

Analyzing Complete Denture Occlusal Contacts: Accuracy and Reliability

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The aim of this study was to investigate the accuracy and reliability of interpreting occlusal markings made by articulating paper on complete dentures intraorally. Clinical teachers at a training hospital interpreted occlusal markings intended for adjustment. Their scores were compared to a control score to determine accuracy. For reliability determination, the observations were repeated. Only between 20% and 30% of observations were found to be both accurate and reliable. Unless the procedure can be standardized, this technique shouldn't be considered appropriate prosthodontics protocol for balancing the occlusion of complete dentures. *Int J Prosthodont* 2016;29:50–52. doi: 10.11607/ijp.4380

The minimum requirement for complete denture (CD) occlusion is a static balanced occlusion: even bilateral contact between posterior teeth in mandibular centric relation position.¹ Occlusal disharmony may cause trauma² and jeopardize denture stability and retention.³ Occlusal assessment and adjustment are routine practice when delivering CDs. Whether an intraoral technique or a clinical remount procedure is chosen,⁴ occlusal indicating material is used to visualize occlusal contacts. When using articulating paper, identification of contacts is based on subjective interpretation of color intensity and shape and size of markings.⁵ Evidence is lacking regarding the accuracy and reliability of intraoral use of articulating paper on CDs. This study was performed to establish (1) the accuracy of identification of markings by clinical teachers, (2) reliability by repeating observations, and (3) the influence of the presence of an opposing denture when interpreting markings.

Materials and Methods

Two series of images of 14 mandibular dentures with occlusal markings, one series consisting of 14 single

mandibular dentures, and a second series of the same dentures with their opposing maxillary dentures (Fig 1) were observed twice, 2 weeks apart, by 10 staff members. For each observation the image sequence was randomized. Markings were made using paper strips (200 µm, Bauch) intraorally, during delivery of new, well-fitting dentures. Observers were instructed of the occlusal scheme and to draw the markings they intended grinding on a printed sketch of a mandibular denture. The consensus score of two experienced clinicians was used as control.

For the control, the influence of the presence of the maxillary denture was analyzed by least squares regression. Accuracy of staff was determined by comparing differences in mean scores of the two different data series with the control by analysis of variance ($P < .05$). Intraobserver reliability was established by comparing the means of sequential observations for each observer by establishing z values.

Results

For the control, difference in mean number of markings for with or without opposing dentures present was 0.214, which was not significantly different from zero (Table 1). However, the number of markings per denture was the same for five dentures only. For only two of these five did the distribution of markings agree. Regression analysis confirmed a difference in distribution between the two series (Fig 2). Table 1 also shows the scores by staff.

Table 2 shows the number of staff that were (1) accurate for the two denture series, (2) reliable over two sequential assessments for each series, and (3) both accurate and reliable.

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Fig 1 Example set of complete dentures with occlusal markings.

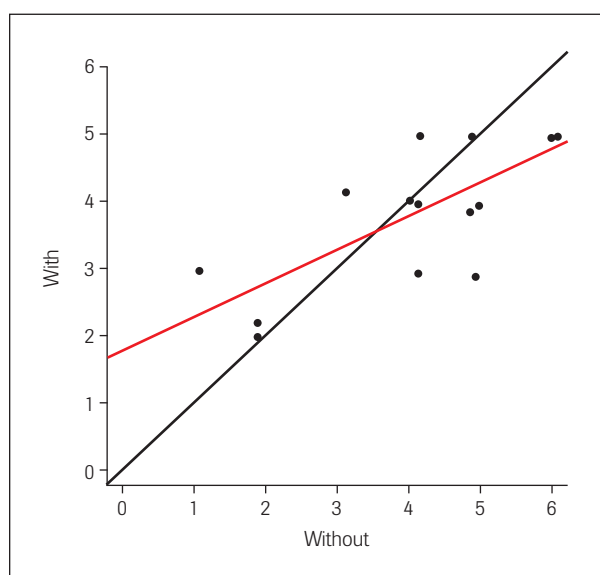


Fig 2 Plot of values for interpretation of markings with maxillary denture present (With) vs interpretation of markings with maxillary denture absent (Without). Red line = least squares regression line (slope 0.500, standard error 0.138), differing from black line with slope 1.

Table 1 Control Data and Mean Number of Markings per Denture for Staff (n = 10), for Two Consecutive Readings, With and Without Opposing Denture Present

Denture	Control		Staff			
	Without	With	Without		With	
			First	Second	First	Second
1	4	3	5.1	5.6	5.2	5.6
2	4	5	3.3	4.9	3.5	4.7
3	2*	2*	2.8	2.8	3	2.8
4	5	3	4	4.4	3.9	3.9
5	5*	5*	4	3.7	4.3	3.6
6	4*	4*	3.3	3.6	3.4	3.6
7	5	4	3.7	4.7	3.9	4.7
8	5	4	3.6	4.5	3.2	4.2
9	6	5	2.3	3	2.4	2.8
10	2*	2*	1.5	2.1	1.5	1.9
11	3	4	3.9	4.6	4.3	4.1
12	6	5	3.7	4.1	3.8	4.1
13	1	3	3	3.4	3.1	3.3
14	4*	4*	4.3	5.2	4.7	5
Total	56	53	48.5	56.6	50.2	54.3
Mean	4	3.79	3.46	4.04	3.59	3.88

*Dentures for which the number of markings were identical.

Discussion

For the control, number of markings hardly differed with or without the opposing denture present for verification of contacts (Table 1). Therefore, additional exploration in terms of distribution was performed. Regression analysis confirmed a difference. This is clinically relevant: depending on verification with an opposing denture, different teeth are selected for adjustment for balancing occlusion. Incorrect selection may result in inharmonious occlusion or unnecessary damage to teeth.

While mean staff scores appeared similar to the mean control scores for both denture series (Table 1), individual observers' scores differed from the control on 27 occasions out of a total of 40 (Table 2). The majority of clinical teachers were not accurate when interpreting markings.

The control score was based on consensus interpretation by two experienced prosthodontists, under the assumption that these interpretations were accurate. This may not necessarily be so. However, because there is no standardization in interpreting paper markings, this consensus was accepted as the control

Table 2 Staff Accuracy Compared to the Control for the Two Denture Series

Reading	Accuracy		Reliability		Accuracy and reliability
	Different (P < .05)	Not different	Unreliable (z ≥ 2)	Reliable (z < 2)	
Without opposing denture					
First	8/10	2/10	3/10	7/10	2/10
Second	6/10	4/10			
With opposing denture					
First	7/10	3/10	2/0	8/10	3/0
Second	6/10	4/10			
Total	27/40	13/40	5/20	15/20	5/20

data for this study. More sophisticated methods of identifying occlusal contacts also failed to be absolutely reliable and accurate.⁵

Reliability was found on 15 occasions, with similar numbers of observers being reliable for with and without series (8 and 7, respectively) when interpreting markings 2 weeks apart (Table 2). However, considering reliability and accuracy together, only 2 (respectively, 3) of the 8 (respectively, 7) reliable teachers' scores agreed with the control scores and could be considered accurate as well (Table 2).

Reliability levels were better than accuracy levels. This may present an opportunity to standardize the technique for producing and interpreting markings made by using articulating paper intraorally on dentures.

The two series of images were each viewed twice, at least 2 weeks apart, first the without series and then the with series. To limit carryover effect in observers' memory, a 2-week interval between viewings was instituted and images within the series were randomized each time. Memory may have improved the reliability of observers viewing the images for a third and fourth time. However, reliability scores for the with series improved for one observer only (Table 2).

Analysis of staff reliability and accuracy was limited to number of markings. Because substantially poor results had already been found, no further analysis of distribution was done. As was the case for the control, this may further reduce accuracy and reliability levels.

Conclusions

Only 20% to 30% of staff could interpret occlusal markings on lower dentures accurately and reliably. This study confirmed that identification of occlusal markings made by using articulating paper intraorally relies on subjective interpretation and therefore lacks accuracy and reliability. Before this technique can be considered appropriate prosthodontics protocol, further research is needed on the standardization of technique and observers.

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