailored to meeting the patient's and dentist's goals should be the basis of modern practice. In this clinical report the author used her three guidelines to treatment planning; scientific literature, experience and common sense. Hence, an IPS E.max modified bridge with thin crescent wings was utilized as a temporary means to replace the unilateral missing right lateral incisor. After 6 months of follow-up no aesthetic or functional problems have been observed. Yet, future observation is needed prior to the recommendation of this MLIA treatment modality.

Learning Objectives

This case report discusses the management of MLIA. The intended learning objectives include:

- Understand the different treatment options that can be utilised for the MLIA patient.
- Consider the patient's stage of development and its impact on the suggested treatment modality.
- Be able to design a prosthesis with minimal-to-no abutment damage as part of a transitionary pathway to a more permanent solution once patient has completed growth.

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