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Complete Denture Case Report: Hollow Maxillary Denture (Glycerin Soap Technique) And Internally Weighted Mandibular Denture (Modified Basal Metal Framework In The Neutral Zone)

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Abstract:
Managing severely resorbed edentulous ridges presents profound biomechanical challenges, particularly maxillary weight-induced bone resorption and mandibular instability caused by muscle dynamics and gravity. This case report details a specialized prosthodontic rehabilitation for a patient with severe vertical and horizontal ridge resorption, utilizing a dual-strategy approach.
The maxillary complete denture was fabricated using an innovative glycerin soap technique to create a lightweight hollow-bulb prosthesis. Glycerin soap served as a water-soluble, easily carved, and cleanable spacer that successfully reduced overall denture weight by nearly thirty percent without compromising structural integrity or aesthetics. Conversely, the mandibular arch was designed as an internally weighted denture incorporating a modified, recycled basal metal framework to lower the center of gravity. Furthermore, mandibular artificial teeth were arranged precisely within the neutral zone—recorded via functional movements using tissue conditioner—to harness muscular equilibrium and neutralize dislodging forces from the lips, cheeks, and tongue.
At post-insertion evaluations, the patient demonstrated remarkable improvements in masticatory efficiency, speech confidence, and overall prosthetic stability. This combination of a lightweight maxillary hollow denture and a stable, neutral zone-aligned, internally weighted mandibular prosthesis offer a predictable, highly effective protocol for managing complex, compromised edentulous ridges.

Key Word: *Complete denture, Hollow maxillary denture, Glycerin soap technique, internally weighted denture, Neutral zone, Severe ridge resorption, Prosthodontic rehabilitation.*

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I. Introduction

Managing severely resorbed edentulous ridges presents a classic prosthetic challenge, particularly in the mandible where muscle attachments, tongue mobility, and gravity compromise retention and stability. Conversely, the severely resorbed maxillary arch often suffers from excessive denture weight, which accelerates residual ridge resorption (RRR) and reduces retention through downward gravitational forces. [1,4]

This case report details a specialized prosthodontic intervention for a patient with severe vertical and horizontal maxillary and mandibular ridge resorption. To overcome these biomechanical limitations, a dual-strategy approach was implemented: **Maxillary Arch:** Fabricated as a **hollow-bulb complete denture** utilizing the **glycerin soap technique** to significantly reduce weight while maintaining optimal contours and aesthetics. **Mandibular Arch:** Designed as an **internally weighted denture** incorporating a modified, recycled basal metal framework embedded within the denture base, positioned precisely within the **neutral zone** to harness muscular equilibrium, combined with a **neutral zone teeth arrangement**. [2,3.5]

II. Patient History And Clinical Presentation

Chief Complaint: Inability to chew comfortably, frequent displacement of the lower denture conventional dentures.
Medical History: Non-contributory; no systemic conditions affecting bone metabolism or mucosal healing.
Dental History: Edentulous for over 8 years, with a history of wearing multiple ill-fitting conventional dentures that exacerbated residual ridge resorption.

Clinical Examination:
Maxillary Arch: Class III ridge resorption (Cawood and Howell classification). U-shaped, broad palate with minimal keratinized mucosa.
Mandibular Arch: Class IV ridge resorption (knife-edge anterior ridge, flat posterior region). Genial tubercles prominent relative to the crest, causing instability during tongue movement.
TMJ / Occlusion: No signs of temporomandibular disorders; inter-arch distance was adequate to accommodate both the hollow cavity and the internal metal weight.

Figure 1 and Figure 2: Maxillary and Mandibular Ridge Relation, Patients Pre-Operative Photograph.

III. Pre-Clinical Planning & Material Selection

Maxillary Hollow Denture (Glycerin Soap Technique):

Reducing the weight of a maxillary complete denture is critical when the interocclusal distance is large or the palatal vault is deep, as excessive bulk increases leverage and stress on supporting tissues.

The Glycerin Soap Technique: Glycerin soap acts as an ideal spacer material because it is water-soluble, easily carved, non-reactive with acrylic resin, and can be completely dissolved out of the processed denture using hot water, leaving a clean, sealed hollow cavity.

Mandibular Internally Weighted Denture & Neutral Zone:
Internal Weighting: Utilizes a high-density, biocompatible metal alloy (a modified, salvaged base metal framework) embedded in the lingual and floor-of-mouth regions of the mandibular denture base. This lowers the center of gravity without increasing overall vertical bulk.
Neutral Zone Recording: Captures the zone of muscular balance where forces from the tongue on the lingual side neutralize the opposing forces from the lips and cheeks on the labial/buccal side.

IV. Step-By-Step Clinical & Laboratory Protocol

Phase 1: Preliminary Impressions and Diagnosis

1. **Primary Impressions:** Made using impression compound in non-perforated stock trays, capturing maximum extension of the denture-bearing areas, including the retromolar pads and hamular notches.
2. **Primary Casts:** Poured in Type III dental stone. Custom trays were fabricated using self-cure acrylic resin with proper spacer design and border molding reliefs.

Figure 3: Primary Impressions of Maxillary and Mandibular Arch.

Phase 2: Final Impressions and Jaw Relations

1. **Border Molding:** Performed using low-fusing green stick compound to capture active and passive functional movements of the lips, cheeks, and tongue.
2. **Final Impressions:** Made using medium-body polyether impression material for the maxilla and light-body polysulfide/addition silicone for the mandible to record delicate basal seat morphology under controlled pressure.
3. **Master Casts:** Poured in Type IV die stone.
4. **Jaw Relation Record:** Facebow transfer was recorded to mount the maxillary cast on a semi-adjustable articulator. Vertical dimension of occlusion (VDO) was established using phonetic, aesthetic, and inter-ridge measurement techniques. Centric relation was recorded using Alu wax on baseplates.

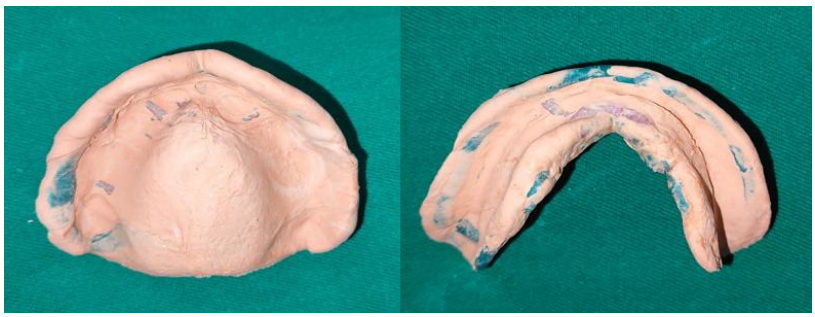

Figure 4: Final Impressions for Maxillary and Mandibular Arch using Zinc Oxide Impression Paste.

Phase 3: Neutral Zone Impression Technique (Mandible)

To ensure muscle harmony, a neutral zone recording base was constructed on the mandibular record base.

1. **Recording Material:** A high-viscosity green compound core wrapped with green stick or impression compound was applied to the mandibular rim.
2. **Functional Movements:** The patient was instructed to perform functional movements: swallowing, drinking water, speaking, smiling, and puckering the lips over a 5-to-10-minute period.
3. **Core Fabrication:** The resulting molded contour represents the neutral zone. Plaster index cores (or silicone putty indices) were fabricated around this generated contour to guide subsequent teeth arrangement.

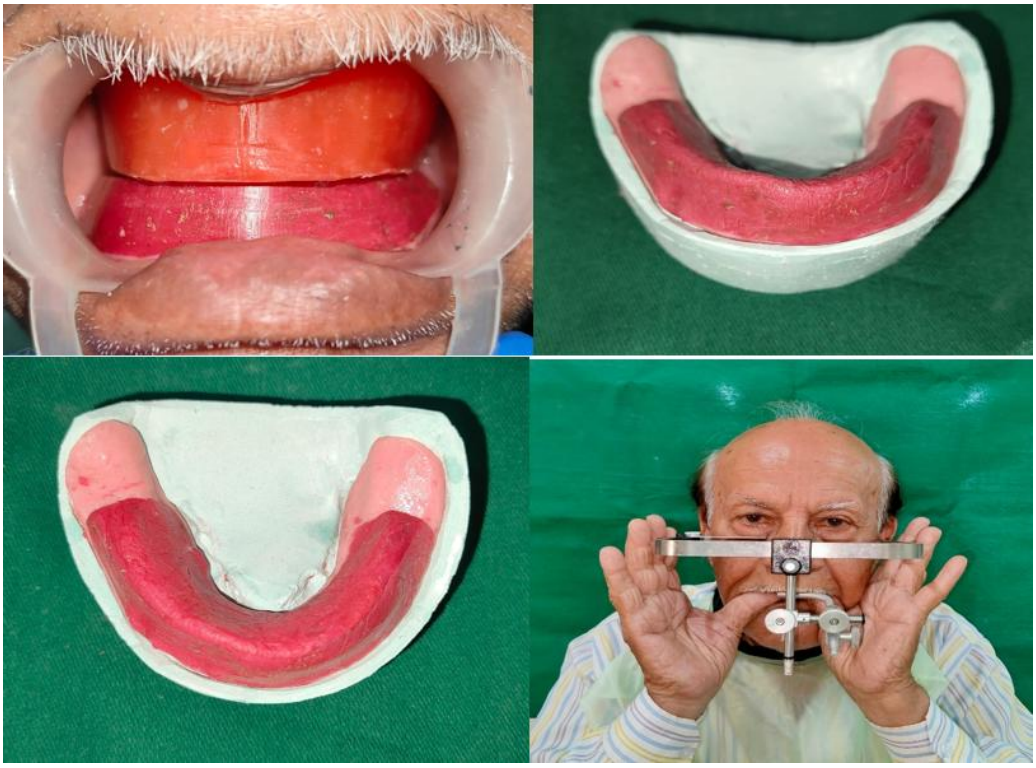

Figure 5: Jaw Relation.

Figure 6: Functional Movements Recording using Impression Compound.

Figure 7: Facebow Transfer.

Figure 8: Wash Impression of Functional Movements for Final Surface Details.

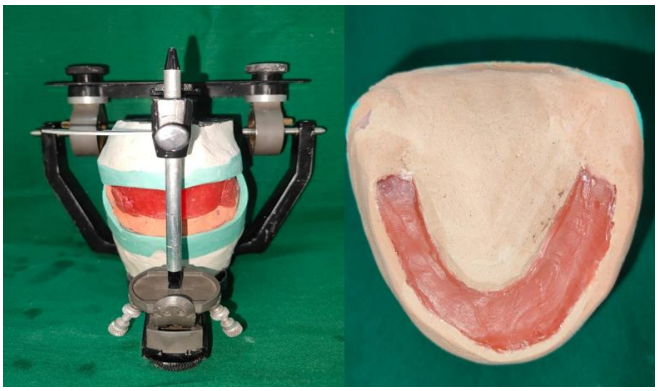

Figure 9: Articulation.

Figure 10: Fabrication of Wax Rim according to the Neutral Zone and Die Stone Index.

Phase 4: Laboratory Processing — Maxillary Hollow Denture (Glycerin Soap Technique)

1. **Wax-Up:** The maxillary trial denture was waxed to standard contour and aesthetics.
2. **Flask and Boil-Out (First Stage):** The maxillary denture was invested in the lower half of the dental flask. A separating medium was applied, and the counter-flask was poured. Wax elimination (boil-out) was performed.
3. **Core Fabrication:** A custom separating core was made using a block of pre-formed **glycerin soap** carved to fit precisely inside the palatal vault of the wax-up, leaving a uniform 2 mm clearance from the internal surface of the denture teeth and resin base.
4. **Packing and Processing:** Heat-cure acrylic resin was packed into the mold halves. The carved glycerin soap core was positioned centrally within the resin mass to create the internal hollow void. The flask was trial-packed, closed, and cured according to standard manufacturer cycles (long curing cycle: 74°C for 9 hours).
5. **Retrieval and Cavity Clearance:** After deflasking, access channels (typically placed near the posterior palatal border or retromolar pads) were opened. Boiling water was flushed through the access ports to completely dissolve and wash out the glycerin soap core, leaving a clean, sealed hollow chamber.
6. **Sealing the Cavity:** The access ports were sealed using autopolymerizing acrylic resin, finished, and polished. A water-tight seal was verified by submerging the denture in water.

Figure 11: Teeth Arrangement and Try In Procedure.
Figure 12: Dewaxing Procedure.
Figure 13: Glycerine Soap Spacer for creating hollow cavity.

Figure 14: Retrieval and Clearance of Soap using Hot water Syring. Using Vent Hole in the Posterior Region.
Figure 15: Final Completed Hollow Denture.
Figure 16: Floating Test.

Phase 5: Laboratory Processing — Mandibular Internally Weighted Denture (Modified Basal Metal Framework)

1. **Framework Adjustment:** An old, salvaged base metal framework (Co-Cr alloy) was thoroughly cleaned, sterilized, and adjusted to fit passively onto the mandibular master cast without impinging on the residual ridge or interfering with the neutral zone borders.
2. **Integration of Weight:** The framework was strategically positioned in the sublingual and lingual flange areas below the height of contour to maximize gravitational pull downward and inward, lowering the center of gravity.
3. **Neutral Zone Teeth Arrangement:** Acrylic artificial teeth (anatomical posterior teeth with reduced cuspal angles to minimize lateral shear forces) were set precisely within the plaster index matrices derived from the neutral zone recording.
4. **Investment and Curing:** The mandibular assembly was flasked, packed with heat-cure polymethyl methacrylate (PMMA) resin embedding the metal framework, and cured using standard cycles.

Figure 17: Dewaxing Procedure for Mandibular Arch.
Figure 18: Old Recycled, Sterile Metal Framework Adjusted according to the neutral zone of the Mandibular Ridge under range of 10-15 grams ideal for internally weighted denture.
Figure 19: Packing and Flasking.
Figure 20: Final Internally Weighted Denture.

Phase 6: Insertion, Occlusal Adjustment, and Post-Insertion Care

1. **Delivery:** Both dentures were evaluated for pressure spots using pressure-indicating paste (PIP).
2. **Occlusal Harmony:** Clinical remounting was performed using a new interocclusal record taken in the mouth. Selective grinding was executed to ensure a balanced occlusion with simultaneous bilateral contacts in centric relation and smooth eccentric guidance.
3. **Patient Instructions:** The patient was instructed on hygiene protocols (especially cleaning around the sealed maxillary cavity and ensuring no food traps occur around the mandibular flanges) and gradual dietary reintegration.

Figure 21: Occlusal Adjustment
Figure22: Denture Delivery.

V. Discussion: Biomechanical Rationale And Clinical Implications

Managing severely resorbed edentulous ridges requires a meticulous balancing act between reducing dislodging forces and harnessing physiological muscle function. The clinical success of this specialized rehabilitation relies on the synergistic integration of four key elements: the glycerin soap technique for the maxillary hollow denture, internal weighting of the mandibular denture, the sustainability angle of recycling an old metal framework, and the precise application of the neutral zone philosophy.

1. The Glycerin Soap Technique vs. Conventional Hollow Denture Techniques

A major challenge in restoring the severely resorbed maxilla is the excessive bulk and weight of traditional acrylic resin complete dentures. Increased vertical dimension and deep palatal vaults require substantial acrylic mass, which creates continuous downward gravitational leverage, accelerating residual ridge resorption (RRR) and compromising peripheral seal.

While hollow-bulb dentures successfully solve this weight dilemma, traditional fabrication methods have distinct clinical drawbacks:

- **The Plaster/Alginate Core Technique:** Using a plaster core or alginate to create the internal void is messy, prone to fracture during retrieval, and difficult to completely remove from small access ports, leaving residual debris inside the finished denture.
- **The Lost-Salt Technique:** While salt is water-soluble, packing and sealing salt granules within the wax-up can be imprecise, and incomplete dissolution can lead to gritty residue or structural voids that compromise strength.
- **The Foil-Wrapped/Styrofoam Spacer Technique:** Non-dissolvable spacers or foil require permanent access windows and meticulous luting, with a higher risk of leakage and bacterial contamination if the seal fails over time.

Advantages of the Glycerin Soap Technique

The **glycerin soap technique** offers superior clinical efficacy:

1. **Water Solubility and Clean Dissolution:** Glycerin soap dissolves entirely under hot water flushing, leaving a pristine, clean, and sealed internal cavity without particulate residues.
2. **Ease of Carvability:** The soap block can be easily trimmed, shaped, and customized to maintain a uniform 2 mm clearance from the internal surface of the denture teeth and resin base, ensuring optimal structural strength.
3. **Non-Reactive Nature:** Glycerin soap does not chemically react with acrylic monomer or polymer, ensuring that the surrounding heat-cure PMMA undergoes unimpeded polymerization.

2. Biomechanical Rationale of the Internally Weighted Mandibular Denture

While a lightweight prosthesis is ideal for the maxilla, the opposing severely resorbed mandible suffers from a lack of basal area, making it chronically unstable under tongue movements. Historically, attempts to stabilize lower dentures included external metal over-extensions or adding heavy weights. However, external weight additions often impinge on the floor of the mouth and disrupt functional muscle movements.

The Role of Internal Weighting

Embedding a high-density metal alloy internally within the lingual and sublingual flanges of the mandibular denture base provides distinct biomechanical advantages:

- **Lowered Center of Gravity:** Shifting the center of mass inferiorly and closer to the residual ridge significantly dampens the tipping moments caused by muscular activity.
- **Gravity as an Ally:** Instead of relying solely on a compromised mucosal seal, the gravitational pull acts on the internal metal mass to seat the denture downward and inward against the basal seat during rest and light functional phases.

3. The Sustainability Angle: Recycling the Old Metal Framework

Incorporating sustainability into modern clinical prosthodontics represents a forward-thinking paradigm shift. Reusing an old, discarded base metal framework (Co-Cr alloy) from a previous, failed prosthesis instead of casting a fresh framework offers multi-faceted benefits:

- **Ecological and Economic Responsibility:** Casting dental alloys demands significant energy expenditure and generates clinical metal waste. Repurposing a salvaged framework minimizes environmental footprints and reduces material costs without sacrificing structural integrity.
- **Biocompatibility and Rigidity:** Cobalt-chromium alloys possess exceptional fatigue resistance, dimensional stability, and biocompatibility. When thoroughly sterilized, adjusted, and re-adapted to the new master cast, an aged framework retains its high modulus of elasticity, providing durable internal reinforcement that prevents midline fracture of the resin base while housing the required internal weight.
- **Clinical Customization:** The old framework acts as a ready-made dense core that can be precisely positioned in the sublingual zone, transforming discarded prosthetic waste into a functional engineering asset.

4. Correlation with the Neutral Zone: Enhancing Stability and Retention

An internally weighted denture and a lightweight maxillary counterpart provide an ideal foundation, but ultimate success depends on how the prosthetic contours interact with the surrounding musculature. This is where the **neutral zone technique** becomes the cornerstone of the case.

Muscular Equilibrium

The neutral zone is the potential space in the edentulous mouth where the outward forces exerted by the tongue are precisely neutralized by the inward forces exerted by the lips and cheeks.

- **Teeth Arrangement in Harmony:** By recording this physiological zone using functional movements (swallowing, speaking, sipping water) and arranging artificial teeth strictly within this corridor, the polished surfaces of the denture are contoured to deflect muscular forces rather than resist them.
- **Synergy with the Weighted Mandible:** When an internally weighted mandibular denture is coupled with a neutral zone teeth arrangement, stability is exponentially amplified. The internal weight stabilizes the denture vertically against gravity, while the neutral zone contours stabilize it horizontally against lateral muscular displacement. Together, they create a balanced, self-stabilizing prosthetic ecosystem that restores the patient's masticatory efficiency, phonetics, and psychological confidence.

VI. Conclusion

This dual-technique prosthodontic rehabilitation demonstrates a highly successful management protocol for complex edentulous cases. By combining a **hollow maxillary denture via the glycerin soap method** (alleviating excessive vertical load) with an **internally weighted, neutral zone-aligned mandibular denture utilizing a recycled basal framework** (enhancing retention and stability), clinicians can significantly restore patient function, comfort, and quality of life.

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