

A NOVEL TREATMENT APPROACH FOR EDENTULOUS RESORBED RIDGES: AN “OCTOPUS TENTACLES” DENTURE!

Shah Rupal J.¹, Sanjay Lagdive B.², Verma Vishal B.³, Acharya Pratik D.⁴, Shrof Sunil N.⁵

1. Professor and Head of Department of Prosthodontics, Govt. Dental College and Hospital, Ahmedabad.

2. Professor, Department of Prosthodontics, Govt. Dental College and Hospital, Ahmedabad.

3. Post Graduate Student, Department of Prosthodontics, Govt. Dental College and Hospital, Ahmedabad.

4. Post Graduate Student, Department of Prosthodontics, Govt. Dental College and Hospital, Ahmedabad.

5. Post Graduate Student, Department of Prosthodontics, Govt. Dental College and Hospital, Ahmedabad.

ABSTRACT:

Ever since the advent of fascinating implant prosthesis availability as a treatment modality in 21st century, every dental patient (including the geriatric age group) is desirous of receiving a fixed prosthesis. However not all edentulous subjects are ideally suited for fixed prosthetic rehabilitations, because a vast majority of them present with compromised ridge conditions, and hence removable prostheses (complete dentures) continue to serve as the largely opted/preferred prosthesis of choice. Commercially available denture adhesives of various sorts (powders, pastes, creams etc) and other mechanical retentive aids (magnets, coils, springs, prongs) helped in achieving adequate levels of retention till date. Improvising further over these conventional aids, a novel approach has been attempted, by incorporating miniature suction cups (soft silicone like material) on the denture's intaglio surfaces, which resemble the tentacles of an octopus.

Key words: Miniature suction cups, octopus tentacles, MOLLOPLAST B, soft silicone, Boyle's law

INTRODUCTION

With a flooding geriatric count of 77 millions, constituting 7.7% of its total population, and an accompanying loss of teeth, edentulousness is a challenging pathological ailment in India, ought to be efficiently tackled. Adding to the grievances, more than fifty percent of the population is uneducated, hence lack of awareness yields into people avoiding dental treatment for prolonged spans of time. A significant chunk of patients have dentures with diminished or less than ideal functional adequacies for a variety of reasons. The GPT-8 defines retention as “Quality inherent in the dental prosthesis

acting to resist the forces of dislodgement along the path of insertion”.^[1] Achieving desired amounts of retention and stability in such patients with severely resorbed residual alveolar ridges is a daunting task, owing to a wide array of detrimental factors, namely, unavoidable atrophy through continuous bony resorption, thinning out of overlying mucosal coverage, decreased or altered salivary flow quality and rates, detrimental alterations in quality of soft and hard tissues with time, and decreased neuromuscular control. Among all the cited factors, the residual ridge resorption (RRR), being an inevitable phenomenon,

causes the most detrimental hard and soft tissue changes. These conditions ultimately contribute to decreased denture retention and stability.

A historical sneak peek describes various other tried out retentive aids in the past. These include the usage of steel springs in 1700s, fabricating moldable flanges in denture to utilize undercut areas effectively, maxillary prong dentures, transitional implants with ball attachments, coils, magnets etc.

Enhancing retention in dentures using miniature suction cup devices is not entirely a novel up surge; rather it is the resurrection of a concept that dates almost a century back! Originally it was conceived and patented by Dr RS Ingalls and Dr J Spyer in the year 1885; however it failed into oblivion thereafter. Its inception into mainstream prosthodontic clinical practice was reinstated much later on in 1967 by Dr A.C Jermyn, from Rochester, New York. [2]

A suction cup denture resembles a conventional complete denture in all aspects, except that on its tissue contacting surface, there are numerous miniature sized suction cups embedded, that are formed from a soft resilient silicone rubber (permanent soft liner). Fabrication of complete dentures with permanent soft liners on tissue surface, combined with multiple suction chambers has been elicited in this case report, in an attempt to enhance the retention. [3] To fetch the most desirous results, it is advisable to have cups with straight sides and a tapered interior angle of 12.5°. It is

alternately also called as “*octopus tentacles*” denture, because of the denture’s impression surface resembling the marine creature octopus.

CASE DETAIL

A 60 year-old male reported to the Department of Prosthodontics with a presenting complaint of loose fitting dentures. The patient could retain the lower denture only by applying adhesive powder. Past medical history was irrelevant. On eliciting dental history and performing intra oral examination, it was revealed that patient was an old denture wearer since last 5 years, the teeth of the present dentures were grossly attrided, and the dentures appeared unesthetically discolored. The mandibular ridge in particular was severely resorbed. [Figure 1]The patient expressed dissatisfaction with the esthetics and retention of the prosthesis. The various treatment modalities in such existing scenario were mutually discussed with the patient, and he insisted for a more economically viable rehabilitative measure. Giving due respect to the patient’s expectations, we decided to fabricate new set of heat cured maxillary and mandibular complete dentures, but by incorporating miniature suction cup aids within the lower denture to compensate for the anatomical constraints. Other treatment modalities like implant supported denture and relining were ruled out due to unfavourable bone morphology and attrition of teeth in old denture respectively.

These miniature suction cups can be incorporated by using either chair side acrylic based soft liner, or silicone based permanent heat cured soft liner. It was decided to go with the later option, specifically Molloplast B (DETAX GmbH & Co., Ettlingen, Germany) because of the extensive research work, backing and validating the success of its clinical applicability.

The findings of a 6 year retrospective investigation on the serviceability of Molloplast B lined dentures, conducted by *William F. Schmidt and Dale E. Smith*,^[4] on 65 patients, at the University of Washington during the period from 1975 through 1980 are summarized as:

A) The Molloplast-B-lined denture is not a temporary expedient but can remain serviceable for a time competitive with that of conventional acrylic resin dentures.

B) All the soft liners were still serviceable after 4 years and 83% after 6 years.

C) The longevity of the soft liner is dependent on correct processing procedures and proper home care.

Different denture relining materials exhibit different properties in terms of susceptibility to yeast and fungal penetration and colonization. The selection of appropriate materials for a given function, and their fabrication may affect oral hygiene maintenance performance on the patient's part. Owing to the high water absorption of most soft lining materials, nutrients become

available within the material, allowing the growth of *C. Albicans* and other yeasts.^[5]

However contrary to belief, *Williamson JJ*^[6] found that Molloplast-B had an inhibitory effect on *C. albicans* in saline medium. Also, *Makila and Hopsu-Havu*^[7] reported that uncured Molloplast-B material caused a definite inhibition of *Candida* growth in vitro.

Thus the numerous advantages conferred upon by Molloplast B stood out and it was thus the liner of choice for incorporating miniature suction cups.

Methodology:

A new set of conventional complete dentures were first fabricated following the routine steps of denture making. [Figure 2]. Preliminary impressions were recorded using impression compound (DPI Pinnacle, Apexion dental products, Calicut, Kerala, India) and poured in Dental plaster (Type 2 model Plaster, Kalabhai Karson Pvt Ltd, Vikhroli, Mumbai, India). Special trays were fabricated on the obtained primary casts using autopolymerising resins (Ashwin, Super Dental Products, Delhi, India), followed by verifying their correct extensions, and sequentially border moulded using low fusing impression compound (DPI Pinnacle tracing sticks). Wash impressions were made using elastomeric impression material of light body consistency (Speedex Coltene, Whale dent Inc. Products, America), which were beaded, boxed and subsequently poured in Dental Stone (Goldstone Stone Plaster Class 3). Maxillo mandibular jaw relations were

recorded, clinical try in were approved, and packing of the trial dentures were accomplished with Lucitone 199 resin system (Dentsply, United States) in Varsity flasks (Jabbar and Co Dental Products Manufacturers, Aligarh, UP, India)

Additional care was ensured so as to retrieve the master casts intact at the time of deflasking. Maxillary complete denture was finished and polished first. The intaglio surface of the mandibular denture was reduced by a uniform depth of 1 to 2 mm, leaving 2 mm of intaglio surface intact from height of denture flange to maintain peripheral seal.

A specially designed bur of specific dimensions was customized and casted [Figure 3] to punch holes of uniform geometry on the mandibular master cast. It was taken care not to make depth cut of not more than 1/3rd mm to 1/4th mm (0.010" to 0.015"). Punch holes were not created over frenal attachments and into depth of vestibule. These holes were ensured to be of uniform size and shape. Also the punch cuts were kept apart, atleast by a distance of 1-1.5mm, to avoid overlapping of the subsequently packed silicone soft liner suction chambers into each other [Figure 4].

Re flasking of the mandibular cast with punched holes was carried out after seating trimmed denture onto it, as done in relining procedure. Adhesive was applied on intaglio surface of flaked denture and was allowed to dry for 1 hour as given in manufacture instructions [Figure 5]. Then cold mold seal (Sodium alginate, Pyrax Polymers, Roorkee,

Uttarakhand, India) was applied and allowed for drying for few minutes. Followed by this, MOLLOPLAST B [Figure 6] which is a heat cured permanent silicone based soft liner material was kneaded and packed onto the intaglio surface of flaked lower denture [Figure 7]. Then flask was closed and kept under bench pressure for 15 minutes. Subsequently the flask was placed in acrylizer for 2 hours at 100°to 120°c temperature for heat polymerization. Flask was allowed to cool. Deflasking was done and resultant denture after finishing and polishing appeared like a denture embedded with octopus tentacles onto it [Figure 8].

Denture was placed in fungicide solution (Ultra dose Germicidal, L&R Manufacturers, Kearny, US) for few minutes followed by that it was delivered to patient [Figure 9] and checked for soreness and occlusal discrepancies. Immediate recall visits were scheduled after 24 hours, 48 hours, once every week, during the first month of prosthesis delivery.

DISCUSSION

Severely atrophic edentulous alveolar ridges, arising due to the inevitable phenomenon of residual ridge resorption (RRR), coupled up with a neglected timely prosthodontic intervention, puts the prosthodontist's skills in a state of dilemma, in terms of the choice of technique to be employed, so as to obtain adequate retention and stability in the dentures. What poses a challenge further is the fact that patient's high levels

of expectations from the prostheses, often becomes a Herculean task for the prosthodontist! Thereby such challenging severely compromised edentulous ridges have to be dealt by formulating a holistic treatment plan, with a precise and apt application of knowledge on materials science, adhesion dynamics and mechanical processing skills.

The case report described above throws upon light a simple, yet effective novel technique of enhancing retention and stability in severely atrophic edentulous mandibular ridges. These miniature suction cups in dentures as an aid for enhanced retention and stability had been tried out with a considerable amount of success by Arthur C. Jermyn (D.D.S.)^[8] hailing from Rochester, N. Y. He had fabricated and delivered over 200 dentures in his span of clinical practice between April 1963 - October 1967, based upon this line of treatment protocol.

In another attempt, the author conducted comparative studies on the retentive and stabilizing abilities of the multiple suction cup dentures, with all-acrylic resin base dentures and dentures simply relined with silicone liners. Of all the three denture types, patients preference for the multiple suction cups dentures were found to be on a higher side, suggesting its good clinical acceptance.^[9]

The ideology is based upon application of BOYLE'S LAW:

($P \propto 1/V$) {Pressure \propto 1/ Volume}

This interesting phenomenon functions in the same way, just as the suction cups pressed against a flat plane of glass to hold firmly in its place. When placed against a compromised edentulous ridge, each of the individual miniature suction cup soaks into it an additional volume of saliva, establishing a vacuum, thereby causing air pressure within the cups to be less than the pressure outside the cups.^[9] This in turn prevents the introduction of suction-breaking air, and strengthens the intactness of the seal between the ridge and the denture.

This phenomenon works best upon flat denture bearing tissue beds, as compared to other ridges. To further maximize its effectiveness, it is advisable to incorporate at least 150 such suction chambers within the dentures, because this overwhelmingly increases the denture bearing surface area by several folds.

These types of dentures are specifically indicated in severely resorbed ridges, patients with diminished neuromuscular control, prostheses with rotational path of insertion, ablative or surgically resected ridges, history of head and neck irradiations.

Incorporation of a single suction cup in the maxillary denture's central most portion has also been tried out as a maneuver to enhance the retention and stability of dentures, which acts by inducing negative pressure on the mucosal surface, thus exerting discouraging pathological effects on palatal tissues.

Resorption of the alveolar bone leads to a situation where the denture although well retained by the rubber disc, rocks around the mid palatal area, exerting excessive pressure. ^[10] These complications can be more severe if the prosthesis is not constructed properly, just like lesions induced by poor prosthesis fit, improper occlusal relationship and continuous presence of denture with a single rubber suction cup.^[11] Contrary to this, the elicited case report incorporates multiple miniature suction cups (atleast 150 in either dentures) , lined with permanent silicone based liner MOLLOPLAST B, which exerted no tissue reaction (soreness or erythema) when the patient was recalled for follow up visits after 24 hours, 48 hours, 1 week interval, bimonthly visit, every 2 months interval visit during the first year of denture delivery. It's been 21 months, since the octopus dentures were delivered to the patient, without a notable discomfort or complaint from his side.

Fabrication of the suction chambers needs specifically designed bur, thereby making it partially technique sensitive, citing this as a drawback. Also this technique should not be used in dry mouth conditions (Xerostomia patients) and flabby tissue cases. A 45 grams jar of Molloplast B costs 72.4\$ (Rs 5000 as per Indian currency), but given the fact that 83% of the relined dentures span for an average of 4-6 years,

REFERENCES

1. GPT-8. *J Prosthet Dent* 2005; 94:10-92.
2. Spyer, J., and Ingalls, R. S.: Patent #310,233, United States Patent Office, Washington, D. C.

^[4] plus the enhanced retention achieved by the miniature suction cups morphology, it can be justifiably viewed as a cost effective option in patients willing to afford it as treatment modality.

CONCLUSION

The prosthetic system described through this case report offers a fairly simple and viable novel innovative technique of incorporating numerous suction chambers on the intaglio surfaces of mandibular complete dentures. This can effectively put to rest the physiological and psychological problems of long term ill fitting unsatisfied prostheses wearers. However they shouldn't be considered as the only gold standard solution and other treatment options should be rightfully contemplated, by weighing the pros against the cons.

A large number of small suction cups formed from a soft, resilient silicone rubber are processed in the same manner as that of an otherwise conventional denture. They grip the oral tissues by establishing vacuum. The tissue tends to temporarily assume the form of the cups, but then returns to normal configuration when the dentures are removed. Hence a timely scheduled follow up is indispensable for predicting the success of its outcome.

3. Engelmeier RL, Gonzalez ML, Harb M. Restoration of the severely compromised maxilla using the multi-cup denture. J Prosthodont 2008; 17:41-46.
4. William F. Schmidt Jr., Dale E. Smith. A six-year retrospective study of Molloplast-B lined dentures. Part II: Liner serviceability. J Prosthet Dent Oct 1983; 50(4):459-65.
5. Khaled Bulad, Rebecca L Taylor, Joanna Verran, J.Fraser McCord. Colonization and penetration of denture soft lining materials by *Candida albicans*. Dental Materials Feb 2004; 20(2):167-75.
6. Williamson JJ. The effect of denture lining materials on the growth of *Candida albicans*. Br Dent J 1968; 125:106-10.
7. Makila E, Hopsu H. Mycotic growth and soft denture lining materials. Acta Odontol Scand 1977; 35:197—205.
8. Jermyn AC. Multiple suction cup dentures. J Prosthet Dent Oct 1967; 18(4):316-25.
9. A tribute to Dr Arthur J Jermyn. Oral Implanton 1995; 21:262
10. Stafford GD. Perforation of the palate due to a suction disc on a denture. Br Dent J. 1974; 136: 240.
11. Ordulu M, Emes Y, Ates M, Aktas I, Yelchin S. Oronasal communication caused by a denture with suction cups: A case report. Quintessence Int. 2006; 37: 659-62.

FIGURES:



Figure 1: Severely atrophic edentulous mandibular ridge



Figure 2: maxillary and mandibular complete dentures.

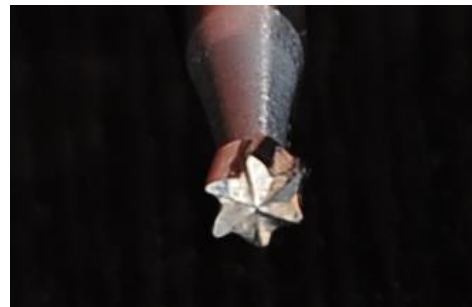


Figure 3: Specifically customized stainless steel bur.



Figure 4: Precise punch holes of uniform dimensions prepared on mandibular master cast.



Figure 5: Adhesive being applied on intaglio surface of flanked mandibular denture.



Figure 9: Complete dentures seated intra orally into patient's mouth.



Figure 6: "MOLLOPLAST B"- heat cured permanent silicone based soft liner.



Figure 10: Gratifying smile of satisfaction



Figure 7: Molloplast B kneaded into uniform dough and packed with adequate pressure.



Figure 11: Octopus tentacles mimicking miniature suction cups incorporated into mandibular denture's intaglio surface



Figure 8: Relined, finished and polished mandibular denture with embedded suction cups.