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Research Article

REHABILITATING PARTIALLY RESECTED MAXILLECTOMY PATIENT UTILIZING THE MODIFIED "SWING LOCK" CAST PARTIAL DESIGN – A NEOTERIC APPROACH!

Rupal J Shah[1]., Sanjay Lagdive[2]., Vishal Verma[3]*., Shraddha Saini[4] and Satyaprakash Shah[5]

[1,2,3,4,5]Department of Prosthodontics & Crown & Bridge, Govt. Dental College & Hospital, Ahmedabad/ Gujarat University, India

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ABSTRACT

The swing lock removable partial dentures (S/L RPDs) justifiably addresses its utility in some specific partially edentulous situations with a higher level of efficiency than the conventional partial denture designs, as in cases of surgically resected carcinomatous invasions of the maxillofacial complex. Despite the S/L design being available as a treatment modality since the 1960's, it's utility in maxillofacial prosthodontics has been limited, owing to its technique sensitivity, especially during hinge and snap-lock fabrication, and sparse literature availability to guide the practitioner accurately. Attempt to reincarnate the effective utilization of S/L design in contemporary clinical maxillofacial practice has been made in this article by incorporating innovative modifications in its primitive framework, in the form of a "wraparound" design, and maximizing the esthetic concern with thermoplastic Acetal resins, in an Aramany class I maxillectomy resected patient.

INTRODUCTION

Prosthodontics is transforming; believe it and achieve it".
The above quote aptly throws light upon the solidarity of prosthodontics as an interventional science. The far sighted vision of a useful treatment modality for a debilitated maxillofacial candidate is executed into actuality, by first believing into it, integrating it with clinical experience and finally rendering a life changing transformation for the patient.

Prosthodontic rehabilitation of the acquired maxillofacial defects is a highly challenging arena that warrants a holistic fulfillment of all aspects of treatment, namely preventive, palliative, supportive and restorative goals [1]. Every phase of rehabilitation needs to be carefully scrutinized, right from diagnosis to treatment planning. The extent of success and failures of the prosthesis is affected by the degree of malignancy, the propensity of recurrence, the level of resection and other coherent complications. Surgical procedures to eradicate carcinomas of head and neck region usually leave behind large tissue defects and it becomes a daunting task for the maxillofacial prosthodontist to rehabilitate these patients to optimum function and esthetics [2]. The patients having partial or complete maxillary resections face a variety of difficulties including defective mastication, swallowing, speech and social interaction.

The partially dentate maxillary defects are classified according to Aramany's classification and are treated successfully by taking support from the natural teeth [3, 4]. More often than not, in most cases the little amount and poor quality of residual bone available after resection, unfavorable grafts of tissue beds, cicatricial contractures and radiotherapy along with economic constraints of patients preclude the use of dental implants. In these cases the prosthodontist has to resort to conventional physical methods to maximize the support, retention and stability [5].

For the most part, much of maxillofacial prosthetics, as it is practiced today, uses technology and manual processes that have remained largely unchanged for over six decades. This sounds surprising considering the era of technological advancements happened by, such as digital imaging, navigation, robotics etc. However the ideologies of treatments have not maintained its staunchness and are open to revivals with the changing facets of time. The incorporation of esthetically competent flexible components in classically rigid metal based RPD designing is popularly accepted innovation today, and thereby the use of aesthetic flexible removable

Corresponding author:* **Vishal Verma
Department of Prosthodontics & Crown & Bridge, Govt. Dental College & Hospital, Ahmedabad/ Gujarat University, India

partial dentures (FRPD) has skyrocketed over the last several years [6].

The idea of "gate clasp" was suggested by Ackerman in 1955 in relation to mandibular defects. The S/L design concept, as it is now recognized, was introduced to the dental profession by Simmons in the early 1960's [7, 8]. The biomechanics of the swing lock design revolves around the placement of a movable labial or buccal bar that is attached to the remainder of the framework by a hinge at one end and a lock at the other end [9].

Following case report describes the fabrication of modified swing lock cast partial denture with a slightly altered framework in the form of "wrap around" design, coupled up with flexible thermoplastic Acetal resin in labial framework to facilitate the ease of smooth insertion and removal and enhancing the aesthetics, as an innovative treatment option.

Case History

A 28 year old male reported to the department of Prosthodontics for the prosthetic rehabilitation of the left sided resected maxillary defect. The patient elicited a past history of Ameloblastic carcinoma of the left maxilla. The characteristic histologic features and behavior of this tumor dictated a more aggressive surgical approach, as radically as possible, than that of a conventional ameloblastoma, due to the spongy maxillary bone architecture. The patient underwent surgical removal of the left sided maxillary alveolar, palatine process, and the entire ipsilateral dentition from the midline, spanning from central incisor to 2nd molar **[Figures 1 & 2].**

Figure 1 Pre operative intraoral view of the resected maxillary defect (Aramany Class I defect)

Figure 2 Frontal Profile view with Aramany class1 defect (resected left maxillary dentition)

Prosthetic rehabilitation was proceeded with, after allowing adequate healing to take place. Clinical and radiographic examinations were done accurately so as to evaluate the condition of the remaining natural dentition of the uninvolved contra lateral side. The primary concern of the presenting clinical scenario was to synchronously distribute the occlusal forces among the remaining teeth, hence a Swing Lock cast partial design was decided for, since it preserves and maintains harmony among the existing hard and soft tissues.

To commence with, preliminary impressions of upper and lower arches were taken with irreversible hydrocolloid (MprESSIX Alginate, Dentsply Sirona, Dentsply) and poured with type II dental stone. The maxillary cast was surveyed and designed to determine the position of occlusal rest, guiding plane and necessary teeth alterations. Maxillary custom tray was prepared using self cured acrylic resin, sequential border molding was performed to record functional movement using low fusing modeling impression compound, and final impression was made using medium body elastomeric impression material (Affinis, Coltene Whaledent, Switzerland) **[Figure 3]** and poured with TYPE IV stone (Kalrock, Kalabhai Karson Pvt. Ltd., Mumbai, India) **[Figure 4].**

Figure 3 Beaded boxed maxillary final impression recorded using medium body elastomeric impression material

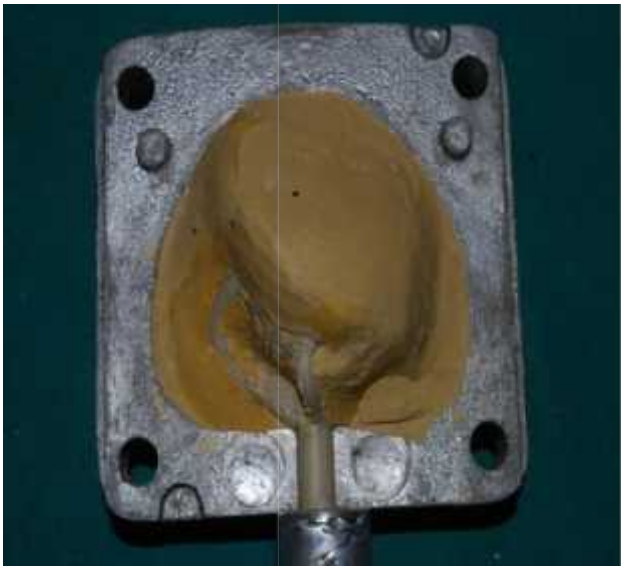
Figure 4 Master cast poured with type IV dental stone

The master cast so obtained was surveyed again and the metal framework was casted with cobalt-chromium alloy (Vitallium;

Dentsply, USA) **[Figures 5 & 6].** The metal framework was tried in to verify the proper seatings with minor adjustments.

Figures 5 & 6 Metal Framework of the Cast partial denture obtained using Crome Cobalt alloy on duplicated master cast.

In the laboratory wax pattern framework for the labial portion was made separately **[Figure 7]** and Acetal resin (DURACETAL) was injected through injection molding technique **[Figure 8]**. Maxillo-mandibular relationship was recorded using bite block **[Figure 9]** and bite registration material. Artificial teeth arrangement was done to obtain unilateral balanced occlusion, and try in was verified.



Figures 7 & 8: Wax pattern for labial bracing of modified swing lock design fabricated using Duracetal resin polymer, injected molded into "Myerson Flex Press".

Figure 9 Finished Polished metal framework with fused Acetal Labial Bracing before jaw relation and try in.

After teeth trial, the denture was flasked, finished and polished**.** To incorporate the orthodontic wrap around retainer like modified swing lock design of the thermo Acetal resin, the MYERSON FLEX PRESS automated digital injection molding system was employed.

The final denture thus consisted of a fused locking between the Acetal resin and the metal portion of the removable partial denture **[Figures 10 & 11]**, that formed a bracing effect around the cervices of natural dentition. Specific emphasis was laid upon for achieving a reasonably durable bond between the cast metal framework and wrap around designed Acetal bracing labial bar, which was precisely "MECHANO-CHEMICAL" in nature. This is because of the reason that it is extremely difficult to achieve true adhesion to Acetal by virtue of its chemical inertness. The cast metal framework was initially DEGREASED, and was then surface treated by means of Shot Blasting abrasion, so as to create mechanical irregularities and corrugations favourable to bond with Acetal. The Acetal component on the other hand was subjected to surface treatment by applying CYANOACRYLATE adhesive, to combat its inertness and generate surface reactivity. During the denture delivery **[Figures 12-16],** retention and stability were evaluated, and were found to be adequate.

Figure 10 Modified Swing Lock cast partial denture with labial bracing (Wrap around design) of Acetal Framework (CAMEO SURFACE)

Figure 11 Modified Swing Lock cast partial denture with labial bracing (Wrap around design) of Acetal Framework (INTAGLIO surface)

Figure 12 Modified Swing Lock prosthesis seated into patient's mouth (Frontal view)

Points of interferences that could hinder the smooth insertion and removal of denture were identified and judiciously trimmed off. Oral hygiene instructions were given. Patient's follow up was scheduled after 24 hours, 1week, 2 weeks, 1 month, 3 months, 6 months and 12 months timely intervals, without notable discomfort.

Figure 13 Modified Swing Lock prosthesis seated into patient's mouth (Intra oral Occlusal view)

Figure 14 & 15 Right & Left Occlusal views (Normal & resected Sides respectively)

Figure 16 Post Operative Rehabilitated Frontal View with intra orally seated prosthesis

DISCUSSION

The above described case is a classical Aramany's class I defect which is unilateral; the entire alveolar process on left side was resected along the midline, while the teeth on right side were left intact. The formulated cast partial design can be either linear or tripodal, with two or three anterior teeth usually splinted whenever possible, and support is derived from the central incisor and the posterior abutment tooth of the unaffected contralateral side. For a curved spanning dental arch, swing lock framework is also tripodal in design with rests and indirect retainers located in manner similar to a conventional framework. Maximal palatal coverage is to be ensured.

Swing Lock cast partial design as the choice of treatment for this case stands suitable because, this concept is specifically recommended for maximizing stability and retention by gaining access to many more teeth surfaces and undercuts that are unapproachable with other partial denture clasp designs. The known major indications for its usage are: 1) missing or weakened key abutment teeth, 2) tooth mobility in patients requiring some sort of stabilization, 3) therapy for oncology patients having undergone ablation surgery and have few remaining teeth, for example, patients who have had a hemimaxillectomy or mandibular resection [11, 12].

A unique value of the swing lock design for the patient undergoing resection lies in the controlled direct mechanical retention and stabilization provided by the labial bar. Reciprocation is achieved via a palatal or lingual plate that contacts all of the teeth or remaining teeth on or above the height of contour. The cast palatal or lingual major connector is maximally extended for maximum support and resistance to occlusal forces on the non defect contra lateral side. Occlusion on the side involving defect is always designed to be light, so as to minimize the rotation of the prosthesis around the midline and into the defect [10]. Direct retention is further aided by small vertical struts (similar to I-bar in design), that traverses the marginal gingiva, and contacts the gingival third of abutment teeth.

However the above described conventional SL design also has few indigenous flaws. Firstly the locking mechanism in a conventional SL-RPD may exhibit noticeable wear in a relatively short time span, leading to loosening of the snap-lock mechanism. This consequently requires frequent adjustment of the labial bar to tighten the snap-lock action [13, 14]. Another critical aspect of consideration with the conventional S/L design is the arc of closure (AOC). It should be so designed that the locking and closure of the labial bar should be hassle free, as freely as possible, without interferences from the abutment teeth and its tissue bed, which is not commonly an occurrence. To specifically combat these drawbacks, and to add up to the aesthetic demands, a modification in the conventional swing lock design framework has been addressed through this case report, but its basic design principles, namely stress distribution, rotational forces, and retentive arms assembly have been adhered to.

The idea to incorporate a wrap around S/L design has been drawn from an orthodontic retainer, which holds the teeth firmly in position as a splinted unit, after the desired orthodontic teeth movement is accomplished. The material of choice decided upon was thermoplastic Poly (oxy-methylene)-based resin, also known as "Acetals" or "Thermoflix". Inspired from the thermoplastic breed of resin systems, Acetal resin is very strong, resists wear and fracturing, and it is flexible, which makes it an ideal material for pre-formed clasps for partial dentures, and components of partial denture frameworks. A high elastic memory, high impact strength (69-122 J/m at 23°C) [15], low modulus of elasticity (2.9 to 3.5 kN/mm2) allow for its preferred usage in larger retentive undercuts than Cobalt- Chromium alloys (Elastic modulus; 22.43 kN/mm2). Owing to these advantageous properties, Acetal resins are fast gaining immense popularity and touted as the "Gen- X material in aesthetic prosthetic dentistry".

CONCLUSION

There is no denying the fact that implants supported obturator prostheses constitute the "mother" of all maxillofacial treatment modalities that can satisfy the form , function and esthetics triad to the fullest extent; but economic constraints and considering the context of extensive nature of resective surgeries of head and neck carcinomatous invasions (specifically maxillary resections), followed by radiotherapies, the sparse tissue bed and its detrimental health left behind, precludes the implication of implant supported obturator prostheses as a treatment option in majority of cases. In this narrated case with Aramany class 1 maxillary defect, an effectively designed modified Swing lock cast partial denture prosthesis with a flexible arc of Acetal labial bar, instead of the conventional hinge and latch locking, mimicking an orthodontic "wraparound" retainer, adhering to the principles of ideal framework designing and in harmonious accordance with its neighboring tissues, can foster with the much needed optimization of retention, stability, effective splinting and esthetic requirements, that altogether constitute a comprehensive maxillofacial rehabilitation, that contributes towards upliftment of patient's overall quality of life.

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