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Case Report

Wide Diastema Closure Using Different Materials without Root Canal Treatment: Case Reports

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Abstract

Background: This case reports were described extra-wide diastemas closing technique using different type of restorative materials. A female and a male patients presented with wide diastema in the anterior region and both of them demanded esthetic natural looking smile. It was decided to apply zirconia ceramics for female patient and porcelain fused to laser sintered metal restorations for male patient, according to their financial situations.

Case Reports: After evaluating the diagnostic models obtained from both patients, a knife-edge step preparation was performed in case porcelain fused to metal restorations, and subgingival 1 mm champher preparation was performed in case zirconia ceramic restorations. In order to achieve esthetics, the teeth in the anterior region were prepared as far as possible from the buccal region and parallelism was maintained between the abutments without any root canal treatment. In both patients, adjustment of gingival level was perform to ensure smile design. The polycarboxylate cement was used as permanent cementation procedure after the control session at third week.

Conclusions: As a result of weekly follow ups at 1st, 3rd, 6th weeks and 9 months, no biological or mechanical complications were observed. The wide diastemas were closed and patients were satisfied with the good esthetic results. Patient was kept on recall every 6 months. There is no need to make root canal treatment to bring the teeth into the desired position in the wide diastema cases all the time. It is possible to prevent the health of the teeth following controlled tooth preparation.

Keywords: Diastema Closure; Esthetic Dentistry; Wide Diastema; No Root Canal Treatment

Introduction

Anterior maxillary spacing has been shown to be one of the most negative influences on self-perceived dental appearance, and a maxillary midline diastema is commonly cited by patients as a primary concern during dental consultations [1,2]. Midline diastema is defined as anterior midline spacing greater than 0.5 mm between the mesial surfaces of the two maxillary incisors [3]. Maxillary midline diastema (MMD) is a common esthetic complaint of patient [4].

According to an epidemiological study on midline diastemas observed, it is stated that in 21.4% of the general population there is a gap behind both jaws [5]. The midline diastema has multifactorial etiology. In addition to the labial frenulum, microdontia, mesiodens, peg-shaped lateral incisors, lateral incisor agenesis, cysts in the midline region, habits such as thumb sucking, tongue thrusting, and/or lip sucking, dental malformations, genetics, maxillary incisor proclination, dental-skeletal discrepancies, and imperfect coalescence of the interdental septum should be considered factors that can cause diastema [6]. Once the etiology is known, a decision must then be taken whether to utilize a multidisciplinary approach or to simply close the spaces by means of direct and/or indirect restorations. If the teeth are accurately aligned and positioned, but the tooth size is the culprit, the clinician is left with the task of selecting the best restorative technique [3].

To obtain a functional rehabilitation that fulfills the contemporary criteria of optimum esthetics, requires both meticulous treatment planning and appropriate material selection [7]. Dental porcelain is considered as the reference material for prosthetic rehabilitation, but it is not easy to handle and esthetic excellence is quite difficult to achieve. The difficulties of ensuring ideal esthetics with porcelain fused to metal restorations and the desire for metal free solutions have resulted in the increased use of zirconia. The unique optical properties of zirconia have introduced new opportu-

nities for achieving superior esthetics [8]. During the past decade, new dental ceramic materials such as glass ceramics, poly-crystalline alumina, zirconia ceramics, and monolithic zirconia have been successfully introduced into the dental clinics, along with new processing technology, i.e. computer-assisted fabrication systems [dental computer-assisted impression/computer-assisted design/computer-assisted manufacturing (CAI/CAD/CAM)] [9]. Metal-free or all-ceramic restorations and the porcelain veneers have been more widely used due to their high esthetic potential [9,10].

This article presents the steps of prosthetic rehabilitation, from diagnosis to final treatment and follow-ups, of two patient which have wide diastema (< 7.3 mm) in the anterior region.

Case Report

Examination

Both patients were informed with printed materials related to the proposed treatment involved, principles of treatment, potential discomforts, and risks of the procedures. Both of them signed a consent form prior to clinical procedure.

Case 1: A 52-year-old man was referred to the Department of Prosthodontics in the Faculty of Dentistry, Gazi University, Turkey, for prosthetic treatment. The patient's chief complaint was the wide diastema (7.6 mm between central incisors) between the teeth in the anterior region (Figure 1). He reported that he had lost two maxillary lateral incisors due to trauma when he was teenager. Panoramic radiograph was taken from the patient to see the bone level of the teeth. According to the periodontal consultation, oral hygiene was not good enough and there were severe periodontal problems. Periodontal pockets were found around the teeth (periodontal index was between 1.0 - 1.9). Firstly, periodontal problems were eliminated with the advanced treatment of scaling and root planning. Then, the diagnostic models were prepared to plan reduction in abutments. Zirconia ceramic restoration was offered to patient, but he could not afford the cost. Therefore, porcelain fused to laser sintered metal restoration was prepared for his prosthetic rehabilitation.

Case 2: A caries-free, 48-year-old woman was referred to the Department of Prosthodontics in the Faculty of Dentistry at Gazi University, Turkey, for prosthodontic treatment. The patient's major complaint was the same as other patient; diastema (7.3 mm between central incisors) and esthetic (Figure 2). Oral hygiene was fair and there was no periodontal problem. Diagnostic model was taken and the patient was instructed about the treatment options. As the patient had no financial constraints along with a decision not to disturb a good occlusion with an acceptable profile, it was decided that the esthetic reconstruction with zirconia ceramic crowns and bridges.

Figure 1: *Intraoral view of case 1.*

Figure 2: *Intraoral view of case 2.*

Treatment

In both patients, according to the preparation, there was no need to do root canal treatment to any of the teeth. The wide diastema closure achieved with the groove on the distal edge of the central incisor. Lateral teeth started from the distal groove (0.5 mm) of the preparation of central teeth (Figure 3). A knife-edge margin preparation was performed in the case of porcelain fused to laser sintered metal porcelain bridge, (Figure 4) and a subgingival 1mm champher margin preparation was performed in the case of zirconia ceramic (Figure 5). In order to achieve esthetics, the teeth in the anterior region were prepared as far as possible from the buccal region and parallelism was maintained between the teeth without any root canal treatment. In the fabrication of porcelain fused to metal restoration, laser sintered metal which has high biocompatibility and does not cause gray stains on the gingiva (Figure 6 and 7).

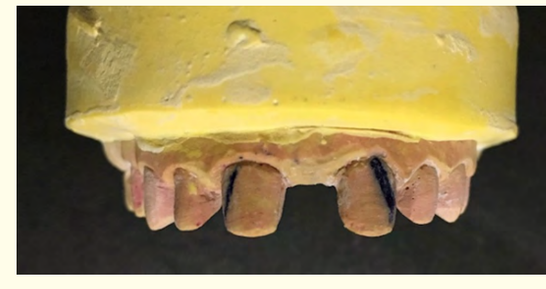

Figure 3: *Analysis of abutment preparation on the dental cast.*

Figure 4: *AIntraoral view of Case 1 after final preparation.*

Figure 5: *Intraoral view of case 2 after final preparation.*

Figure 6: *Metal framework try-in for case 1.*

Figure 7: *Zirconia core try-in for case 2.*

For both cases, gingival level alignment was perform to obtain smile design, and pink colored porcelain was used to achieve pink esthetic. After the preparation of abutments, double retraction cord technique was followed (size 00 retraction cord firstly placed, and then size 000 onto the first cord), the final impressions were made with an elastomeric impression material (Zetaplus C-Silicone Impression Material, Zhermack, Italy) and restorations were fabricated. Form of lateral incisors were adapted on the distal edges of the central incisors due to cover up the diastema and provide accurate alignment of teeth.

Finally the occlusions of the restorations were adjusted so that equal-intensity in centric relation was established and anterior guidance was constituted to dis-occlusion of posterior teeth in eccentric jaw movements (Figure 8 and 9). As a result of third week control, no biological or mechanical problems were observed. Permanent luting was made using zinc-polycarboxylate cement for both patients. Gingival embrasures have been closed down slowly on time after the use of three weeks.

Figure 8: *Intraoral view of final zirconia ceramic restoration for case 2.*

Figure 9: *Intraoral view of final porcelain fused to metal restoration for case 1.*

At sixth month follow-up, several questions were asked to the patients related to their satisfaction about the prosthetic rehabilitation. The patients mentioned that there were no complains for esthetics, temporomandibular joints, gingival tissues, and sensitivity when eating meals or drinking cold/hot beverages.

The wide diastemas were closed without any root canal treatment and patients were satisfied with the good esthetic results. The male patient that has porcelain fused to laser sintered metal bridges have just one problem about the opaque tone of the porcelains. But, he gave 4 point to this complaint regarding to 1 to 10 point scale (1 minimum, 10 maximum). The female patient was so satisfied from his prosthetic treatment and esthetic outcomes.

Discussion

The problems encountered in the anterior teeth, which play an important role in the esthetic image, adversely affect the psychological structure of the patient. One of the possible problem is the midline diastema.

Multidisciplinary treatment planning is recommended in diastema closure cases [11]. Factors such as the patient's age, occupation, occlusion, economic and sociological status, diastema location and size, patient's expectancy are the criteria to be assessed. Diastema closure options include orthodontic treatment, orthodontic treatment with prosthetic rehabilitation, composite resin laminates and ceramic restorations. Orthodontic treatment requires more time, financial, psychological and physical factors. Composite restorations are an advantageous application, because it can be finished in a short time or sometimes even by a single appointment [12]. However, composite resin applications (bonding technique) are a suitable form of treatment to close midline diastema that do not exceed 4 mm. Goyal., *et al.* [3], showed in their case report that composite resin could be used to close the 4 mm diastema between anterior incisors using with posterior matrix along the construction phase. Meijering., *et al.* [13] applied direct composite veneers, and stated that the failure rate of direct composite veneers was so high in a 2.5 years follow-up

In the presence of diastema as wide as 4 mm, crowns or bridges with preparation of abutments are recommended to prevent the failure of the restorative material. In the prosthetic approach; laminate veneers, porcelain fused to metal restorations, zircon ceramics and lithium disilicate ceramic systems can be used.

The success rate of porcelain laminate veneers over 10 years is 91% [14]. Okida., *et al.* [15], mentioned in their case report that patient was referred to an orthodontic treatment in order to provide better distribution of the diastemas, harmonious proportion of the teeth, and to balance the midline and after the orthodontic treatment thin glass ceramic veneers used to cover up the diastemas between teeth. Fradeani., *et al*. [16], reported that 12 years follow-up success rate was 94% of 182 porcelain laminate veneers luted using adhesive technique. Peumans., *et al.* [17], followed-up their cases made with 87 laminate veneers for 10 years. During that period, only five restorations had a problem due to micro-leakage, marginal discoloration and fracture.

Porcelain fused to metal restorations have some drawbacks compared to zirconia ceramics. Especially when the subgingival preparations were made, it has been stated that as time passes, the metal framework causes gray coloring in the gingiva [18]. Technological developments improved several features of restorations, such as it can be concluded that the newly developed laser-sintering technique is more successful than casting of non-precious metal and is less expensive than noble alloys [19,20]. The corrosion resistance, marginal adaptation and biocompatibility of a Co-Cr alloys fabricated using milling or laser sintering techniques was greater than casted alloys [20,21].

Biological compatibility of zirconia ceramics is better than porcelain fused to metal restorations. Laser sintered metal reinforced porcelain fixed partial dentures can cause metal allergies [22]. Zirconia does not generate any allergic reaction like other type of metals. It has similar thermal expansion coefficient and thermal conductivity to natural tooth structure. They are resistant to shearing forces. They are safe due to ion release and electrolytic corrosion. However, it was stated in some articles that there was no significant difference in the fracture strength between the metal framework and the zirconia core [23]. In a study, there was no statistically significant difference between the two groups in terms of marginal adaptation in full ceramic and porcelain fused to laser sintered metal for single crowns [24]. Because, the metal is not translucent, it is difficult to achieve adequate color depth and natural appearance for dental restorations.

Monaco*., et al*. [25] conducted a randomized controlled trial and reported that zirconia ceramic and porcelain fused to metal restorations showed similar survival rate for follow-up period more than 5 years. No significant differences were illustrated in terms of esthetic, functional and biological outcomes between the groups. Sailer., *et al.* [18] compared the survival rate of all-ceramic and metal-ceramic single crowns after follow-up period of five years, described the incidence of biological, technical, and esthetic complications. The survival rates of most types of all-ceramic single crowns were similar to those reported for metal-ceramic single crowns in the anterior and posterior regions.

In a cohort study conducted by Shi., *et al*. [10] for 2.5 years, and 45 patients were treated using zirconia ceramics and 50 patients were rehabilitated with porcelain fused to laser sintered metal restorations. Complications and patient satisfaction were assessed

in that study. For the zirconia based restorations, VAS evaluation criteria was 8.18. It was 8.46 for porcelain fused to metal restorations. The authors stated that the difference between the restoration types was not statistically significant.

This paper described wide diastema (7.3 mm<) closure without root canal treatment using prosthetic rehabilitation techniques in the anterior region first time in the literature. A smile design program and dental surveyor were used to plan preparation of the abutments. Vitality of the teeth have been secured and denture design have been accomplished in light of smile design. Both patients were satisfied that outcomes of natural looking smile.

Conclusion

The clinical success of fixed partial dentures depends on accurate treatment planning. Application of laser sintered metal framework shows great adaptation and biocompatibility to the periodontal tissues and does not cause any gray stains on the cervical line of gingiva.

Wide midline diastema (7.3 mm<) cases could be covered up obtaining parallel abutment preparations without root canal treatment to maintain vitality of the teeth. Satisfaction of the patients and esthetic appearance might be achieved that regardless of restorative material.

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