Esthetic Rehabilitation Of Maxillary Anterior Diastemas With Porcelain Laminate Veneers

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Abstract:

Smile plays an important role in physical attractiveness. Today, there is an increasing demand for esthetic correction of unsightly anterior teeth. Anterior diastema closure is a major challenge in esthetic dentistry. Along with esthetics, the functionality of anterior teeth must also be considered and anterior guidance in harmony with healthy joint positions is essential for stable occlusal scheme. This case report describes the sequential steps in diastema closure using porcelain laminate veneers with emphasis on esthetic and functional guidelines to achieve a beautiful smile and harmonious occlusion.

Keywords: diastema, esthetics, porcelain laminate veneers, custom anterior guide table, occlusion.

Introduction:

Smile is an important physical attribute and teeth alone impact esthetic, attractiveness and personality[1]. Today, with increasing awareness of esthetics, the formerly independent disciplines of orthodontics, periodontics, restorative dentistry, and maxillofacial surgery must collaborate to satisfy the public's desire to look better[2]. One of the most challenging tasks of esthetic dentistry is closure of anterior diastema. The causes of diastema are varied. Hereditary factors include congenitally missing teeth, tooth/jaw size discrepancy, supernumerary teeth, abnormal frenum attachments. Developmental factors include habits, periodontal disease, tooth loss, posterior bite collapse[3,4]. Identifying the cause(s) of a diastema must direct appropriate corrective measures in treatment.

Treatment options for diastema closure include orthodontics, restorative procedures like porcelain laminate veneers, direct bonding, crowns and periodontal procedures or a combination of the above therapies. In cases of dento-alveolar and Bolton discrepancies, orthodontic intervention is insufficient to establish satisfactory proximal contacts, overjet and overbite and may be used to redistribute the spaces prior to restorative procedures[5,6]. Direct composite resin restorations and veneers are conservative restorative options while porcelain laminate veneers afford maximum control in establishing shade, contour, proportion, maintaining their texture and contour indefinitely[5].

The following case report describes treatment for diastema closure where it was difficult to obtain satisfactory esthetics and occlusion with orthodontic intervention alone. Hence, porcelain laminate veneers were planned for optimum esthetics, function, structure and biology.

Case History:

A 24-year-old male patient reported to the department of Prosthodontics, Nair Hospital Dental College, Mumbai with a chief complaint of poor appearance due to spacing between upper anterior teeth. The patient had history of orthodontic treatment with removable appliance prior to his visit and wanted prosthetic correction at the earliest.

Clinical examination of maxillary arch revealed a spacing of 3mm between central incisors, 1.5mm between the central and lateral incisors and 0.5mm between the lateral incisors and canines. The vertical and horizontal overlap were 1mm and 2mm respectively. Only central and lateral incisors contacted in protrusion, group function lateral excursions were observed. Following communication with the patient, prosthetic correction of diastema using porcelain laminate veneers was planned.

Diagnostic impressions were made using alginate (Tropicalgin, Zhermack), casts were made in dental stone (Shiva Products). Orientation jaw relation was recorded using face bow (*Hanau™ Spring-Bow)*, centric and protrusive records were made using bite registration wax (Aluwax). The casts were mounted on a semi-adjustable articulator (*Hanau Wide-Vue*) and programmed using these records. Diagnostic wax-up (Renfert Geo Natural Modelling Wax, Opaque) was done using esthetic guidelines suggested by Oquendo[5] and mutually protected occlusion was achieved. Shade of the patient was recorded in the incisal and cervical regions using Vitapan classical shade guide (Vitazahnfabrik, Germany).

Addition silicone putty index (Express STD, 3M ESPE) was made of the diagnostic wax-up. The wax mock-up was transferred into the patients' oral cavity using provisional material (Cool Temp® Natural - Coltene). Occlusion,

esthetics, phonetics and comfort were evaluated, patient's approval was taken.

Alginate impressions were made of the upper arch with temporaries and lower arch, casts were made in die-stone (Ultrarock, Kalabhai). Casts were mounted on a semi-adjustable articulator using face-bow transfer, centric and protrusive records. Custom incisal guide table was made by recording the protrusive path and lateral excursions on the flat incisal guide table having self-cure resin, clear (*DPI* RR Cold Cure) by movement of the articulator pin in the unset resin.

Labial tooth reduction was carried out through the temporaries using depth cutting bur for conservative preparation only of areas required. Proximal preparation was done beyond contact areas to hide the tooth restoration junction. Labial and proximal sub-gingival chamfer margins were prepared for better emergence profile of final restorations[5]. Incisal reduction was done to form shoulder margin for butt joint with the final prostheses.

Expasyl (Kerr Dental) was used for gingival displacement. Addition silicone putty and light body impression (Take 1 Advanced, Kerr Dental) was made using the double step double mix method. Final die-cut casts were made in die stone (Kalrock, Kalabhai). The die-cut cast of the prepared teeth was mounted opposing the lower cast on the articulator using centric records.

The shade, mock-up, articulated casts, custom incisal guide table were sent to the ceramist. Lithium di-silicate glass ceramic (IPS E.Max, Ivoclar Vivadent) veneers were fabricated in planned occlusion. Laminates were tried in the patient, fit and esthetic were evaluated, patient's approval was taken.

Sequence of cementation was: central incisors followed by lateral incisors followed by canines. Inner surfaces of the laminates were sand-blasted, steam cleaned, etched with 9%hydrofluoric acid (Ultradent) for 90 seconds, ultrasonically cleaned dipped in 100 percent alcohol, dried and silane coupling agent (Monobond S, Ivoclar Vivadent) was applied. Teeth were etched with 37% phosphoric acid (SDI Dental Esthetic Products) for 20 seconds, rinsed and dried.

Adhesive and self-cure activator (Prime& Bond ® NT ™ Dual Cure, Dentsply) were mixed and applied to the tooth and silanated surface of the laminate, dried and light cured for 10 seconds. Equal amounts of base and catalyst (Calibra Esthetic Resin Cement, Dentsply) were mixed and applied on the tooth surface and laminate surface. The restoration was carefully seated, spot light cured for 5 seconds, excess resin cement was removed, each margin and surface were light cured for 20 seconds. Centric and Eccentric Occlusion was checked, high points were removed, teeth and restorations were polished.

Discussion:

Diastema in the esthetic zone presents a dynamic challenge. There is a need to either decrease arch circumference or length or tooth structure to be added[5]. Orthodontic treatment alone can be used when acceptable tooth proportion and tooth size exist. If, however, there is no excess overjet, diastema closure orthodontically without restorations can adversely affect functional occlusion because of possible over-retraction of the incisors[5,7]. Restorative options include composite veneers, porcelain laminate veneers and crowns. In comparison to composite resins, porcelain laminate veneers offer better control of shade, contour, proportion, more stable long term colour and texture. Their glazed surfaces resist plaque adherence and promote periodontal health. The main drawbacks include higher cost, longer time and technique sensitivity in laboratory steps involved[5].

The clinical considerations for diastema closure involve[5]:

1. Esthetic parameters- these include facial, dentofacial, dento-gingival dental analysis.

2. Tooth proportion – It involves dividing the width of the tooth by its length. Pleasing proportion for a maxillary central incisor is in the range of 75% to 85%. Closer the proportion is to 100% the tooth will appear broad. If the ratio approaches and is less than 75%, the tooth will appear slender.

3. Tooth-tooth proportion: Golden proportion and recurrent esthetic dental proportion are common guidelines. Another guideline is that width of the maxillary lateral incisor and canine should be approximately 2 mm and 1 mm less than the central incisor respectively.

4. Incisal edge position- It is evaluated according to the following parameters:

a. The relationship of the incisal edges with the upper border of the lower lip both at rest and dynamically
b. The length of the incisal edges compared with the length of the buccal cusps of the maxillary posterior teeth
c. The distance between the upper and lower lip
d. The ratio between width and height of the teeth
e. Phonetics.

5. Occlusion is planned by mock-ups, wax-up and esthetic pre-evaluative temporaries[9]. This allows us to:

a. Determine the incisal edge position through a dentofacial analysis.
b. Determine the position at which occlusal contact should occur at the vertical dimension of occlusion.
c. Develop the intermediate pathway.

6. Gingival esthetics: Defects in the surrounding pink tissues must not compensated by the quality of the dental restorations and vice versa.

7. Gingival architecture: The progression of the gingival margins (gm) is considered normal when the zenith of the lateral incisors is 1 mm coronal to the tangent drawn between that of the central incisors and canine. Resective (gingivectomy, osseous crown lengthening) or additive (gingival grafting, coronal soft tissue repositioning) surgeries are recommended when discrepancies in the soft tissue interfere with the proposed tooth proportion or esthetic corrections are necessary.

8. Papilla formation: One of the difficulties encountered in closing a diastema preventing an excessively wide gingival embrasure or black triangle. If the distance from the base of the contact point to the crest of the bone is 5 mm or less, the papilla will fill the embrasure almost 100 percent of the time. If the distance is 6 mm the papilla will be present only 55% of the time[10].

Minimal or no tooth preparation is an accepted concept for porcelain laminate veneers. Preparation through APT's (Esthetic Preemptive Temporaries) and use of depth cutting burs help in conservative tooth reduction[9]. Tooth reduction for diastema closure requires proximal preparation beyond the contact area to hide the tooth-restoration junction and develop contact areas in the restoration. Also, slice preparation rather than wing type preparation of proximal surfaces prevents formation of a lingual ledge. Chamfer margins prepared and placed subgingivally enable the ceramist develop restorations with a natural emergence profile and papilla anatomy[5]. Incisal shoulder finish line as compared to palatal chamfer margin design decreases the load[11] and offers better control in esthetic ceramic build-up.

Custom anterior guide table was used in this case to (1) record and re-establish a physiologically acceptable anterior guidance, (2) produce an occlusal restoration in harmony with the patient's physiologic occlusion, (3) aid the dental laboratory technician in developing occlusion, and (4) decrease the chair side time for insertion adjustments[12]. Lithium disilicate ceramic veneers with thicknesses ranging from 0.4 to 0.7 mm were fabricated for this patient as they have relatively high wear resistance without compromising optical properties[13]. In case of porcelain with a thickness of more than 0.7 mm light-cured resin composites do not reach their maximum hardness and hence, dual-cured luting composite, was preferable as stronger bond could be obtained with the porcelain[14]. Excellent esthetics could be achieved due to natural appearance of porcelain and scattering effect of the luting cement.

Conclusion:

The esthetic problem of spaces in anterior zone can be successfully dealt with the use of porcelain laminate veneers. Proper planning of esthetics, occlusion and function, correct selection of veneering material and cements and good coordination with lab technician help to achieve a pleasant smile and harmonious occlusion. This in turn leads to long term success of treatment and satisfaction of both patient and dentist.

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