

Prosthodontic-Orthodontic Treatment Plan with Two-Unit Cantilevered Resin-Bonded Fixed Partial Denture

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Abstract: Congenitally missing lateral incisors create an esthetic problem with specific orthodontic and prosthetic considerations. Selecting the appropriate treatment option depends on many factors, such as the malocclusion, the anterior relationship, specific space requirements, bone volume, root proximity, the condition of the adjacent teeth, and esthetic prediction mainly when the canine must be reshaped. Resin bonded bridges were considered to be doomed owing to their very high decementation rate, have come alive once again because of newer resin based cements. This article will discuss the variety of treatment managements in case of space opening and treated with two 2-unit cantilevered resin-bonded fixed partial dentures supported by the cuspids. This conservative treatment plan was cost-effective without having any significant biological cost.

Keywords: Agenesis, Resin- bonded fixed partial denture, interim prosthesis.

I. Introduction:

Tooth Agenesis is the congenital absence of one or more of the normal complement of teeth and is one of the most frequent alterations of the human dentition. Although, Tooth Agenesis does not represent a serious public health problem, it may cause both speech and masticatory dysfunction as well as aesthetic and functional problems [1,2]

Literature as Hypodontia (2-6 Teeth Missing), Oligodontia (>6 Teeth Missing) and Anodontia (all Teeth Missing) [1,3]. It can occur as an isolated finding which can be sporadic or familial or could be part of a syndrome. Single dominant, recessive and X-linked genes have been isolated in familial hypodontia, though expressivity and penetrance may vary depending upon dentition, gender, demographic and geographic profiles [1,3].

The genetic control of dental development can be divided in two pathways; specification of type, size & position of each dental organ and specific process for formation of enamel & dentin [4]. Different studies on human genetics identify genes like MSX1, PAX9, AXIN2 and FGFR1 but these conditions may represent a more complex multifactorial trait, influenced by a combination of gene function, environmental interaction and time of development of dental components [1].

Tooth Agenesis occurs in up to 1.5 % -3 % of the population [1,3]. Tooth Agenesis and its associated syndromes are more prevalent in females than males by a ratio of 3:2 . The permanent dentition usually present with a distinct pattern of agenesis involving the last teeth of a dentition group to develop .[1,3]

Modern dentistry can address the issue of missing maxillary lateral incisors with two different approaches: space opening and prosthetic replacement of the lateral incisors or closing space to substitute the canine tooth in place of the lateral incisor.[1-5]

When space opening is indicated, both orthodontist and prosthodontist play a key role in determining and establishing space requirements.[5] Based on many parameters that can be considered in the choice of the treatment options such as: the height and width of the ridge, occlusal context, interdental spacing, treatment time, and the patient's openness to treatment alternatives.[6] The restorative approaches can be divided into two categories (single tooth implant, and tooth supported restorations) where dental implants are the most commonly used to replace congenitally missing maxillary lateral incisors once skeletal maturity has been reached.[1] When

dental implants are contra-indicated, there are two available options: resin bonded bridge which is a minimally invasive option for replacing congenitally missing lateral incisor, and full coverage fixed partial denture.[5,6]

Space opening for missing maxillary incisors favors an ideal intercuspation of canines through first premolars and as a result this is marked as an advantage both functionally and occlusally.[1,5,6,7] These teeth are maintained in their natural position within the dental arch with their natural morphology. In addition, if the treatment plan includes a single tooth implant, the natural teeth remain totally untouched. Finally, the orthodontic treatment is generally shorter in contrast with orthodontic space closure.[1,8,9]

The major disadvantage of this treatment option is that it commits the patient to a lifelong prosthesis in the most visible area of the mouth where tooth shade and transparency, gingival color, contour and margin levels are critical and difficult to control, particularly in the long term.[1,7 ,9] Furthermore, the overall treatment is not complete when the orthodontic treatment ends. This means, particularly in adolescent

patients, that the patient needs long-term retention of the spaces with temporary retainers until all skeletal growth is complete and tooth eruption has ceased, so he or she is eligible for permanent restoration. In addition, all the additional expenses for the permanent restoration and its life long maintenance are marked as a disadvantage.[10,11,12]

Cantilevered fixed partial denture is the second most conservative restoration and in contrast with the resin-bonded fixed partial denture, the success of this type of restoration is not dependent on the amount of proclination or mobility of the abutment teeth. The 5-year survival rate is 92,3%.[12]The canine is an ideal abutment for such a restoration due to its root length and crown dimensions .Long-term success of the cantilevered fixed partial denture can be achieved if all contacts in excursive movements are removed from the cantilevered[1].

Clinical indications of resin-bonded fixed partial denture include vital, non-mobile, and minimally restored abutment teeth which present sufficient coronal length, short edentulous span, and minimal dynamic occlusal contacts on abutment teeth. It can be indicated for the replacement of congenitally missing lateral incisor[1,5,8,9].

This article will discuss the variety of treatment managements in case of space opening and treated with two 2-unit cantilevered resin-bonded fixed partial dentures supported by the cuspids. This conservative treatment plan was cost-effective without having any significant biological cost.

Case presentation

A 15-years-old girl with congenitally missing bi- lateral incisors was referred to the my private clinic. Her medical history was unremarkable. Her chief complaint was diastemas closure. A clinical examination revealed multiple anterior diastemas with bilateral missing maxillary lateral incisors and bilateral class I molar and canine relationships with canine guidance. Extraoral findings were normal. Radiographic analysis confirmed the agenesis **Figure 1a**. A comprehensive treatment plan included diastemas closure and space opening to the replacement of the missed lateral with single tooth implant. After 3years, the objectives of the orthodontic treatment were achieved, and the patient was referred back to the prosthodontic therapy **Figure 1b**. Dental implants were not recommended at that time due to the patient's incomplete growth. When the patient attended 20-years-old, clinical examination and radiographic findings revealed



Figure 1a,b: (a)Pre operative Intra oral view (b) A retainer with a denture toothr

unsufficient bucco-lingual bone ridge which did not allow implant placement in the site of the missing lateral. For that, a bone grafting was indicated. Oral antibiotic was administrated 1hour before surgery. At the same time, antiseptic mouthwash, 0.12% chlorhexidine gluconate, was used. Under local anesthesia, surgery commenced at the recipient site to confirm the shape and size of the defect. Then, the patient underwent surgery

for bone graft material. After 6months, the bone graft was rejected. So, the indication of single tooth implant replacing the agenesic maxillary lateral incisor was declined in the favor of abutment teeth restoration. **Figure 2**



Figure 2: Intraoral view showing the missing lateral incisor right ,left sides

As the occlusal bite in the anterior teeth was located in the 1/3 incisal of the palatal surface of maxillary teeth, the indication of resin bonded bridge was retained. Due to the occlusal scheme and the canine guidance, the impact point was identified using articulator paper, and the limits of preparation were localized just behind these impacts.



Figure .3; Tooth Shade or Color

Central incisor and canine were reduced with flame-shaped, chamfer, and shoulder diamond rotary cutting instruments. The palatal surfaces of the abutment teeth were reduced by about 0.7mm, with a supra-gingival chamfer finish line about 1mm from the tissue crest. A slight interproximal elbow preparation was completed to counter dislodging forces and increase framework connector strength **Figure 3**.



Figure .4: Labial view Laboratory prepared of restoration

Adequate and parallel axial reduction of the proximal surface adjacent to the edentulous area and extending lingual to the planned interproximal contact required for a path of insertion and retention. All line and point angles were rounded. A complete arch impression was made with a silicone impression material, then was transferred to the laboratory to be casted. The master cast was checked, the limits of prepared surfaces were marked. Then, the model was referred to the technician to be scanned. Finally, 2-unit cantilevered resin-bonded



Figure .5a,b: (a)Intra oral after prosthesis cementation. (b)Postoperative occlusal view

fixed partial dentures was fabricated . At the initial trial, complete seating of prosthesis marginal adaptation, form of the pontic, and tissue contact were assessed. Subsequently, veneer porcelain was added the resin bonded bridge was checked again intraorally. **Figure .4** Finally, the resin bonded bridge was cemented using bonded cement after isolation of the teeth with a rubber dam and sandblasting of the internal surface of the frameworks **Figure 5a,b**. The patient was instructed to clinical recalls every 6months.

II. Discussion:

Tooth Agenesis, not a life threatening condition, can pose great impact on the physical, intellectual and psychological maturation of the patient. It affects the normal living pattern not only of the patient but also of the family.[1]

Aims and objective of the treatment modalities are improvement of aesthetics, phonetics, function and mastication, which improve the tone of facial and masticatory muscles to compensate for the reduced vertical dimensions. Joint orthodontic /restorative diagnostic clinics provide the ideal basis for successful treatment and should be considered the most appropriate mechanism for providing patients with high quality care .[1-9]

Prosthodontic management of oligodontia patients is important for functional , esthetic and psychologic reasons. Teeth replacement permits establishment of bilateral centric stops and a normal vertical dimension of occlusion and support for oro facial soft tissues.

When dental implants are indicated, there is a consensus that it should not be used until growth completion has been definitively achieved. [1]On the other hand, implant-supported crown may not be advisable when available bone volume is minimal, or when the adjacent root is in close proximity.[1]

When the orthodontist opens space for the missing lateral incisor with fixed appliances, he should be very careful so the central incisor and the canine are moved bodily and not to tip them apart, because this is likely to make implant placement impossible. Thus, the orthodontist must confirm the ideal root position with a periapical or a panoramic radiograph, before the fixed appliances are removed.[13]

In certain patients, it may be impossible to achieve acceptable interradicular spacing, even though the coronal spacing may be ideal. Particularly, in a patient with a Class III tendency malocclusion who requires proclination of the maxillary central incisors, when the crowns are tipped labially, the roots tend to converge toward each other resulting in a “wagon-wheel” effect. In such cases, an alternative restoration option is required.[14]

Goodacre et al showed that the debond rate during the first two years was 10%, between 2-5 years the rate was 20%, and at more than 5 years the rate was 24%. The debond rate for resin-bonded fixed partial denture with more than 1 pontic (52%) was double that the framework supporting a single pontic.9However, improvements in adhesive technology along with adapted preparation designs limited debonding failures and increase the clinical longevity of resin-bonded fixed partial denture.[15]

Kern et al reported a 5-year survival rate of 92% for cantilevered resin-bonded fixed partial denture which was significantly superior than the 74% survival rate found for the traditional to-retainer design[16].

Livaditis proposed abutment preparation, including reduction of lingual and proximal surfaces to create a path of insertion, along with occlusal rest seat preparation to resist to the displacement of the retainer.4 Since that time, a number of significant modifications to the Rochette’s design have improved its longevity in the oral cavity by enhancing retention and resistance.[17]

Rabelo et al proved that in 6.6% of all bone grafting procedures, dental implant placement is not possible.7 In those situations, resin-bonded fixed partial denture can be used with success to replace missing teeth, mainly if the patient present vital and non-carious abutments with a shallow incisal guidance, and a minimal occlusal contact on the retainer and the pontic. [12]Bonded bridges present several advantages as they showed no difference in quality of life with single tooth implant, mainly because of its preparation design (non-invasive preparation with supragingival margins) which allow an adequate oral hygiene to control plaque and prevent periodontal diseases.[12]

Goodacre et al noted a common problem with metal ceramic resin-bonded fixed partial denture related to grayish discoloration of the abutment teeth caused by a shadow effect of the framework showing through the tooth enamel. Both glass-ceramic and high-strength oxide ceramic can be use to produce optical properties similar to those observed in natural teeth.[15]

According of Creugers et al. resin-bonded fixed partial denture showed a high degree of patient satisfaction, and it seems not to be influenced by the occurrence of failure.[18,19]

Retention prevents the removal of the restoration along the path of insertion or the long axis of the tooth preparation. Resistance prevents dislodgement of the restoration by forces directed in an apical or oblique direction and prevents any movement of the restoration under occlusal forces”. Resistance form can be evaluated prior to cementation of the restoration. It optimises dissipation of forces and minimises dependence on the resin bond.[7] Tooth preparation aims to create a definite outline form and path of insertion for the restoration, therefore optimising resistance and retention forms while minimising metal display or show through. Tooth reduction is conservative (remaining in enamel) for resin-bonded fixed partial denture preparation. This is one of numerous advantages of this restoration.[18,19,20]

A 13-year prospective follow-up study of 74 resin-bonded fixed partial denture found a survival rate of 69% after 13 years.29 A total of 15 failures (20.3%) were observed; the main causes of failure reported were loss of retention, carious lesions and fractures of the veneering porcelain. Djemal et al. studied 832 resin-bonded fixed partial denture and splints provided at a postgraduate teaching hospital and reported mean survival of seven years and 10 months with retainer design, area of coverage and operator experience associated with survival. [21]

Pjetursson et al. conducted a systematic review of the survival and complication rates of resin-bonded bridges after an observation period of at least five years in 2008. The authors conclude that resin-bonded fixed partial denture still debond relatively frequently, which can consume a lot of extra chairside time. The estimated survival rate after five years was 87.7%. They recommend further research with greater than 10-year observation periods to evaluate long-term outcomes in more detail.[22,23,24,25]

In this case, the patient chose the option of cantilevered resin-bonded fixed partial dentures as a prosthetic solution for the problem encountered. This type of conservative treatment allows practitioners to evaluate the clinical condition over time, while offering the patient acceptable restorations. The predictability and longevity of this prosthetic design is less than conventional fixed bridges, but they are more reliable and less expensive than conventional resin-bonded fixed partial dentures with 2 abutments. Moreover, they offer better esthetics, easy cleaning, less biological damage and no chance of having an undetected debonded retainer with decay underneath it. In fact, the difference in the mobility of 2 abutments in the case of 3-unit resin-bonded

fixed partial dentures can increase the risk of debonding. According to the literature, the success rate for 2-unit cantilevered resin-bonded restorations with a follow-up of at least 2 years is about 95%. The quality of life of people wearing this type of bridge is, moreover, no different than that of those with implants.[24,25,26].

III. Conclusions

The team approach that accounts for the esthetic and functional success of this case, taking advantage of the synergy of working together to maximize each clinician's skill in contributing to the best, most predictable, least invasive outcome for the patient.

Two-unit cantilevered resin-bonded fixed partial dentures can replace missing lateral incisors when a patient has clinical problems with the initial prosthodontic-orthodontic treatment plan. Full assessment of the patient's oral conditions, needs and preferences; regular check-up visit; and the patient's awareness of all treatment options, benefits, and potential risks and complications are essential parts of this management plan.

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