

Carving of a master cast to obtain a posterior palatal seal of a complete maxillary denture as performed by four prosthodontists: a pilot study

Zdzisław J. Krysiński¹⁾ and Mariusz Pryliński²⁾

¹⁾Department of Prosthodontics, Poznań University of Medical Sciences, Poznań, Poland

²⁾Department of Biomaterials and Experimental Dentistry, Poznań University of Medical Sciences, Poznań, Poland

(Received 23 February and accepted 30 March 2007)

Abstract: This study was conducted to clarify the degree to which a master cast needs to be carved to obtain a posterior palatal seal according to Swenson, based on a comparison among four dental practitioners. Sections of the casts with the seal scraped were made, and an optical microscope was used to measure the sagittal and vertical dimensions. It was found that the sagittal dimension may show a smaller difference in carving of the master cast in the posterior palatal seal area. The present results also suggest that the clinical experience of the prosthodontist in applying this method seems to have an effect on the carved shape and depth of the posterior palatal seal. (*J. Oral Sci.* 49, 129-132, 2007)

Keywords: posterior palatal seal; post dam; depth; width.

Introduction

It has been well proven that physical factors play a decisive role in the retention of a maxillary complete denture, at least before the patient has learned muscular control. Successful physical retention is most importantly determined by achieving a valve-like border seal, preventing saliva and air from being drawn beneath the denture. Along the posterior border of a maxillary complete denture, such a seal is obtained either by scratching a groove into

the master cast or by applying easy mouldable wax or compound to the secondary impression (1-10). In this way the posterior border of the finished denture becomes embedded into the palatal mucosa. In the first technique described above, the dentist needs to carve the groove to a proper depth, width, and shape in accordance with the clinically estimated compressibility, i.e. the degree to which the soft palatal tissues yield in a particular patient.

According to Avant (2) the most effective way of achieving complete circular valve sealing of the maxillary denture borders is by producing a posterior palatal seal using the technique applied by Swenson (9). In this method the posterior line of the seal runs identical to that in other methods, i.e. along the vibrating line. However, the depth and the anterior extension of the seal outline depend on the compressibility of the soft tissues covering the palate anteriorly to the vibrating line. The frontal contour of the palatal seal has a Cupid's bow shape (11), i.e. it approaches the vibrating line along the midsagittal line and comes close to the right and left pterygomaxillary notches. Into the intermediate spaces the seal areas extend anteriorly in a tapering manner depending on the gradual decrease of compressibility of the soft tissues. In the method described above, both the compressibility of the soft tissues, which is most often defined in a simple clinical manner in the palatal seal area, as well as the carving of the master cast performed accordingly by maximal approximation, are left to the dentist's subjective discretion.

The purpose of the present study was to clarify the degree to which carving of the master cast to obtain a posterior palatal seal according to Swenson differed when performed by four dental practitioners.

Materials and Methods

This laboratory study was carried out using a maxillary master cast boxed, poured and trimmed carefully following a routine procedure. The base and side walls of the cast were trimmed on a model trimmer TR II (Schütz-Dental, Rosbach, Germany).

In order to obtain 13 identical casts of the edentulous maxilla, an original master cast considered as a reference one was duplicated using a silicone impression material, Profisil 15/24 (Kettenbach, Eschenburg, Germany), following the manufacturer's directions. Four impressions of the original master cast were made, and from each impression three further casts were prepared. Having carried out a routine clinical test of the compressibility of the soft tissues covering the posterior palatal seal area, four prosthodontists made three scratched negatives of the seals (which later would facilitate pressure contact of the posterior border of the denture against the palate), each according to Swenson's pattern, on duplicate casts poured from hard Dentaloc III-type plaster (Dr Böhme and Schöps, Goslar, Germany). Two dental practitioners who took part in the study were graduates in prosthodontics with over 25 years of work experience, whereas the other two had graduated from dental school six months prior to the study.

The next stage involved making 5 longitudinal parallel sections of the 12 duplicate casts (Fig. 1). The location of

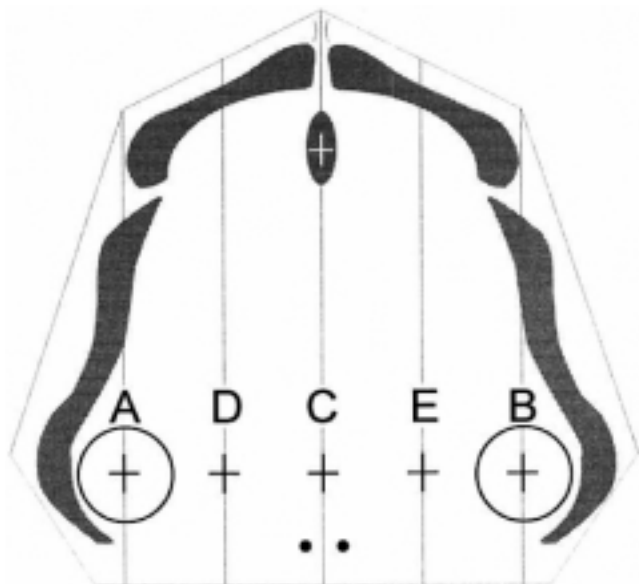


Fig. 1 Topographic points indicating the planes of sectioning of the master cast. All sections run parallel to the midsagittal line. A and B: points positioned in the middle of the right and left hamular notches; C: point positioned on the midsagittal plane; D and E: points located halfway between the midline and points A and B, respectively.

each section was established so that it was identical on all casts and comparable within the greatest practically possible approximation. For the location of the sectionings, three topographic points were assumed as a reference base. Two points, A and B, were located 12 mm anteriorly from the base wall of the cast in a central position between the right and left pterygomaxillary notch, whereas the third point, C, was located at the intersection between the line connecting points A and B and the midsagittal line, which is determined by the position of the middle of the incisive papilla and the fovea palatinae. After the essential anatomic topographic points had been marked out, two further points, D and E, were determined half way between the mid-line of point C and points A and B (Fig. 1). In order to transfer topographic points onto all the duplicated 12 casts, a template was made from a 2-mm thick transparent plastic plate, Imprelon S (Scheu-Dental, Iserlahn, Germany). The borders of the template were filed off to a degree sufficient to enable a collision-free transfer of the template onto a cast on which the topographic points had been marked out earlier. These points were then transferred onto the template, and in their place holes 0.1 mm in diameter were drilled (Fig. 1). After the template had been transferred from the master cast onto each of the 12 duplicated test casts, it was possible to establish the points that had been marked out on the same locations of the section. The casts were sectioned parallel along the marked lines using a saw designed for accurate cutting of casts (MOC; Schütz-Dental, Germany). The measurements from each test cast were recorded to the nearest 0.01 mm using a universal microscope (Zeiss Jena, Jena, Germany). The difference between the values obtained from the original master cast (without the seal scratching) and the values obtained at given measurement points from the duplicate casts with the carved negative of the seal were expressed in millimeters, with vertical dimensions representing the depth of the seal and sagittal dimensions the length of the seal.

Results

The measured data enabled comparison of the depth and width of carvings in the given profiles, i.e. sections of the casts, expressed jointly for the four dentists involved in the study as well as for the individual practitioner. It appeared that the depth of scratchings measured along the vibrating line in sections A1 and B1, the pterygomaxillary notches in Fig. 1, ranged from 0.17 mm to 0.99 mm for the group of four dentists as a whole, from 0.86 mm to 0.99 mm for the more experienced practitioners, and from 0.17 mm to 0.44 mm for their two less experienced colleagues. In section C1, the midline, the respective

ranges were 0.24 mm to 0.95 mm, 0.92 mm to 0.95, and 0.24 mm to 0.35 mm. On the line halfway between the midsagittal line and the pterygomaxillary notches, points D1 and E1, the respective ranges were 0.17 mm to 0.99 mm, 0.76 mm to 0.99 mm, and 0.17 mm to 0.44 mm. The width of the scratching measured from the anterior extent of the so-called Cupid's bow to the vibrating line for all four dentists ranged from 1.87 mm to 4.69 mm in sections A2 and B2, whereas those for carvings made by the more experienced practitioners ranged from 2.49 mm to 2.77 mm, and those made by the less experienced dentists ranged from 1.87 mm to 4.69 mm. In section C2, the midline, the respective values ranged from 2.93 mm to 3.36 mm, from 3.35 mm to 3.36 mm, and from 2.93 mm to 3.02 mm. On the line halfway between the midsagittal line and the pterygomaxillary notches, points D2 and E2, the data varied between 6.33 mm and 8.06 mm, 7.49 mm and 7.94 mm, and 6.33 mm and 8.06 mm, respectively.

From the figures given in Table 1, it is clear that the data for vertical dimensions were distinctly higher, and for certain measurement points several times higher, than for sagittal dimensions. The biggest differences between the extreme values were noted in the vertical dimensions at

points A1 and B1, and ranged from 0.17 mm to 0.99 mm. The differences recorded in the sagittal dimensions at the same measurement points, A2 and B2, ranged from 1.87 mm to 4.69 mm. The values referring to vertical dimensions in the midline (C1) showed values ranging from 0.24 mm to 0.95 mm. The measurement data describing the width at point C1 ranged from 2.93 mm to 3.36 mm. The extreme values for vertical dimensions at points D1 and E1 ranged from 0.17 mm to 0.99 mm and were distinctly higher than the figures recorded in the sagittal dimensions, which ranged from 6.33 mm to 8.06 mm. Thus, it was evident that the differences between the analyzed data tended to decrease in the sagittal dimensions and increase in the vertical dimensions. The figures describing the posterior palatal seal cut by the two experienced prosthodontists show a stronger tendency to be similar with respect to all dimensions in the analysed casts than in the case of seals made by the practitioners with shorter clinical experience. There was a considerably wider variation in the measurement data for both dimensions at points A and B, corresponding to the right and left pterygomaxillary notches, and at point C, which defines the median palatine raphe near the fovea palatinae.

Table 1 Depth and width of scratchings (in mm) with respect to the measurement points

Prosthodontists		Point of measurement									
		right side			midline				left side		
		A1	A2	D1	D2	C1	C2	E1	E2	B1	B2
1*	mean	0.17	2.33	0.20	7.68	0.24	3.02	0.44	6.33	0.17	1.87
	(SD)	(0.14)	(0.47)	(0.29)	(0.79)	(0.15)	(0.79)	(0.50)	(0.11)	(0.16)	(2.20)
2*	mean	0.39	3.22	0.17	8.06	0.35	2.93	0.21	7.63	0.44	4.69
	(SD)	(0.29)	(0.28)	(0.13)	(1.23)	(0.26)	(0.79)	(0.30)	(0.69)	(0.49)	(0.81)
3*	mean	0.86	2.55	0.76	7.55	0.95	3.36	0.87	7.94	0.97	2.71
	(SD)	(0.37)	(0.06)	(0.26)	(0.21)	(0.34)	(0.31)	(0.16)	(0.17)	(0.07)	(0.12)
4**	mean	0.89	2.49	0.85	7.49	0.92	3.35	0.99	7.77	0.99	2.60
	(SD)	(0.23)	(0.12)	(0.18)	(0.27)	(0.32)	(0.41)	(0.10)	(0.21)	(0.20)	(0.19)
	'a'	'0.58'	'2.65'	'0.50'	'7.70'	'0.62'	'3.17'	'0.63'	'7.42'	'0.65'	'2.97'

Values reported represent means of three measurements (\pm SD).

* prosthodontist with short work experience

** prosthodontist with long work experience

A1, D1, C1, E1, B1: depth of the scratching

A2, D2, C2, E2, B2: width of the scratching

'a' average obtained by adding mean values for the four prosthodontists

Discussion

As reported by Ansari (1), the fact that the majority of dental schools in the USA and Canada teach scratching of the posterior palatal seal on dental casts can be explained by the simplicity and effectiveness of this technique. Its simplicity is based on the acceptance of subjective factors affecting the shaping of the master cast in the posterior palatal seal area. Namely, the research conducted in this study throws some light on the combined effect of the subjective factors influencing the estimation of mucosal compressibility in the post-dam area, and in the manual carving skills of practitioners who use the method as described by Swenson. As expected, all of these factors were reflected in the results for each individual dentist who made the posterior palatal seal and also in the interindividual comparisons of the data for all four dentists who carved this area of the master cast.

Analysis of the mean values and the range of the measurement data showed that the sagittal dimension had a significantly greater similarity of master cast carvings in the posterior palatal seal area. It was also evident that the clinical experience of the prosthodontists seems to be a factor influencing the scope of carving similarity in terms of the shape and size of the posterior palatal seal. The distinctively wider range of measurement data based on the scratchings made by the young practitioners at points A, B, and C, can probably be related to the fact that these measurement points are more difficult to evaluate clinically than the softer glandular area, which runs in an anterior direction bilaterally sideways from the fovea palatinae. However, studies of a larger number of subjects will be needed to confirm these observations and whether this explanation is correct.

Since the specialist literature includes no available data devoted to the issue investigated in this study, it is unfortunately not possible to make a comparison with the present results. However, it is hoped that the present findings will prompt further research in this field, especially

involving a larger sample of material and incorporating other techniques for producing a posterior palatal seal.

References

1. Ansari IH (1997) Establishing the posterior palatal seal during the final impression stage. *J Prosthet Dent* 78, 324-326
2. Avant WE (1973) A comparison of the retention of complete denture bases having different types of posterior palatal seal. *J Prosthet Dent* 29, 484-493
3. Calomeni AA, Feldmann EE, Kuebker WA (1983) Posterior palatal seal location and preparation on the maxillary complete denture cast. *J Prosthet Dent* 49, 628-630
4. Colon A, Kotwal K, Mangelsdorff AD (1982) Analysis of the posterior palatal seal and the palatal form as related to the retention of complete dentures. *J Prosthet Dent* 47, 23-27
5. Halperin AR, Graser GN, Rogoff GS, Plekavich EJ (1988) *Mastering the art of complete dentures*. Quintessence, Chicago, 77-78
6. Hardy IR, Kapur KK (1958) Posterior boarder seal – its rationale and importance. *J Prosthet Dent* 8, 386-397
7. Miller TH (1984) Obtaining the posterior palatal seal. *J Prosthet Dent* 51, 717-718
8. Millsap CH (1964) The posterior palatal seal area for complete dentures. *Dent Clin North Am*, November, 663-673
9. Swenson MG (1959) *Complete dentures*. 4th ed, The CV Mosby, St Louis, 390-397
10. Zarb GA, Bolender CL, Carlsson GE (1997) *Boucher's prosthodontic treatment for edentulous patients*. 11th ed, Mosby, St Louis, 293-297
11. Mitchell L, Mitchell DA (1991) *Oxford handbook of clinical dentistry*. Oxford University Press, Oxford, 334