



## Review Article

### RUGAE DUPLICATION TECHNIQUES – A REVIEW

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#### Abstract

While fabrication of an edentulous maxillary arch, phonetics is one of the most important factor to be taken into consideration. Palatal contour of an edentulous maxillary arch are customized by adding palatal rugae which helps in eliminating the adjustment period for proper phonetics. This article describes the various techniques for rugae duplication for edentulous maxillary arch to improve phonetics.

**KEYWORDS : Palatal rugae, Rugae duplication, Phonetics**

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#### INTRODUCTION

Phonetics play an important role in edentulous maxillary arch. For this palatal rugae contour have a very important role as production of palatolingual group of sound

involves the contact between tongue and the palate. Palatal rugae duplication in edentulous maxillary arch it may help alleviate the speech problem in patients whose speech is sensitive to the changed relationships with the dentures and difficulty

in accommodating<sup>1</sup>. Proper phonetics is produced by some obstruction so as to create turbulence in the outgoing stream and letting the tongue to locate a landmark where it can produce best particular sound. So when the tongue is not able to find rugae so it might press on forward to find a structure where tongue can make touch with some profitable structure which might be teeth, thus sounds like ‘Th’ and ‘D’ might be poorly pronounced, as tongue is not able to form a base in making damp for impounding air<sup>2,3,4</sup>. Apart from enhancing phonetics, these soft tissue landmarks aids in mastication, deglutition and better taste perception<sup>5</sup>.

### CLASSIFICATION OF RUGAE

Thomas et al classified palatal rugae on the basis of number, length, shape and identification pattern of rugae<sup>6,7</sup>.

Three categories are identified on the basis of length of all rugae.

1. Primary rugae (5-10mm)
2. Secondary rugae (3-5mm)
3. Fragmentary rugae (less than 3mm)

The shape of individual rugae are classified into four major types

1. Straight – Runs directly from origin to termination.
2. Curvy – Simple crescent shape that are curved gently.
3. Circular – Definite continuous ring
4. Wavy – Serpentine form

The unification pattern is further subdivided into diverging and converging types<sup>8,9</sup>.

Diverging pattern occurs when two rugae begin from the same origin but diverge transversely<sup>10,11</sup>.

Converging pattern occurs when two rugae arise from different regions and converge transversely<sup>8,9</sup>.

### METHODS OF RUGAE DUPLICATION

- **Arbitrary method** - This is the simplest method in which arbitrary carving is done of the rugae but this is very difficult to correct, if it is incorrectly done and it is difficult to polish<sup>12</sup>
- **Investment core method** - In this method the refractory investment material is applied to the palatal surface of the master cast, covering the palatal design which was previously outlined with indelible pencil. This refractory investment core, or matrix, is then pried off the master cast, trimmed to the indelible outline, and saved until the duplicate refractory cast has been made and is ready for waxing. The core is then carefully positioned on the refractory cast by means of wax shims to provide space for the palatal portion of the casting. This space is then closed at its periphery with wax to which the clasp struts, connectors, etc., are luted to complete the pattern. This method has great limitation in high arched palates with parallel walls and prominent rugae. But in wide, flat palates with low rugae, there was frequent breakage of either the refractory cores or the master casts. Furthermore, high palate cases required the refractory cores to be cut. This method even showed limitation for cobalt- chrome alloys.<sup>13</sup>

- **Plaster – Matrix method** - In this method plaster matrix is made similar to the refractory core. This matrix, when hardened, is dried off the master cast, coated with a tin-foil substitute, and then used to press out a self-curing acrylic pattern against the previously tin-foiled master cast. The advantage is that the defective matrix alignment results in holes in the acrylic patterns instead of in the castings and it can also be used for chrome-cobalt alloys. This technique has a limitation in high arched palates having parallel lateral walls and prominent rugae areas<sup>13</sup>.
- **Mate surface and rugae reproduction**- Preparation of the chrome cobalt metal plate - Select a painted metal surface with striations which seem appropriate, then dam off a 2 inch square section with Plasticine, coat this area with a light coating of oil. Make a standard mix of refractory investment and pour it onto the prepared surface, allow the investment to set, preheat it in an oven and then dip in into hot beeswax. Adapt two layers of 28 gauge wax to the refractory surface. Sprue from the center of a waxed sheet with a piece of inlay wax approximately ¼ inch long. Invest, burn-out, cast, sandblast, and electropolish in the usual manner. Use a rubber wheel lightly over the entire surface of the casting, then polish it lightly with high shine polishing material and a rag wheel on a low speed polishing motor (Fig. 1).

Altering the surface contour of the plastic sheet - Spray the surface of the plastic sheet lightly with a plastic spray, adapt the plastic sheet to the mat surface of the metal sheet, and hold the metal and plastic sheet in water

at a temperature of 140°F for 15 seconds. Remove from the water bath and readapt the plastic sheet to the metal plated. Chill the pattern and metal plate in water at a temperature of 40°F, the reproduced mat surface will remain on the plastic sheet remainder of the waxing procedure. Utilize this modified plastic sheet for waxing the palatal section of upper refractory cast (Fig. 2)

*Finishing and polishing procedure* - Invest, burn-out, cast, sandblast, and electropolish the casting in the usual manner. Finish and use a rubber wheel on all clasps, rests, bars, and other areas covering the cingulae of the remaining teeth. Boil the casting in trisodium phosphate, steam, and wash it in hot, soapy water (Fig. 3).

Advantages of the mat finish procedure include simplicity of the procedure, the procedure does not require the use of additional material or equipment. Although artificially produced, the mat surface on the finished partial denture casting resulting from this procedure accomplishes its purpose of providing a more compatible surface against which the tongue may function<sup>14</sup>.

- **Tin foil method**

NEW PROSTHESIS - Tinfoil (0.001 mm) is cut to the desired shape and adapted on master cast to the rugae area with prominent rugae (Fig 4). After removing the tinfoil pattern from the cast it is sealed to the palatal area of the completed wax-up (Fig 5). Then as routine the denture is flaked, processed, finished and polished<sup>1</sup>.

EXISTING PROSTHESIS - Tinfoil is adapted on the cast with prominent rugae,

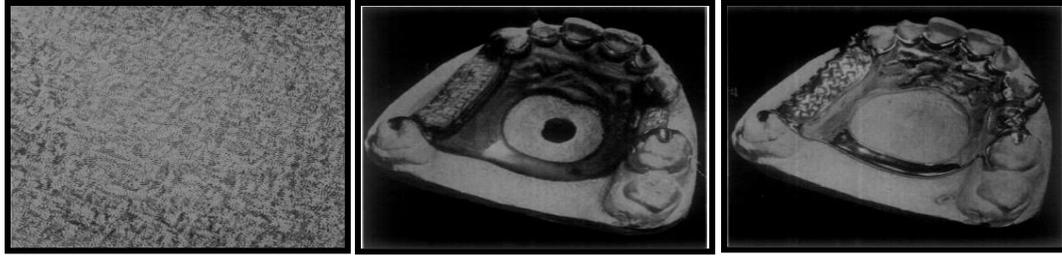


Fig. 1 – 3 (Left to Right): (1) Mat surface fabricated in a chrome cobalt alloy, (2) Wax up utilizing the altered plastic pattern, (3) Finished casting showing the mat surface of the palatal section

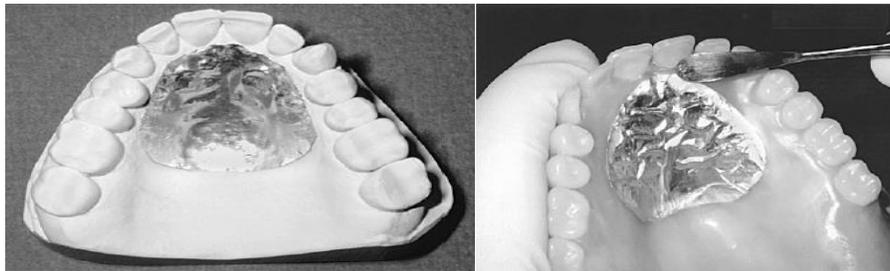


Fig. 4, 5: (4) Tinfoil trimmed and adapted to cast with prominent rugae, (5) Sealing of tinfoil pattern to palatal area of completed wax-up



Fig. 6 – 10 (Left to Right): (6) Tinfoil adapted to cast, (7) Hot wax flown over surface of tinfoil to reinforce pattern, (8) Acrylic resin applied to pattern to fabricate rugae, (9) Acrylic resin secured to existing prosthesis, (10) Completed addition of rugae

hot baseplate wax is flown over the surface to reinforce the tinfoil (Fig 6, 7). Wax is removed from reinforced tinfoil from the cast and trimmed to desired shape. Rugae are fabricated by applying autopolymerizing acrylic resin on the underside of the tinfoil pattern (Fig. 8). When cured, remove the tinfoil and secure acrylic rugae to the palatal area of the existing prosthesis with autopolymerizing acrylic resin (Fig 9). Refine, finish, and polish<sup>1</sup> (Fig 10).

- **Putty impression technique** - In this method, putty is adapted over rugae area of maxillary cast to record prominent rugae on the palate. Modelling wax is melted and poured over the putty impression slowly and carefully to record the imprints of rugae over the impression. Before flasking of denture, wax imprint of rugae was placed on maxillary trial denture base, adapted

carefully on the palatal portion of the maxillary trial denture base<sup>15</sup>.

- **Dental floss method** - Rugae patterns are marked in definitive maxillary cast using permanent marker. Apply auto-polymerizing resin (clear) in sprinkle on method on the rugae portion on the cast. The markings will be seen through the transparent resin in the cast. The thickness of resin added should not exceed 1 mm. Apply auto-polymerizing resin (pink) in sprinkle on method on the rest of cast and fabricate the record base in the usual manner. Proceed with the tentative jaw relation and teeth arrangement. Trial denture verification is done Demount the maxillary cast from articulator. Cut dental floss as per the required lengths and lute them over the rugae marking seen through the record base using inlay casting wax. Proceed with fabrication of denture in conventional manner. The rugae pattern is duplicated in the denture.<sup>16</sup>

## DISCUSSION

Palatal rugae also called plicae palatinae transversae and rugae palatina, refer to the ridges on the anterior part of the palatal mucosa, each side of the median palatal raphe and behind the incisive papilla<sup>7</sup>. They play an important role in most of the animals in gripping the food before tearing it with brutal force and in phonetics. Palatal rugae are one the anatomical landmarks perhaps which a least understood or are unexplored regions of the oral mucous membrane. But they seem to play and integral part in functions like speech, adaptation, proprioception and taste<sup>17</sup>.

The palato lingual consonant sounds t, d, n, and l are of interest to dentists. The tongue

must be placed firmly against the anterior part of the hard palate to produce these sounds<sup>18</sup>. Central and lateral lispings may develop in a patient's speech when contours are incorrect<sup>19</sup>. Slaughter et al believes that the smoothness of the denture is disturbing, and without rugae the tongue loses its capacity for local orientation<sup>20</sup>. Palatal rugae can also be used in forensic odontology for identification of a person since the pattern of rugae is unique and individualistic.<sup>21</sup>

Various authors have tried various techniques for palatal rugae fabrication, the primitive ones being the arbitrary carving of rugae in the maxillary which has a limitation that the rugae can be extensively carved and can cause hiderance in speech, then is the dental floss method in this also its arbitrary fabrication of rugae only but a better technique than arbitrary carving. Then there are methods like plaster matrix method and investment core method which provides good reproduction of patients rugae but always have limitation in high arched palate where there is every chance of breakage of the core matrix and with cobalt chrome alloys. Then matted surface has been tried by various authors which are very helpful is metal denture bases and in cast partial denture. Tin foil method is very useful as it can be used in existing prosthesis and can also be used in new prosthesis. With the advent of new impression materials like elastomeric impression material methods have be advocated for duplication of rugae with help of elastomeric impression materials which help is refine duplication of rugae to the denture.

## CONCLUSION

Phonetics is always a neglected factor in complete denture fabrication especially the maxillary denture. While using complete

denture patient come across mis pronunciation of many sounds which are mainly due to absence palatal rugae in complete denture and palatal contours. Creating a customized palatal rugae will definitely go a step ahead in improving the phonetics for the patient and ease of adaptation of new prosthesis in the oral cavity.

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