

All Zirconia: A New Material for Posteriors with Minimal Tooth Preparation

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ABSTRACT

Planning and executing the restorative rehabilitation of a decimated dentition is probably one of the most intellectually and technically demanding tasks being faced by a dentist. Full mouth rehabilitation involves restoring the dentate or a partially dentate mouth to provide an orderly pattern of occlusal contact and articulation that will optimize oral function, occlusal stability and esthetics. This case report demonstrates a full mouth rehabilitation of a patient for esthetically and functionally compromised dentition by a recently introduced 'metal-free' restoration. The final prosthesis ensured a restoration resulting in predictable posterior disclusion and anterior guidance in harmony with the condylar path.

Keywords: Ceramics, Zirconia, CAD-CAM.

INTRODUCTION

The goal of dentistry is to increase the life span of the dentition, just as the goal of medicine is to increase the life span of the individual. In striving to achieve its goal, dentistry uses its knowledge, skill and all the resources at its command in both maintenance work and rehabilitation. Occlusal rehabilitation has been defined as the restoration of functional integrity of the dental arches by the use of inlays, crowns, bridges and partial dentures¹.

An ideal full mouth rehabilitation treatment plan should be minimally invasive, for preserving as much of the natural tooth structure as possible. It should realign the ideal form and function of the teeth and tissues while enhancing the esthetics and should never compromise the patient's oral health. All ceramic restorations are classified into 1. Silica based



(Feldspathic, Leucite reinforced and Lithium disilicate) and 2. Non-silica based (Alumina and Zirconia). Amongst all the above, zirconia has highest strength (800-1600Mpa)².

Zirconia or zirconium dioxide (ZrO₂) is an oxide of a shiny metal Zirconium. Zirconia which is used as a crown material is Y-TZP (Tetragonal Zirconia Polycrystal), partially stabilized zirconia achieved by adding yttrium oxide. It is used in anterior and posterior full coverage crowns and bridges, onlays, posts etc. Zirconia based crowns utilize CAD/CAM technology for fabrication of copings. Zirconia block is milled in 'pre-sintered state' or 'green state' and then sintered to form a zirconia coping. After that, ceramic veneer compatible with the properties of zirconia coping is either layered or pressed on it, creating a strong esthetic restoration³. The commonly faced problem with the tooth coloured restorations is their requirement of more tooth reduction. Approximately 63% to 72% of coronal tooth

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structure is removed. Occlusal clearance of 1.5-2mm for all ceramic and 1.5mm is required for porcelain fused to metal crowns⁴, which makes them difficult to use in posterior regions with short clinical crown height. A recent technique by 3M named *All Zirconia* (3M Monolith), can be useful in such conditions where in entire crown or bridge is milled and sintered from zirconia blocks followed by staining and glazing without veneering porcelain on it, making it choice of treatment in the cases of posterior regions with short clinical crown height, Bruxism, patients with history of chipping in old all ceramic or porcelain fused to metal restorations and heavy occlusal forces⁵.

The clinical report describes the sequenced treatment for an adult male patient with mutilated dentition by full mouth rehabilitation with the use of *All Zirconia* (3M Monolith) bridges in the posterior region and conventional veneering all ceramic bridges (3M Essential) in the anterior region.

CASE REPORT

A 54 year old male patient reported to the Department of Prosthodontics with a chief complaint of unsightly appearance due to missing teeth in upper and lower front and back region and difficulty in chewing. The medical history did not reveal any systemic condition or disease that contraindicated dental treatment. Dental history revealed that patient had undergone extraction of lower third molars 3 months back due to caries and endodontic treatment of some teeth in upper and lower front and upper left back region.

On extra oral examination, patient had an ovoid facial form, straight profile, average facial features and wheatish complexion. Lips were competent, thick with average lip length. Mandibular range of motion was within normal limits. Temporomandibular joint, muscles of mastication and facial expressions were asymptomatic. Intra oral examination revealed missing 13, 23, 26, 35, 36, 38, 42, 43, 46, and 48. Restored teeth were 11, 14, 17, 21 and 47. Root canal treatment was carried out in 12, 27, 31 and 32 with 32 having Grade II mobility. Carious lesions were seen on 33, 44, 45 and 47. Erosion facets were found on the premolar teeth. Supra-eruption of 24 and 25 was seen and 14, 41 were rotated (Figure 1).

Type of occlusion was Group function. Three mm of freeway space was present without any discrepancy between centric relation and maximum intercuspation. Smile line was average and flat, with the width of 6-8 teeth⁶. The gingiva was pink and healthy with thin biotype and stippling was present. Three sets of full arch diagnostic impressions using irreversible hydrocolloid (Imprint) impression material were made and poured in type III dental stone (Kalabhai Karson, Mumbai). Diagnostic casts were mounted on semi adjustable articulator (Bioart A7 plus) by using face bow and centric occlusal record (Aluwax) (Figure 2).

On radiographic examination, generalised bone loss up to 3mm in the mandibular arch was observed; the lamina dura of teeth were intact. Maxillary left canine was impacted. Deep carious lesion close to the pulp was seen with respect to 33, 44, 45 and 47 (Figure 3). From all the above clinical and radiographic findings, the case was diagnosed according to Breaker's classification as Group II Class-I: Partially edentulous maxillary and mandibular arches⁷.

Inter disciplinary treatment approach was planned for the patient. Patient was informed about surgical, periodontal, endodontic and restorative procedures required. Treatment plan included extraction of 32 (mobility), oral prophylaxis and composite fillings in 37 and 41. Endodontic treatment of 33, 44, 45 and 47 was advised. Intentional root canal treatment for supra-erupted 24 and 25 to correct the occlusal plane followed by crown lengthening procedure was planned. Final rehabilitation was planned with metal free prostheses which would have mutually protected and group function occlusal scheme following Dawson's concept of occlusal rehabilitation^{8,9}.

Treatment was divided into pre-prosthetic, prosthetic and maintenance phase. In Pre prosthetic phase, patient's protrusive wax records were made and transferred on the articulator to adjust the horizontal condylar guidance at 32⁰. Using the Hanau's formula, Bennet angle was calculated as 15⁰ and adjusted on the articulator¹⁰. Mock preparation was done on the diagnostic mounted cast. Diagnostic



Fig 1: Preoperative maxillary and mandibular arches.



Fig 5: Maxillary and Mandibular tooth preparation.



Fig 2: Diagnostic mounting.



Fig 6: Provisionalisation.



Fig 3: Pre operative OPG.

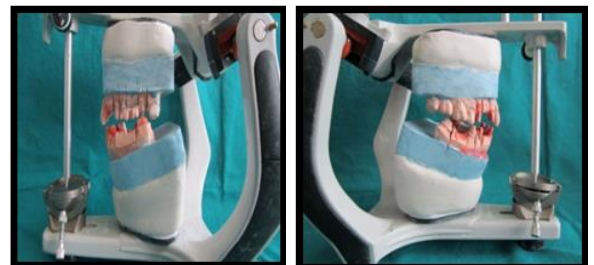


Fig 7: Mounting of final casts on semi-adjustable articulator.



Fig 4: Diagnostic wax up.



Fig 8: Maxillary and Mandibular Coping trial.



Fig 9: Final cementation (frontal and lateral views).



Fig 10: Occlusion in lateral excursion (Group function).



Fig 11: Occlusion in protrusion (Posterior disclusion).



Fig 12: Pre and post operative smile.

wax up was made using the above obtained values and adjusting the incisal table at 5°, mutually protected and group function scheme of occlusion was then established¹¹ (Figure 4). Indices of the wax up were made with the help of putty to aid in tooth preparation¹². All procedures were carried out according to the prepared treatment plan. A3 and A3.5 shade was selected with the help of VITAPAN 3D MASTER¹³.

In prosthetic phase 12, 14, 22, 24, 25, 27 and all mandibular teeth were prepared. Three mm of combined incisal clearance was provided in anteriors (Canines and laterals), 3 mm of combined occlusal clearance in 1st premolars and 1.5mm on posterior region (Figure 5). Full arch impressions were made with irreversible hydrocolloid for fabrication of the heat cured acrylic resin provisional restorations. Heat cured acrylic provisionals (DPI dental products, Mumbai) were checked intraorally for proper contacts in centric occlusion and disclusion on protrusion and lateral excursion. Provisionals were cemented in the mouth using luting cement (Templute, prime dental products, Mumbai) (Figure 6). Patient was kept under observation for a period of 2 weeks.

After 2 weeks, as patient was comfortable, it was decided to proceed with permanent restorations. Mandibular and maxillary provisionals were removed. Gingival retraction was done using pre-impregnated retraction cord (Ultrapack 000) and final impressions were made using polyvinyl siloxane addition silicon material (Aquasil soft putty and light body, Dentsply) using two step dual viscosity impression technique. Impressions were poured in type IV die stone followed by die cutting¹⁴. Inter occlusal records (Aluwax) made with the help of anterior bite stop (Lucia jig)¹⁵.

The working casts were scanned under digital scanner (LAVA SCAN ST, Germany) with a non-contact white light fringe pattern. Detection was carried out from occlusal third to the margin of the teeth. The system automatically defined the overall preparation margins. After that, both the working casts were articulated with the wax bite placed in the scanner to scan the occlusion. The minimum thickness of coping is adjusted to 0.5mm for ceramic bridges and 0.75mm was the thickness of zirconia bridges. The cement space was kept 25 microns and the optimum framework was designed

by using CAD. After completion of design, the information was transferred to a milling machine. The zirconia blocks under milling unit were milled by hard metal tools to undergo sintering.

Working casts were mounted on semi-adjustable articulator using facebow record and existing interocclusal record (Figure 7). The articulator settings were duplicated as per the diagnostic wax up.

All zirconia (3M MONOLITH) prostheses for posterior units and all ceramic prosthesis copings (3M ESSENTIAL) for anterior units were tried intra orally to check marginal accuracy and fit (Figure 8). Ceramic build up was carried out on the ceramic units followed by Bisque trial on the articulator and then intra orally. Posterior disocclusion on protrusive movements and disocclusion on balancing sides was achieved by selective grinding. After the bisque trial, gingival porcelain was layered on the cervical third of 14, 22 and 24. Ceramic layering was done on gingival third of 23 to increase crown height. Well defined fossae and cingulum were prepared on the anteriors. All protrusive and excursive contacts were corrected. Periodontally healthy proximal embrassures were created on the prostheses by using interdental rubber polishing disc with diamonds¹⁶. Esthetics, smile line and visibility of the prostheses were checked.

After the adjustments, all units were sent for staining and glazing. Final cementation was done by using resin modified glass ionomer cement (RelyX Luting2, 3M ESPE) in accordance with the manufacturer's guidelines (Figure 9). Instructions regarding maintenance of proper oral hygiene were given to the patient and he was recalled for an evaluation at an interval of 3 months. At recall visits, patient was very happy with improved function and esthetics by oral rehabilitation.

DISCUSSION

The treatment plan should have common goals i.e., functionality, esthetics and longevity. Full mouth rehabilitation was performed by using Dawson's concept to get stable contact in all teeth at the level of centric relation as well as mutually protected and group function occlusion, (Figures 10, 11) which is simplest yet effective means of achieving treatment objectives in a stepwise

manner¹⁰. The marginal fit and shade of the restoration was satisfactory. Metal free bridges were fabricated out of which anterior units were made from zirconia copings and ceramic layering (3M ESSENTIAL) and posterior units were made with All Zirconia (3M MONOLITH) because, it provides the adequate strength (1440Mpa 3 point bend strength and 1066 Mpa 4 point flexural strength)^{17,18}. It requires minimal tooth preparation (0.5mm or more occlusal clearance). No chipping/fracture of the restoration is usually seen. It does not cause wearing of antagonist tooth under high stresses⁵. It was found to be an esthetic as well as sufficiently strong alternative for the porcelain fused to metal and full metal restorations used for the posterior restorations.

SUMMARY

This clinical report presented the use of recently introduced ALL ZIRCONIA (3M MONOLITH) bridges in the posterior region which facilitates minimum reduction of the tooth structure as compared to the other restoration techniques available today. Treatment objectives were achieved by accurate diagnosis, meticulous treatment planning together with dedicated interdisciplinary team approach. The outcome of the full mouth rehabilitation was a pleasing smile with adequate function (Figure 12).

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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