

Anterior esthetic rehabilitation with full and partial veneers using conventional and digital techniques: A case series

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Abstract

Effective esthetic rehabilitation requires a proper treatment planning in addition to the associated diagnostic wax-up. For anterior rehabilitation, most dentists favor conservative and esthetic treatments, such as indirect laminate veneer restorations which can be partial- or full-ceramic anterior crowns according to the clinical situations. After the introduction of technologies such as intraoral scanners, dental software for digital restoration design, and additive manufacturing (three-dimensional printing), these techniques further enhanced the digital workflow of restorative therapy. These technologies also fabricate prosthesis with natural esthetics and marginal integrity. This case series discusses the conventional and digitally fabricated full- and partial-ceramic veneers for discolored and misaligned anterior teeth after the fabrication of corresponding diagnostic wax-up.

Keywords: Ceramics; dental veneers; lithium disilicate; rehabilitation; zirconium oxide

INTRODUCTION

Anterior esthetic rehabilitation has always been challenging for every dentist. The anterior esthetics are mainly affected due to discoloration and spacing in the teeth, especially maxillary teeth. The common treatment options for these clinical situations are bleaching and composite veneers. However, both these options have their own limitations and provide short-term esthetic results. Due to advancement in dental ceramics, ceramic veneers (full/partial) are developing as an alternate treatment option for repairing discolored, fluorosed, and spaced anterior teeth. It can also be used to rehabilitate cases where orthodontic correction of malocclusion was unsatisfactory following conventional or digital wax-up.^[1,2]

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The success rate of ceramic veneer restorations depends on a number of variables, including preparatory design, adhesive methods, and sufficient patient home care. Lithium disilicate, feldspathic porcelain, feldspathic porcelain reinforced with leucite, and lithium disilicate reinforced with zirconia are some of the ceramic materials now available in the market for the clinician. When treated with hydrofluoric acid followed by the application of silane, these ceramics provide excellent esthetic results and great adhesion with resin cement because of large proportion of glassy matrix.^[3,4]

This case series discusses the esthetic rehabilitation of discolored and misaligned anterior teeth using full- and partial-ceramic veneers fabricated by conventional and digital techniques.

CASE REPORTS

Case I

A 20-year-old female reported chief complaints of discolored and fractured upper front tooth region. The

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patient also gave a history of chipping of incisal edges of teeth frequently while biting food. There was no relevant past medical and dental history. On intraoral examination, the patient had generalized moderate fluorosis (Dean's Grade III) with chipped incisal edges in relation to right and left maxillary lateral incisors (22, 12) and left maxillary canine (23) [Figure 1a-c].

Treatment planning

After examination, gingival zenith was observed to be uneven for maxillary right and left central incisor (11, 21), hence gingivectomy was carried out in 11. The patient was given three treatment options such as in-office teeth bleaching, composite veneers, and ceramic veneers. In-office bleaching was denied by the patient, as she gave a history of bleaching 3 months back and had unsatisfactory results. The patient was explained about the disadvantages of composite veneers such as less color stability and wear resistance, and since she had a high esthetic demand, composite veneers were denied. Hence, ceramic veneers (IPS e.max lithium disilicate) were planned from 13 to 23 (maxillary right canine to left canine) and informed consent was taken before the commencement of procedure.

Clinical procedure

The diagnostic impression was made using irreversible hydrocolloid material (Zelgan, Dentsply), and diagnostic cast was poured. The diagnostic wax-up was done on the cast, over which two putty reduction guide indexes

were fabricated using additional silicone elastomeric putty material (3M ESPE Express Xt VPS Impression Material – Putty and Refills): one for incisal reduction and second for labial reduction (incisal third, middle third, and cervical third) [Figure 1d and e].

The ceramic veneer preparation was done using putty reduction guide index. Initially, horizontal and vertical guide grooves of 0.5 mm were made at the incisal edges and labial surfaces of 13–23 using depth gauge diamond burs (Preident Diamond Depth Cutting Bur). Then, the subsequent tooth reduction 0.5–1.0 mm on the incisal edge and 0.3–0.5 mm on the cervical region was performed using a round-end tapered fissure bur. Evaluation was done with the help of putty reduction guide index and periodontal probe [Figure 1f and g]. A butt joint veneer preparation with shoulder finish line was prepared followed by finishing and polishing using finishing burs and discs [Figure 1h]. Since the sulcus depth was very less because of gingivectomy, a single cord gingival retraction (cord #00) technique was performed. The elastomeric light body material was placed immediately after removing the retraction cord and the impression was made using elastomeric putty material (3M ESPE Express Xt VPS Impression Material – Putty and Refills) [Figures 1i and 2a]. After impression, the shade selection was done under mid-day light and approved by the patient. With the similar shade, temporary restorations (Prevest DenPro Oratemp C and B) were fabricated and inserted into the patient using temporary cement (Prevest Oratemp Ne Manual-Mix).

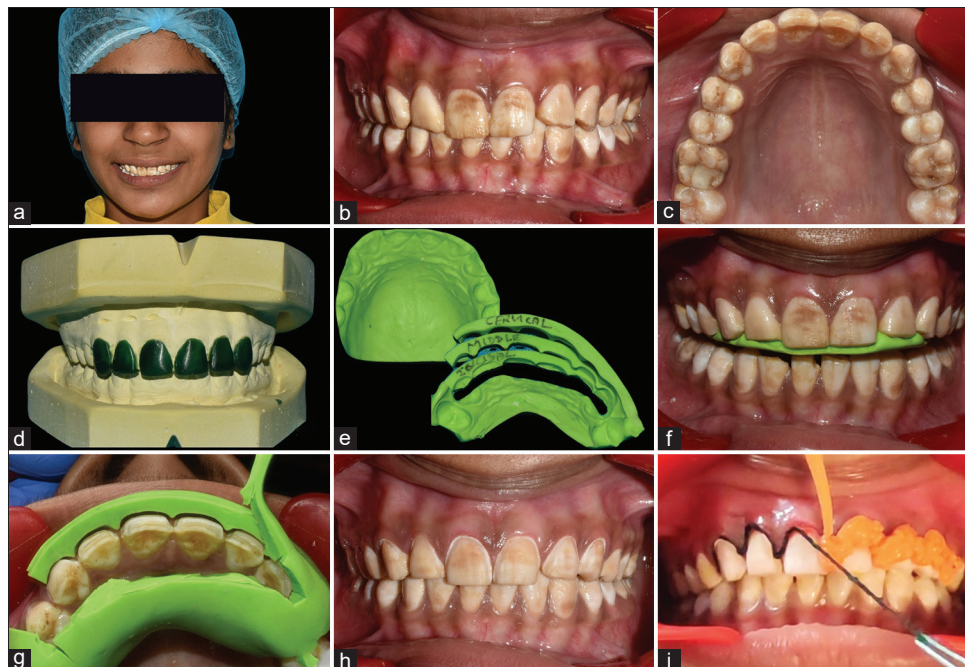


Figure 1: Case 1. (a) Prerehabilitative smile view, (b) Prerehabilitative frontal view, (c) Prerehabilitative intraoral occlusal view, (d) Diagnostic wax-up, (e) Putty reduction guide index, (f) Incisal preparation with guide *in situ*, (g) Labial preparation with guide *in situ*, (h) Completed butt joint veneer preparation with shoulder finish line, (i) Gingival retraction and its removal during light body application

Laboratory procedure

The master cast was retrieved with individual dies from 13 to 23 using type IV gypsum product (Kalabhai Kalrock Diestone) [Figure 2b and c]. The glass-ceramic lithium disilicate was chosen (IPS e.max Press, Ivoclar Vivadent) to fabricate very thin restorations, and the veneers were fabricated using cutback technique to fulfill the patient’s high esthetic demands. The wax patterns were fabricated in the cast as an undersized core with 0.2–0.5-mm space left for layering. The wax patterns were invested and the mold was inserted into a furnace for heating treatment. After dewaxing, the ceramic ingot LT (glass ceramic ingot [Press lithium disilicate]) was heated and pressed into the mold under pressure [Figure 2c]. After pressing, the undersized coping was retrieved and layered using lithium disilicate layering material (IPS e.max Ceram) [Figure 2d]. After finishing and polishing, the final prosthesis was evaluated for marginal integrity, accuracy, and esthetics [Figure 2e and f].

Insertion and postrehabilitative instructions

Following patient approval, the prosthesis was cemented using resin cement (3M Espe Relyx U200 Self-Adhesive Resin Cement) after etching of prosthesis using 9% hydrofluoric acid and teeth using 32% phosphoric acid and bonding using silane coupling agents and universal bonding agents [Figure 2g]. The excess cement was removed using floss and microbrush in the interdental and cervical regions. Occlusion, excursive movements, and protrusion

were checked and the patient was pleased with the final esthetic result [Figure 2h and i].

Case 2

A 28-year-old male reported chief complaints of spacing in the upper front tooth region. The patient gave a history of spacing from childhood. On intraoral examination, the patient had midline diastema between two maxillary central incisors (11 and 21). The patient was offered a combination of orthodontic correction and restorative treatment, but he denied the orthodontic appliances in his mouth and wished for early restorative treatment.

Hence, a ceramic veneer (IPS e.max lithium disilicate) was planned for 11 and 12. The incisal overlap veneer preparation with shoulder finish line was decided to close the midline diastema and provide favorable esthetic results. The remaining clinical and laboratory procedures were performed the same as Case 1 [Figure 3a-l].

Case 3

A 24-year-old male reported missing teeth in the upper front tooth region. The patient gave a history of road traffic accident 6 months back resulting in fracture and avulsion of upper anterior teeth. The patient does not have any relevant past medical history. On intraoral examination, the patient had missing right and left maxillary central incisors (11 and 21) and right maxillary lateral incisor (12) which got avulsed immediately after accident. On further

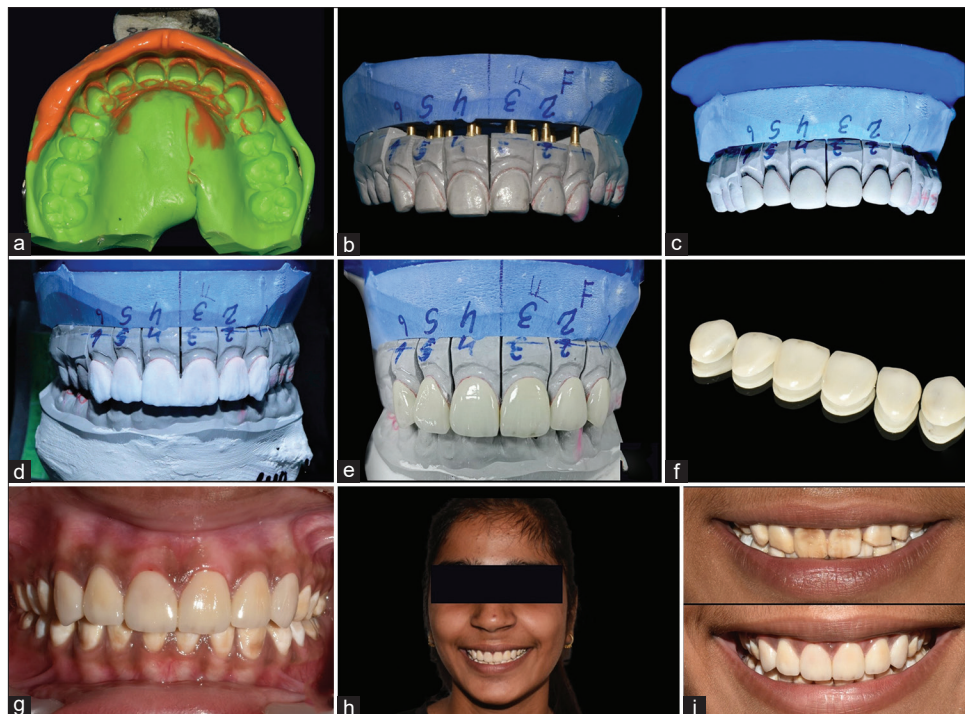


Figure 2: Case 1. (a) Final elastomeric impression, (b) Master cast with individual dies, (c) Undersized IPS e.max core, (d) Layering of IPS e.max Ceram material, (e and f) Final individual veneer prosthesis, (g) Final prosthesis *in situ*, (h) Postrehabilitative view, (i) Pre- and postrehabilitative smile view

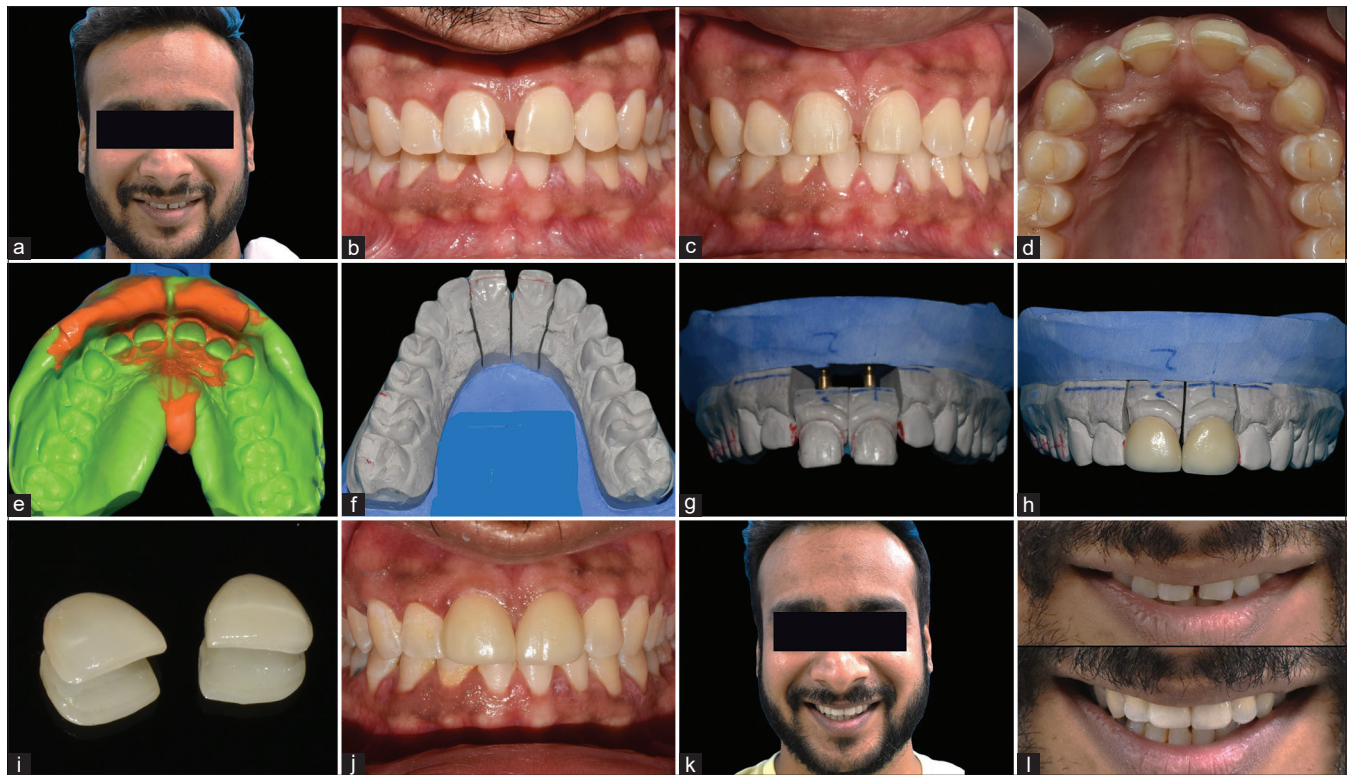


Figure 3: Case 2. (a) Prerehabilitative smile view, (b) Prerehabilitative frontal view, (c and d) Completed incisal overlap veneer preparation with shoulder finish line, (e) Final elastomeric impression, (f and g) Master cast with individual dies, (h and i) Final prosthesis, (j) Final prosthesis *in situ*, (k) Postrehabilitative view, (l) Pre- and postrehabilitative smile view

examination, it was observed that the left maxillary lateral incisor (22) was Grade II mobile (Miller’s classification) and out of occlusion [Figure 4a-c]. Furthermore, it was noted that the edentulous space availability for rehabilitation was lesser than the space mesiodistal dimension of missing teeth.

Treatment planning

The patient was offered a combination of orthodontic space creation and restorative treatment, but the orthodontist declared that the orthodontic correction was not possible because of bone loss during accident. Hence, the restorative treatment was decided following the extraction of mobile lateral incisor (22). Since the space availability for replacing missing teeth was very less, the patient was informed for the need of virtual diagnostic wax-up followed by rehabilitation with digitally fabricated zirconia bridge extending from the right maxillary first premolar to the left maxillary first premolar (14–24) which was planned for the patient.

Virtual wax-up

The diagnostic impression was made using putty and light body elastomeric impression material which was then scanned using Self-Monitoring, Analysis and Reporting Technology (SMART) desktop scanner (Open Technologies FARO Europe), and computer-aided

designing (CAD) diagnostic wax-up was prepared using EXOCAD software (exocad GmbH, Darmstadt, Germany). In the software, the mock-up design was generated using mock-up “Clip-on” option followed by merging the design with a patient model to generate the digital wax-up model. During designing, it was found that the maxillary right canine (13) was migrated to the lateral incisor region and there was edentulous space available between the canine and premolar (14), hence it was decided to prepare the canine to the shape of lateral incisor and place the canine as pontic in the edentulous space between 13 and 14 [Figure 4c]. The Standard Triangle Language (.STL) file of the virtual wax-up was then transferred to the three-dimensional (3D) printing machine (3D Systems NextDent 5100) and the wax-up model was printed using 3D printer resin (NextDent model 2.0 resin) [Figure 4d and e].

Clinical procedure

Similar to Case 1, a putty reduction index was fabricated from the 3D printed model and the tooth preparation (full-veneer crown preparation on 13, 14, 23, and 24) was performed with the help of the index [Figure 4f]. The maxillary right canine (13) was prepared to the shape of lateral incisor as planned during the virtual wax-up [Figure 4g]. After tooth preparation and gingival retraction using retraction cord, an elastomeric impression (putty and light body)

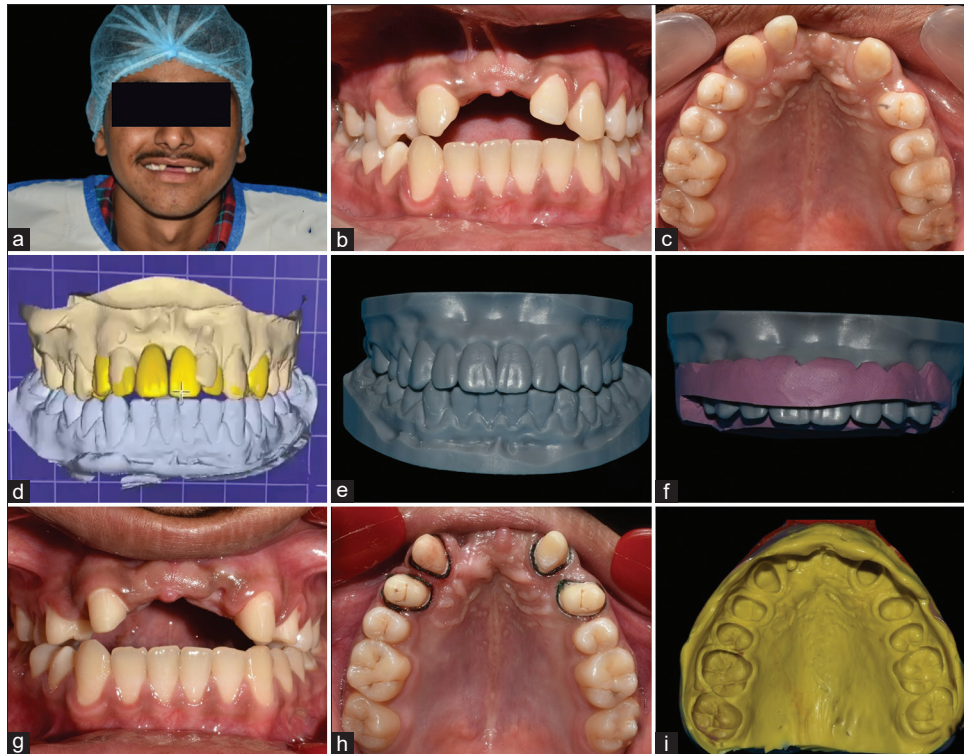


Figure 4: Case 3. (a) Prerehabilitative smile view, (b) Prerehabilitative intraoral view, (c) Prerehabilitative intraoral occlusal view, (d) Virtual diagnostic wax-up in scanned model, (e) Three-dimensional-printed diagnostic wax-up model, (f) Putty reduction guide index, (g) Full-veneer preparation in 13, 14, 23, and 24, (h) Gingival retraction, (i) Final impression

was made and the temporization was done using direct technique [Figures 4h, i and 5c, d].

Laboratory procedure

In the laboratory, the impression was scanned and the core of final restoration was designed using a similar scanner and software used for virtual wax-up [Figure 5a and b]. Then, the designed core was milled in the milling machine (Roland DWX-52 DCI machine) using zirconia (Dentsply Cercon ht ML). The milled core was then layered using the same zirconia material and pink porcelain was also added in the edentulous region [Figure 5e].

Insertion and postrehabilitative instructions

After finishing and polishing, the final prosthesis was evaluated for marginal integrity and accuracy. Following patient approval, the prosthesis was cemented using the same technique as Case 1 [Figure 5f-i].

All the three patients were followed after a year and they were satisfied with the esthetic results.

DISCUSSION

The proper diagnosis and treatment planning are very important in decision-making to choose indirect ceramic laminate veneers as a treatment option. The presence of normal overjet and overbite and the absence of malocclusion

such as crowding, crossbite, and parafunctional habits with sufficient enamel are the ideal conditions for selecting ceramic veneers as the most acceptable treatment option.^[5]

In Cases 1 and 2, for evaluation and diagnosis, conventional diagnostic wax-up was done, which is a dental diagnostic procedure in which planned restorations are developed in wax on a diagnostic cast. It can provide information regarding discrepancies between actual and ideal tooth size, the amount of possible restorative space, the occlusal pattern, and any treatment required in the opposite arch. The diagnostic mock-up helps patients to request any desired adjustments at early stage and also allow them to understand the clinical evaluation of the possible future restorations. The diagnostic wax-up can also be used to fabricate diagnostic guides and in preparation of reduction guides which help in conservative tooth preparation.^[6,7] Various treatment options were given for both the patients, but considering their esthetic demands and clinical situations, ceramic veneers were planned. The study conducted by Mazzetti *et al.*^[8] and Alotman and Bamasoud,^[9] also states that the ceramic veneers have various advantages in terms of durability, strength, wear and stain resistance, and esthetics compared to composite veneers.

For Case 1, since the patient had severe discoloration and chipped incisal edges on the maxillary anteriors,

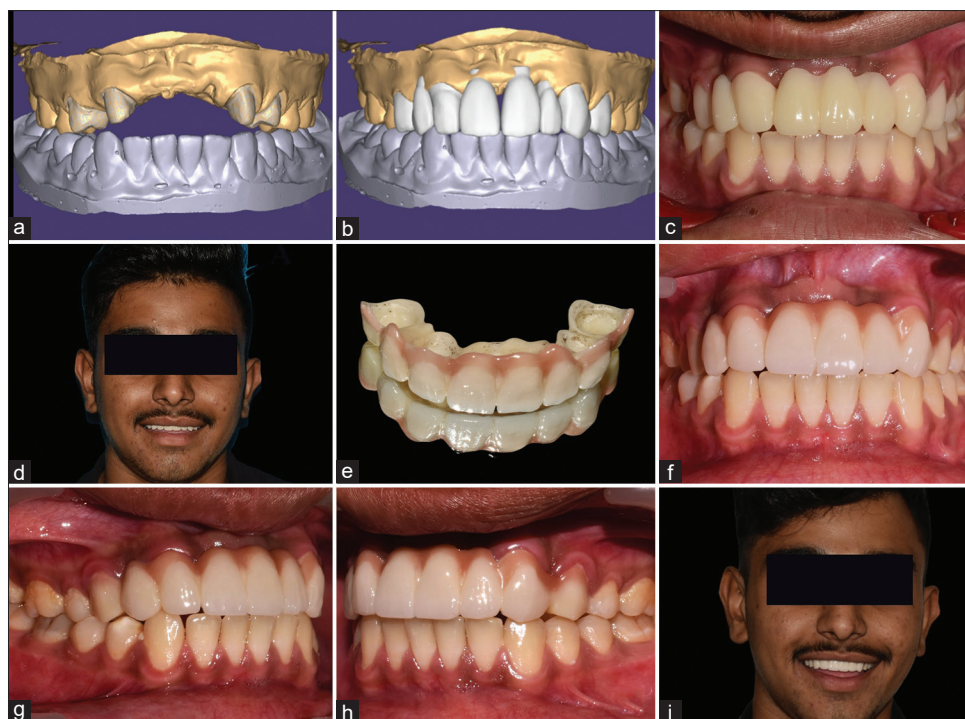


Figure 5: Case 3. (a) CAD model of prepared teeth, (b) CAD designing of zirconia prosthesis similar to diagnostic wax-up, (c) Temporization, (d) Smile view after temporization, (e) Milled zirconia final prosthesis, (f) Final prosthesis *in situ* (frontal view), (g) Final prosthesis *in situ* (right lateral view), (h) Final prosthesis *in situ* (left lateral view), (i) Postrehabilitative smile view

rehabilitation with six partial veneers from maxillary canine to canine veneers was decided. To incorporate the chipped incisal edges, butt joint veneer preparation was planned. The preparation was restricted to the enamel (0.5 mm) to provide a conservative tooth preparation and to enhance the bonding of veneers. For Case 2, since the patient had midline spacing and there is no discoloration of maxillary anteriors, ceramic veneers were planned in maxillary central incisors as it is more acceptable to close the spacing than composite veneers.

In the final case, since the patient had less edentulous space for replacing the missing teeth, to simplify the procedure and to improve the accuracy of the diagnostic wax-up, we tried virtual diagnostic wax-up after laboratory scanning of conventional elastomeric impression. This helps to control the thickness of the wax-up virtually and also determine the amount of tooth reduction needed and the available restorative space accurately when compared to conventional technique.^[7,8] Even though the patient was young, a full-veneer milled zirconia fixed partial bridge was planned than the implant retained prosthesis because of less space availability, fractured and resorbed anterior alveolar ridge after accident, and deranged teeth and occlusion. A study by Gargari *et al.*^[10] also concluded that the zirconia FPDs can be considered a reliable treatment option for both the anterior and posterior compromised ridges with survival rates comparable to traditional metal-ceramic and implant-retained prostheses. For all

three cases, the existing occlusion (mutually protected occlusion) was maintained after rehabilitation.

In terms of ceramic materials, since laminate veneers were planned for the first two cases, we used IPS e.max press ceramic as a material of choice which is a lithium disilicate pressed glass ceramic with superior physical properties, excellent translucency, and a different reactive index and crystalline volume.^[9] For the third case, since the patient had multiple missing teeth and the prosthesis extending to the posterior region, to improve the strength of the prosthesis, multilayered hybrid zirconium oxide was selected which provides high strength and natural esthetics.^[10]

CONCLUSION

Smile is the person's most important ability to express a wide range of emotions and determines how well a person can function in society. With the help of ceramic materials and diagnostic wax-up, a dentist can provide better esthetic rehabilitation with minimal tooth preparation by preserving the enamel layer for bonding of the ceramic with tooth structure. In this case series, anterior esthetic rehabilitation of patients with discolored and misaligned teeth using full and partial veneers fabricated by conventional and digital techniques is discussed.

Declaration of patient consent

The authors certify that they have obtained all appropriate

patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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