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Case Report

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Modified Combined Impression Technique for Cawood & Howell Class V/VI Mandibular Ridges: A Case Report

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ABSTRACT

Geriatric prosthodontic rehabilitation with compromised residual ridge has become challenging, the principal concern being rejuvenating and maintaining complex stomatognathic functional harmony with severe residual ridge resorption (RRR). Modification of contemporary treatment techniques should be considered to achieve a patient's functional and esthetic requirements. Contemporary prosthodontics utilizing combination of Neutral zone technique (NZ) and all green impression (AGI) for the management of Cawood & Howell Class V/VI (severely resorbed) ridges are innovative techniques for the construction of removable prosthesis with a profound effect in denture stability and retention, particularly in mandible. NZ implies the principle of synergistic activity of Oro-muscular function in denture stability by arranging the prosthetic teeth within the neutral zone area, hence preventing their interfere with the oro-muscular function, while AGI aimed at achieving prosthesis retention through functional moulding and the viscosity of impression material helps disseminate the forces transmitted to the denture-bearing area reducing the potential for discomfort arise from the soft tissue folds over atrophic ridge. This case report attempts to present a combination of modified impression techniques utilizing all green impression techniques and neutral zone techniques in a 66-year-old patient for C&H Class V mandibular ridge. The goal of this technique is to provide optimal stability covering the maximum denture bearing area and selectively distributing the pressure and to produce a denture molded by oro-muscular function in harmony with its surrounding structures thereby enhancing stability and retention.

Keywords: Residual alveolar ridge, Neutral zone, Mandibular complete denture, Denture stability.

Introduction:

Almost 7% of Pakistan total population as of 2019, fifteen million people living are aged over sixty years, which is expected to double by 2050.(1) Geriatric oral health care has become one of the challenging and under-explored area in dentistry, the principal concern is to rejuvenate and maintain complex stomatognathic functional harmony with severe residual ridge resorption (RRR).(2,3) To date several conventional and contemporaries approaches have been proposed for retention and stability in patient with RRR (4). Among contemporary prosthodontics, the neutral zone technique (NZ) is an innovative approach for the construction of removable prosthesis provided to highly atrophic ridge with a profound history of denture instability (5,6). Similarly, all green impression techniques (AGI) aimed at achieving prosthesis stability and retention in compromised bony foundation by reducing the potential for discomfort arise from the soft tissue folds over atrophic mandible (7). However, the combination of these two techniques is unprecedented in literature. It is becoming more and more important in prosthodontics to treat severe residual ridge resorption (RRR) since Pakistan's geriatric population is expected to. druple by 2050. When it comes to giving these patients' dentures stability and comfort, traditional techniques frequently fall short. Both the All-Green Impression (AGI) and Neutral Zone (NZ) techniques have demonstrated promise in improving denture stability and retention through ideal pressure distribution and muscle function, respectively. Combining these methods has not been studied in the literature. In order to manage Cawood & Howell Class V/VI mandibular ridges, this study attempts to combine NZ and AGI approaches, providing a comprehensive solution that improves denture stability, retention, and patient comfort. This strategy aims to raise the standard of care for older patients with severely resorbed ridges by combining the advantages of both

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approaches, leading to a new paradigm in the field of geriatric prosthodontics.

Case Presentation

The existing protocol was carried out according to the CARE guidelines (checklist for reporting case report) (8). A 66-year-old female patient reported to the Department of Prosthodontics, Dow International Dental College, Karachi, Pakistan in December 2020, with the chief complaint of difficulty in performing oral functions due to unstable lower complete denture. The patient was wearing a set of complete removable prosthesis for the past 8 years and was edentulous since then. Clinical and radiographical examination revealed Cawood and Howell (C&H) Class V (Flat ridge form) atrophic mandibular ridge (figure 1 & 2).

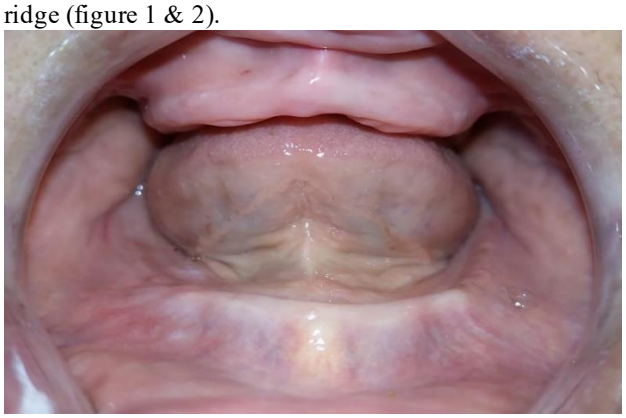

Figure 1: Lower resorbed mandibular ridge (C&H class V)

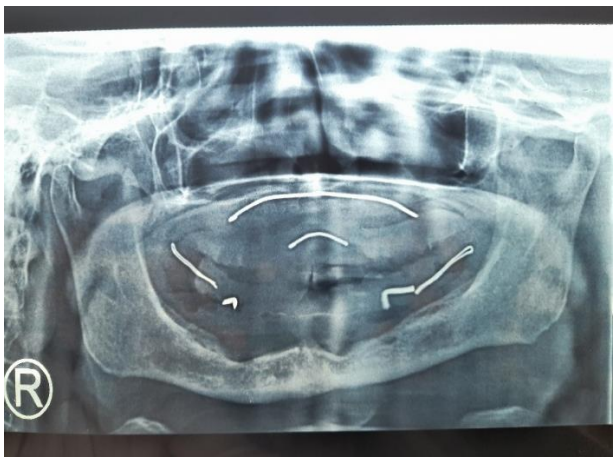

Figure 2: Radiograph of residual ridge.

Patient was informed of all treatment modalities according to PARQ process (Procedures, Alternatives, Risks, and Questions). This included surgical bone augmentation/ vestibuloplasty, implant supported overdenture and conventional complete denture. Patients refused any surgical treatment and requested a new conventional complete denture. Thus, encounter to the clinician, a prosthesis was required to exert uniform pressure on the denture bearing area and stability during function.

Impression technique:

Step 1: Preliminary impression was made with impression compound (Hiflex, Prevest Denpro Ltd. India) in metal stock trays. Impression was poured in type III dental stone to make preliminary dental cast. Custom trays were fabricated on the using self-cure acrylic resin (Dentsply, Pacific Link Tower, Wong Chuk Hang, Hong Kong). The trays were adjusted to be at least 2 mm short of the vestibules on the preliminary cast for border moulding.

Step 2: All green impression technique: Low fusing green stick compound (Hiflex, Prevest Denpro Ltd. India) is heated with flame, kneaded in a homogenous mass, and loaded in custom trays with optimum bulk to record secondary impression. The loaded tray was tempered in water bath (45-50ºC) moulded with fingers to mimic the borders of the final denture, then inserted intraorally to perform border moulding. The sequence of the clinical steps of border moulding was performed considering the simple principles proposed by Park et al. (figure 3) (9). One of the benefits of low fusing green stick is the viscosity of the compound that eliminates any soft tissue folds and smoothens them over the mandibular bone. After border moulding, intaglio surface was minimally scraped off and mechanical retentive grooves were incorporated. ZOE wash impression material was loaded, and final wash impression was recorded. Following disinfection by immersion in 2% glutaraldehyde (CIDEX Johnson & Johnson Company, India) for 10 min, the master cast was poured. Final denture base plates were fabricated using heat-cure acrylic resin. Wax occlusal rims were constructed over base plates and jaw relation was recorded to appropriate horizontal and vertical dimensions, then was mounted on a simple hinge articulator.

Figure 3: All green impression technique

Step 3: Neutral zone technique: The recorded mandibular occlusal rim was removed from the articulator mounted mandibular base plate and was replaced with wire loops. The retentive wire loops of 0.7mm stainless steel wire, secured to the base plate with self-cure acrylic resin were kept at determined lower vertical occlusal height, the purpose of the wire is to help retain the material for recording neutral zone

(figure 4). Uniformly tempered green stick compound was applied over the denture base held with wire loop, seated in patient's mouth over maxillary rim in determined vertical dimension and various functional movements were performed included puffing, blowing, whistling, smiling, sucking, swallowing, pronouncing E and O sounds and protruding the tongue to simulate physiological movements for about 10 minutes by intermittently tempering the material in water bath (45-50ºC). The shaping and moulding of the tempered material during functional movements facilitated the recording of a stable denture position in neutral zone. Following disinfection, a putty index was made using silicon putty (Alphasil, Muller Omicron, GmbH, Germany) through boxing and beading technique to form negative replica of neutral zone. The wire-loops along with green stick compound were removed and duplicated with modelling wax through putty index to carry out mandibular teeth set-up in neutral zone (figure 5). The chair-side trial was carried out conventionally then final prosthesis was fabricated, inserted and adjusted (figure 6).

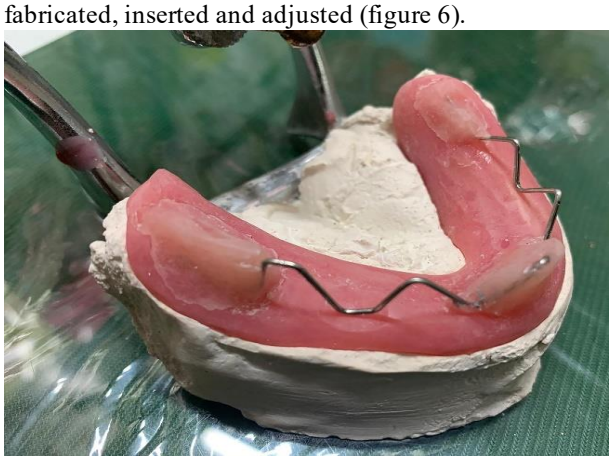

Figure 4: Mandibular base with retentive Wire loops for NZ technique.

Figure 5: Mandibular teeth set-up in NZ.

The patient was recalled after 24 hours, one week and one month, reported satisfaction with the prosthesis.

Figure 6: Final prosthesis.

Discussion:

RRR is a chronic and inevitable physiologic process which jeopardizes the retention and stability of removable prosthesis, especially in mandible. Depicting the handicap edentulous condition, ideally surgical reconstruction and dental implants are indicated, but when these are not the options i.e., referring to patients' financial constrain or medical contraindications, alternative cost-effective prosthodontic techniques must be contemplated to achieve an optimum quality of life. Prosthodontic rehabilitation with compromised residual ridge in a conventional protocol has become challenging. Modification in treatment techniques should be considered to achieve the patient's functional requirements. Combination of AGI and NZ presented in this case report achieved better denture stability and retention from the compromised denture bearing area. One explanation suggests that the primary advantage of AGI is that the functional moulding and the viscosity of impression material helps disseminate the forces transmitted to the denture-bearing area and prevents sandwiching of mucosa, thereby maintaining the health and integrity of residual ridge and overlying mucosa from the constructed prosthesis. The goal of this technique is to provide optimal stability covering the maximum denture bearing area and selectively distributing the pressure (10). A study by Wilfred Fish in 1931 first reported the stability of complete denture is influenced by the neuromuscular functional harmony, involving the complex synergistic activities of the tongue, cheeks, lips and floor of the mouth, and also the influence of the polished surfaces on denture stability in the dead space known as the 'neutral zone' (11). Neuromuscular coordination, and the contour and shape of polished surface of denture play a crucial role in stability as they are more subjected to destabilizing forces during function (12,13). When the prosthetic teeth are arranged within the neutral zone, they do not interfere with the oro-muscular function. Studies reported arrangement of teeth using NZ is not only helpful in edentulous patients but also for patients with oral

deformities and stated that this concept implies acquired muscular control towards stability of removable prosthesis (5,6). There have been a number of different methods in the literature, the purpose is to produce a denture moulded by oro-muscular function in harmony with its surrounding structures thereby enhancing stability and retention (5,6). Rehmann et al. described an alternative approach for NZ in which base plate with posterior occlusal rims were worn by patients for up to two days and the functional impression was recorded using thermoplastic denture adhesive, besides, he reported that this complex technique cannot be recommended for routine clinical use (14). Moreover, the likelihood of uncertain deformation of occlusal rim formed from modelling wax is a questionable consequence of his reported technique.

The technique for NZ in the current case report is simple. Heat softens green stick compound was preferred to obtain the impression because of the controlled amount of material moulding from muscular force during recording impression and almost minimum odds of distortion of recorded NZ during lab handling as compared to other materials i.e. modelling wax, tissue conditioner or impression plaster. Existing report by Agarwal et al. utilized polyether impression material for recording neutral zone due to its moderate viscosity (15). However, uncontrolled and/ or over closure opposing maxillary rim and high cost of material needs to be overlooked. Endorsing the outcomes of the present case report, a study by Yadav et al. reported the mean force required to dislodge the dentures fabricated by conventional impression technique was 5 N, on the other hand 12 N for AGI and 20 N for NZ [7].

The shortcomings of the present case report included discomfort due to heat used for tempering impression materials, furthermore, uniformly reheating the material is critical for success. Furthermore, the high cost of material, increased laboratory expenses and the requirement of additional dental appointments are usual consequences. Besides, effectiveness and practicality of these modified techniques needs to be overlooked for convincing outcomes.

Conclusion:

The combination of all green impression techniques and Neutral zone technique implies an effective alternative method to incorporate better retention and stability in complete denture for the highly resorbed mandibular ridges. This technique incorporates theoretical principles, concomitantly overcomes the complications commonly encountered with conventional impression techniques.

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Author's Contribution:

Dr. Abeerah Tanveer: Final Script
Dr. Saim Siddiqui: Study Design and provide treatment planning.