Digital smile designing in a patient with excessive anterior spacing and impacted central incisor – A case report.

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Abstract
Esthetic rehabilitation has become one of the most acceptable treatment modalities in order to correct malpositioned anterior dentition which cannot be corrected by orthodontic procedures. An attractive smile clearly enhances the acceptance of an individual in the society by improving the initial impression in interpersonal relationships. Esthetic and functional rehabilitation can be done successfully in such cases by various treatment approaches. Orthodontic therapy is the most conservative treatment option for such cases but often not a treatment of choice, due to various reasons like prolonged treatment time, financial constraints, appearance during the course of treatment and relapse after the treatment. Alternatively, endodontics in collaboration with prosthodontics, provides a quick, reliable and economic treatment option. When the spacing is caused by tooth size discrepancy involving one or more teeth then an interdisciplinary treatment plan involving orthodontic, restorative and periodontal treatment approach is recommended to achieve a harmonious esthetic result. Hence, the aesthetic appearance with a pleasant smile requires an interdisciplinary approach to achieve the clinical success. This article describes the case of a patient with maxillary anterior spacing, which was treated using a planned sequence with multi-disciplinary approach for an esthetic treatment.

Keywords- Esthetics, Missing teeth, Smile designing, Spacing, Rehabilitation.

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Introduction

Smile is an important facial expression in expressing happiness, friendliness, agreement, appreciation to name a few.[1] The accelerating demand for esthetics has opened avenues to develop new techniques for proclined anterior teeth, discrepancy in size of teeth or aesthetically displeasing spaces between anterior teeth.[2] Most often, an interdisciplinary approach may be required to gain an aesthetically pleasing outcome, which may combine more than two treatment options. This case report describes the treatment of a patient with spacing in the maxillary anterior region which followed soon after the relapse of orthodontic treatment, eventually leading to uneven spacing in that area, over a time period of 8 years.

Case Presentation

A 23 year-old female patient reported to the department of Endodontics, complaining of unpleasing smile. On examination, missing 21 and uneven spacing was present between 13-23 (Fig. 1 – 11). She was referred to department of Prosthodontics due to missing 21 along with anterior space management. A reduced vestibular space with 21-22 region. Discrepancy between facial and dental midline by 1 – 1.5 mm to the left side, was visible (Fig. 12). The space between 11 and 22 was approximately 13-15 mm. Increased

overjet and overbite measuring 5-6 mm was found between maxillary and mandibular anterior teeth. She revealed a past dental history of extraction of impacted 21 followed by orthodontic treatment for alignment of her proclined maxillary anterior teeth, but space closure was not achieved. Thus, the patient wanted to consider other options for correction of her smile. After obtaining a detailed case history and informed consent, irreversible hydrocolloid impressions (Coltoprint, COLTENE, India) of both arches were made (Fig. 3), to fabricate diagnostic casts (B. N. Stone, B. N. Chemicals, India). Interocclusal records were made using automixed elastomer (Registrado X, Voco GmBH). Occlusal imprint of maxillary teeth was recorded with pink hard wax (Cavex Set Up Hard, Cavex Holland BV), transferred to facebow, followed by mounting of casts on a semi - adjustable articulator (Fig. 14 – 16). The horizontal condylar guidance angles were obtained as 30° and 30° for the patient's right and left sides, respectively. Lateral condylar guidance angles were obtained as 16.37° and 15.75 ° for right and left sides, respectively using the Bennett formula (L = H/8 + 12). On establishing anterior guidance, minimal space was found between 12-42 and 22-32, thus, she was advised for endodontic treatment with respect to 12 and 22, as they might eventually become non vital, if any kind of prosthodontic procedure in relation to smile designing would be planned. During endodontic treatment, working length was established, followed by the biomechanical preparation of root canals using Protaper Universal rotary system up to F5 for 12 & 22. Irrigation was performed with 3% NaOCl (10 ml) solution followed by 17% EDTA and normal saline. The canals were obturated using appropriate gutta percha points by lateral compaction method with AH Plus sealer. The access cavity was sealed with composite resin.

Necessary photographs were taken and shade selection was done using 3D Vita Master Shade palette (3R). Diagnostic mock – up was fabricated using white press wax (Delta, India) and the anticipated cervico-incisal, labio – lingual and mesio – distal dimensions were established (Fig. 17). Putty index was fabricated using putty addition silicone (PRESIDENT, COLTENE Whaledent Pvt. Ltd) over the prepared mock up, to aid temporization. During tooth preparation care was taken, to utilize the extra spacing so that there can be even spaces present, for ceramic material to occupy, during ceramization. After the preparation, gingival retraction cord (size: 000, Ultrapak, Ultradent) was placed into the gingival margin and final impression was made using putty and light body material (Photosil, DPI) using two-stage putty impression technique (Fig. 18). Intraoral scanning of maxillary and mandibular arches was done by an intraoral scanner (3Shape TRIOS 3, 3SHAPE) and shade was auto-selected in the 3Shape software as 3R1.5 following which temporization was done (Fig. 19 - 21). Temporary restorations, that is, crowns with 13, 12 and 23 and bridge in relation to 11-22 were fabricated using bis-acryl composite resin (CoolTemp® NATURAL (A3.5), COLTENE Whaledent Pvt. Ltd., India) and was cemented using zinc – oxide non - eugenol cement (Templute, Prime Dental) CAD/CAM full contoured monolithic zirconia crowns with 13, 12 and 23 and bridge with 11- 22 was fabricated and cementation was done using resin cement (SoloCem, COLTENE, India) (Fig. 20 - 25). Patient was recalled for follow – up after 7 days, 1 month and 3 months.

Discussion

An attractive smile is an asset of great manifold to one's personality.[3] The colour, shape, position of teeth as well as their proportion and the architecture of the gingiva can be worked with to create a pleasing

smile.[4] An appropriate white and pink esthetic balance is one of the most important aspects in smile designing.[5] The goal of aesthetic rehabilitation is to develop a stable masticatory system, where the teeth and supporting structures including joints, all perform their functions in harmony.[6] [7]

In this case report, a deviated facial midline with a difference of 1 – 1.5mm from the dental midline, was present. Uneven spacing with maxillary anteriors and excessive spacing was present between 11 and 22. (13 – 15mm). 11 was approximately 10mm mesio-distally, thus 21, if present, could presumably have similar mesio-distal dimension as 11. Thus, esthetic rehabilitation in this case proved to be more challenging because final restorations would have to be fabricated in dimensions greater than the natural teeth, to remove spacing completely. Intentional endodontic therapy with respect to 12 and 22 was planned due to reduced tooth structure and clearance being less, more amount of vital tooth structure would have to be removed w.r.t. 12 and 22 to create space to allow the ceramic to flow during ceramization, causing dentinal hypersensitivity, leading to pulpal involvement. Tooth preparation for 13 and 12 was done to increase the clearance during protrusive movement. The incisal edges of 13 and 12 were reduced to about 0.8 – 1mm. Although 1.5 – 2 mm of cervico-incisal reduction of the tooth is required for monolithic zirconia crowns and bridges,[8] here only 0.8 – 1mm was reduced, due to insufficient tooth structure, shorter clinical crown height and maintaining of equal amount of ceramic deposition on incisal edges of all teeth and incisal translucency. Unequal deposition of ceramic, might induce unequal distribution of stresses along long axes of all restored anteriors, causing fracture of the restorations.[9]

Tooth preparation for zirconia crowns, suggests a reduction of 0.5 - 2mm of tooth structure in the incisal region, 1 – 1.5mm of facial reduction and a minimum of 0.8 – 1mm at the shoulder margins which was proved to give a significantly better marginal integrity than feather edged margins in case of monolithic zirconia crowns.[10] Full contoured CAD/CAM monolithic zirconia crowns and bridge require a minimum of 0.5mm of incisal reduction. At the facial surface, depth orientation grooves were placed at a depth of 0.8mm; which finalized to 1mm after finishing. Margins placed, had been prepared with a 1-mm-wide circumferential shoulder with rounded inner edges. To reduce the incisal edges, three depth grooves of depth 0.5mm were created and the tooth structure between them was reduced judiciously, but carefully. Creating undercuts, was avoided to the best possibility, at the junction of the shoulder finish line and the axial walls. Feather edges and sharp transitions were not given, as indicated and the shoulder was created as smooth as possible. A taper of 6 -8° was achieved. A football-shaped bur was used to reduce and shape lingual surfaces. Smooth edges, exert lower stresses on the porcelain crown, thus decreasing the potential for fracture.[11] [12]

Scanners can read smooth preparations more accurately, which was easily achieved, when intraoral scanning procedure was perfomed using the intraoral scanner The temporary restorations were cemented, which would aid in establishing a customized anterior guidance for the patient, allowing her to get accustomed before final cementation. After completion, the mesiodistal and labio-palatal dimensions from 13 to 23 followed the golden proportion. Anterior proclination was reduced. Overjet and overbite decreased to about 2 – 3mm. Anterior teeth had a good emergence profile and no gross asymmetry. The facial and dental midline coincided. The spacing between the anterior teeth, had been eliminated. A pleasing smile was achieved and the patient was completely satisfied.

With the development of CAD/CAM systems and rapid improvement in the mechanical properties of ceramic materials, zirconia became more popular. Generally for anterior crowns and bridges, e-max veneered lithium disilicate is the material of choice for its excellent translucency. But in this case report, monolithic zirconia was selected, due to better flexural strength of the monolithic zirconia (900 – 1200 MPa) as compared to lithium disilicate (360 – 400 MPa), which was required for prevention of chipping or fracture of the prosthesis due to reduced clearance during anterior guidance.

Conclusion

Interdisciplinary approach in dentistry is important for comprehensive and effective patient care because patients are becoming discriminating, increasing demands for accurate diagnosis and detailed treatment plans. Therefore, acquaintance of smile design and latest technologies, allows the restorative dentist to diagnose, plan, create and deliver esthetic smile to the patient.

Informed Consent

Written informed consent was signed by patient with regard to treatment and publication of the case report and images.

Conflicts of Interest

There are no conflicts of interest regarding this article

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FIGURES

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

Figure 8

Figure 9

Figure 10

Figure 11

Figure 12

Figure 13

Figure 14

Figure 15

Figure 16

Figure 17

Figure 18

Figure 19

Figure 20

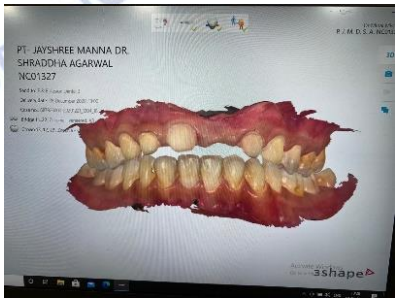

Figure 21

Figure 22

Figure 23

Figure 24

Figure 25