

## Interdisciplinary Management of Anterior Dental Aesthetics

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**ABSTRACT:-** Congenitally missing teeth are frequently presented to the dentist. Interdisciplinary approach may be needed for the proper treatment plan. The available treatment modalities to replace congenitally missing teeth include prosthodontic fixed and removable prostheses, resin bonded retainers, orthodontic movement of maxillary canine to the lateral incisor site and single tooth implants. This article reports the case of a patient with bilateral hypodontia of the maxillary lateral incisors who was dissatisfied with the outcome of initial orthodontic treatment, highlighting the importance of a multidisciplinary interaction among Restorative Dentistry, Orthodontics, and Implantology to achieve satisfactory esthetics and functional results.

**Keywords:-** Agenesis, orthodontic treatment, Dental implant, lateral incisor

### I. INTRODUCTION

Agenesis, the absence of permanent teeth, is a common occurrence among dental patients. [1]The total incidence of tooth agenesis is about 4.2% among patients that are seeking orthodontic treatment and with the exception of third molars, the maxillary lateral incisors are the most common congenitally missing teeth with about a 2% incidence.[2,3] Esthetically correcting congenitally missing maxillary lateral incisors is a common challenge that every orthodontist and dental team will face, and dentists must consider the treatment options that are most appropriate for each patient. The main treatment options are: implants, resin-modified bridges (RMB), and orthodontic space closure. Not every case is suitable for each of the three treatment options, and there is a little in the literature to indicate which treatment leads to the most esthetic outcome.[4]

The smile arc allows dental professionals to correlate the upper anterior teeth to the lower lip. If the maxillary anterior incisal edges follow the curvature of the lower lip while smiling, it is called consonant. A flat smile arc is characterized as nonconsonant. Research has shown that flatter smile arcs are less attractive.

From an anterior view, the maxillary teeth should follow the guide of the golden proportion: the maxillary lateral incisor appearance in the smile should be 2/3 or 62% the width of the central incisor. The maxillary canine should be about 62% of the lateral incisor width; thus a tooth will show 62% of the tooth mesial to it in an anterior view.[5]



**Fig.1; Pre-operative view**

Buccal corridor spaces have recently become more important to smile esthetics.

The buccal corridor is the space between the facial surfaces of the posterior teeth and the corners of the lips when smiling. [4] While researchers like Hulsey [6] did not believe that this buccal corridor contributed to smile esthetics, research by Moore et al [7] and Parekh et al [8] show that decreasing the buccal corridor space is more esthetic. Researchers and clinicians now consider larger buccal corridors as part of the problem list during diagnosis. One study confirmed that orthodontists and lay persons thought that a broader arch form produces a more attractive smile, and lay persons think it is more attractive to have a greater number of teeth displayed while smiling than having fewer teeth visible. [8]

The inherent shape and proportion of the anterior teeth are other key factors that affect a patient's overall smile. Each person's anterior teeth have nuances in shape and size that affect appearance. The maxillary central and lateral incisors should ideally have a width/height ratio of 8/10 or 80. [5] Several factors may contribute to a discrepancy in these proportions. A short clinical crown height could be due to inherent tooth size, attrition, incomplete passive eruption, or vertical gingival encroachment. [9] Contact points, the point where teeth actually touch each other on their mesial and distal surfaces, tend to be more incisal in the anterior region and more gingival in the posterior. The area where the teeth appear to touch is called the connector. [9,10,11]



**Fig.2; Crestal incisions were made along the edentulous ridge**

This connector site is longest between the central incisors and decreases toward the posterior. The connector between the maxillary centrals tends to be about 50% of the tooth height, 40% between the central and lateral incisors, and 30% between the lateral incisor and canine. The areas incisal or gingival to the connector are called the embrasures. The embrasures are smallest between the central incisors and larger in the posterior. Gingivally, the embrasures should be filled with the papillary tissue; but if the interdental papilla is absent, an unesthetic dark triangle occurs. [10,11,12]

The shape of an individual's anterior teeth varies enough to influence dental esthetics. Anderson (2005) researched the different tooth shapes of male and female patients. He divided the shapes of anterior teeth into: square, square-round, and round. [13]

For female patients, general dentists preferred round incisors while orthodontists preferred round and square-round incisors. For the male patient, dentists and orthodontists both preferred square-round incisors. [10,12]

Tooth color also reflects the attractiveness of a smile. In general, posterior teeth tend to have a more yellowish color than the anterior teeth, which are whiter. Yellow teeth are deemed to be unattractive by dental professionals and lay persons alike. The color shade of each tooth and how they blend with the adjacent teeth is crucial to dental esthetics. A study showed that orthodontists, general dentists, and laypeople all thought a dark shade of an anterior tooth was less attractive than an unesthetic gingival margin, crown width, or incisal shape. [14]

As one smiles, the height of the gingiva displayed between the maxillary central incisors and the upper lip is important. An ideal amount of gingival display is 2.1mm, while too much gingival display is unesthetic and called a 'gummy smile'. [15]

Gingival shape and contour are determined by the osseous contour. The gingival margin of the maxillary central incisor and the canine should be one to two millimeters higher than that of the lateral incisor. [16] The bony projection over the labial surface of the canine root is called a canine eminence. The gingival zenith is the most apical point of the gingival tissue on the facial cervical area of a tooth. For mandibular centrals and maxillary laterals, the gingival zenith is in line with the long axis of the tooth. The gingival zenith for the maxillary central incisors is located distal to the longitudinal axis. [16]



**Fig.3; implant being inserted into the osteotomy with an implant inserter**

For patients with a congenitally missing maxillary lateral incisor, multiple factors should be considered when formulating a treatment plan. These should include available space for the crown and root, canine position, molar occlusion, smile/dental/gingival esthetics, bone quality and quantity, age, facial profile, lip posture, and finances.[17,18]

Whatever treatment option is chosen will depend primarily on two factors: occlusion and anterior esthetics. In the past, orthodontists thought the presence or absence of a major malocclusion was the most important factor, but with anterior esthetics as a more recent major orthodontic goal this may not always hold true. Currently, treatment planning is becoming more directed toward the importance of anterior esthetics and the position of the maxillary incisors, the best treatment may be one that provides the best esthetic outcome. Anterior esthetics and occlusion must both be considered together; since a less favorable treatment plan may be implemented if only one is considered. [17,18,19]

However, finances also factor into the decision making process and resulting treatment. Unfortunately, not every patient will follow through with ideal treatment, or any treatment at all due to monetary constraints.[16]

Treatment options available for patients with missing lateral incisors and no other malocclusion include implants, RMBs, or even a conventional bridge. Orthodontics may not need to be a part of this procedure if the teeth are in good alignment and the lateral space is sufficient for a prosthesis. Treatment of malocclusions having agenesis of one or both maxillary lateral incisors generally falls into two possible options. The space can be either opened or closed. [17,18] If the space is opened, a prosthetic procedure is required to replace the missing tooth. Implants are becoming the treatment of choice, but resin-modified bridges (RMB), cantilevers, or conventional fixed partial dentures are still performed due to finances or because they are a less invasive procedure, or there is deficient bone volume for implants. If the space is closed, the canine must be reshaped to resemble a lateral incisor, and the first premolar will substitute for the canine. This is called canine substitution.[19]

Recently RMBs have become more of a temporary restoration due to their high failure rate and diminished esthetics when compared to other options. Many RMBs tend to have a gray cast through the adjacent teeth due to the metal covering the lingual of the abutment teeth. Creugers et al [20] showed that anterior RMBs have a survival rate of 75% over 7.5 years, but others have shown less favorable rates of 54% survival over 11 months. [17] With the possibility of bond failures, RMBs have been recommended for shallow overbites and contraindicated for deep overbites. Many clinicians will use a RMB as an interim restoration until growth is complete prior to implant placement.[16]

With lateral incisor agenesis and available space, implants are usually the treatment of choice. Implants are a favorable option because no adjacent tooth is prepared for restorations, and implants have a success rate of 90% over 10 years.[21]

Pre-implant orthodontics must leave adequate room for the implant between the adjacent roots as well as sufficient crown space. This can be achieved by using the golden proportion, the contralateral lateral incisor, a Bolton analysis, or a diagnostic wax-setup. Generally the lateral incisor site should be 5-7mm. Space between the roots of the adjacent teeth and the implant can be no less 0.75mm, with 1.5-2mm space between the adjacent crowns and implant head. [16,17] Implants must be placed after growth cessation due to the continuing vertical growth of the jaws. If growth has not stopped, this can lead to infraocclusion of the implant with an unesthetic gingival architecture. On average boys finish growth at 21 years of age and girls at 17 years.[22] After

orthodontics, the adjacent roots must be maintained out of the edentulous site, and the alveolar ridge may need bone grafting in the future if the ridge narrows.[23] The lateral incisor space will also need a temporary pontic, which is often built into a retainer or a RMB. If the implant is placed too labially, the thin buccal bone can resorb and the gingiva can appear gray in color. [24]Poor soft tissue management can also lead to loss of papillary esthetics; the papilla distal to the lateral incisor implant can be particularly difficult to fill in the embrasure space.[23,24]

Closing the space created by maxillary lateral incisor agenesis orthodontically is called canine substitution. This is a frequent option when the molar relationship is Class II.[25] As the canine is brought into the lateral site, certain orthodontic movements are essential for an acceptable esthetic result. [26]The canine will first be protracted and then extruded to align the scalloped free gingival margin slightly more incisal than the central incisor gingival margin. Proper position of the canine root to the lingual will decrease the canine eminence. The first premolar should be rotated more mesially and buccal root torque applied to mimic a canine eminence; intrusion of the tooth may also be done to achieve a more canine-like gingival architecture.[26]

Research has shown that removing the enamel of the canine does not cause harm to the tooth or pulp except for a temporary sensitivity.[26] Canine substitution has had no correlation with development of temporomandibular dysfunction .[16,27] Possibly the most common objection expressed by a layperson is the yellowish-white color of the canine when used as a lateral; most researchers recommend selective bleaching or restorative treatment .[19]

This article reports the case of a patient with bilateral hypodontia of the maxillary lateral incisors who was dissatisfied with the outcome of initial orthodontic treatment, highlighting the importance of a multidisciplinary interaction among Restorative Dentistry, Orthodontics, and Implantology to achieve satisfactory esthetics and functional results.

## **II. CASE REPORT**

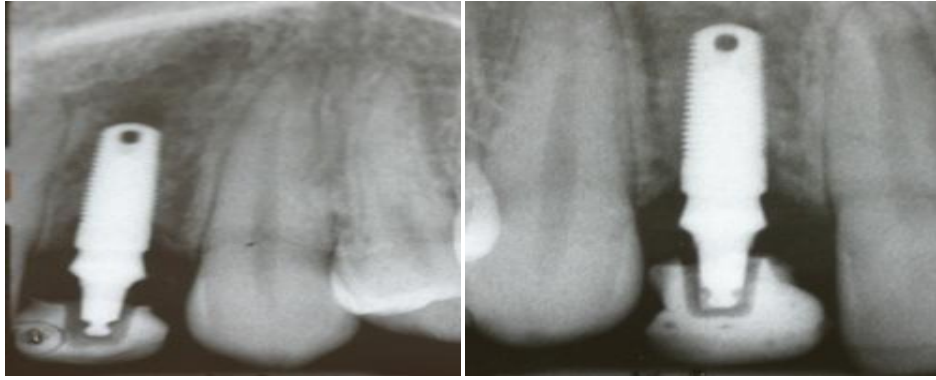
A 21 year old female presents with congenitally missing lateral incisors. Medical health is non contributory. Patient is a non-smoker and presents no family history of systemic disease. Her chief complaint was “I want to replace my missing teeth”. Periodontal exam revealed localized mild gingivitis, probing depth range from 1-3 mm, negative recession and mobility and missing teeth #7 and #10. Her home care was excellent. The treatment plan to replace the missing laterals with dental implants was presented to the patient.



**Fig.4;** Integrated Abutment Crown being inserted.

The patients continued wearing the removable temporary prosthesis. After the soft tissue healed the patient was brought back to the clinic and temporary restorations were fabricated to mold the soft tissue contours. With her chief complaint in mind, this case could be successfully treated by different approaches. These include implant placement, fix prosthodontics with ovate pontic site development and as a last approach a removable appliance. The decision was made to place individual implants due to the age of the patient and excellent height of bone as well as soft tissue. The challenging aspect of the case lies in the ridge width deficiency. For that reason 3.0 one piece dental implants were used creating a surgical challenge due to the strict angulations and positioning protocols.





**Fig.5;** Post-operative radiograph after the insertion of the right maxillary lateral Integrated Abutment Crown

### III. DISCUSSION

Hypodontia usually has a genetic basis and often a high proportion of affected individuals have a family history of hypodontia or associated dental anomalies.[1] Mutation in transcription factors *MSX1*, *PAX9* and *AXIN 2* have been identified in families with an autosomal dominant oligodontia. Normally, teeth which are „end of series“ are more commonly absent, i.e. lateral incisors, second premolars and third molars.[28] Hypodontia is also often seen in patients presenting with syndromes such as ectodermal dysplasia, Down's syndrome and hemifacial microsomia and in non-syndromic conditions such as cleft lip and palate.[29] However, familial hypodontia is complex and multifactorial; influenced by a combination of gene function, environmental interaction and developmental timing.[28;29,30] This interdisciplinary approach may involve preprosthodontic orthodontic treatment following consultations with an oral surgeon or a periodontist and a restorative dentist to ensure that orthodontic alignment will facilitate the surgical, implant and restorative treatment.[30,31]

For patients with congenitally missing lateral incisors, in addition to over-retained primary teeth, permanent canines may erupt or drift mesially into the edentulous space. If the space is to be opened orthodontically for ideal prosthesis, the canines will need to be moved distally, which may result in development of the alveolar ridge in the canine region [2,7,20,32]. In cases where the occlusion and esthetics of the canine in the lateral position are acceptable, closure of the lateral space by the mesially positioned canine may be the simplest alternative treatment option. However, in all the above congenital missing cases we considered space opening followed by fixed prosthesis would be more acceptable on aesthetic point of view [19,20,21].

Esthetics as well as occlusion must be considered in the final orthodontic positioning of the teeth adjacent to the edentulous space.[33] To satisfy the "golden proportion" principle of esthetics, the space for the maxillary lateral incisor should be approximately two-thirds of the width of the central incisor.[33,34]

However, if the patient is missing only one maxillary lateral incisor, the space required to achieve symmetrical esthetics and occlusion is primarily dictated by the width of the contralateral incisor [16].

The optimal time for placement of fixed prosthesis is after the growth of the maxilla, mandible and alveolus is complete. If fixed prosthesis/implant are placed before growth is complete, the surrounding alveolar bone may continue to develop vertically and adjacent teeth may continue to erupt. [35] Thus a discrepancy between the gingival margins of the prosthesis and the natural teeth is created and the prosthesis appears to become submerged. This creates a functional as well as an esthetic problem [23].



**Fig.5;** Right profile tw12 weeks post insertion of Integrated Abutment Crowns

Generally, implants must not be placed until the patients have completed their facial growth and the majority of their tooth eruption. As the face grows and the mandibular rami lengthen, teeth must erupt to remain in occlusion. However, the implant behaves like an ankylosed tooth and will not follow the changes of the alveolar processes due to the eruption of adjacent teeth.[35,36]

Williams et al. showed a relatively high risk of debonding. Finally, treatment with the single implants – a frequently described method of one-tooth replacement should be mentioned.[37] Many investigations showed that more than 90% of the patients are satisfied with the effects of implant supported single tooth restoration in the aesthetic. Nonetheless, the longterm observations proved many negative alterations. The periodontal problems such as marginal bone loss around the adjacent teeth, connected with a larger loss and reduction of the distance between the implant and the tooth were mentioned in contemporary literature. [38,39]



**Fig.6;** Post-operative radiograph after the insertion of the 12,22maxillary lateral Integrated Abutment Crown

In this case could be successfully treated by different approaches. These include implant placement, fix prosthodontics with ovate pontic site development and as a last approach a removable appliance. The decision was made to place individual implants due to the age of the patient and excellent height of bone as well as soft tissue. The challenging aspect of the case lies in the ridge width deficiency. For that reason 3.0 one piece dental implants were used creating a surgical challenge due to the strict angulations and positioning protocols.

Restoration of congenitally missing maxillary lateral incisors treatment could include removable partial dentures, tooth supported restorations, resin bonded fixed partial denture, canine substitution or a single tooth implant. Space conditions and patient's age as well as on the patient's dental, skeletal and occlusal conditions should be taken into consideration when selecting the proper treatment for each individual case. Wax set-up study models are helpful involve the patient in the treatment plan.[25]

Implant supported fixed partial prosthesis is the most conservative way of treatment because of protection of the supported teeth, preventing of the alveolar bone resorption and esthetic outcomes. In this case report the patients were evaluated both radiographically and clinically at each appointment.[26]

The appropriate multidisciplinary rehabilitation of congenitally missing lateral incisors with previous orthodontic treatment, followed by correct tridimensional implant positioning and well fit lateral incisor implant-supported crowns associated to ceramic laminates on central incisors was effective in successfully restoring function and aesthetics for the case reported.[25,26,40]

#### **IV. CONCLUSION**

Orthodontic space closure and implant substitution of missing maxillary incisors produced similar satisfactory esthetic results. However, this case report demonstrate an acceptable increase in ridge width and this technique may be used successfully as an alternative to the current, invasive augmentation methods. Furthermore, successful restorative treatment involving implants depends on interdisciplinary treatment planning, preprosthetic orthodontic tooth alignment for achievement sufficient space, bone grafting for augmentation ridge width and implant surgery and prosthesis.

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