Influence of Articulating Paper Thickness on Occlusal Contacts Registration: A Preliminary Report

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The objective of this preliminary study was to determine if the occlusal contact surface registered with an articulating paper during fixed prosthodontic treatment was contained within the area marked on a thicker articulating paper. This information would optimize any necessary occlusal adjustment of a prosthesis' veneering material. A convenience sample of 15 patients who were being treated with an implant-supported fixed single-unit dental prosthesis was selected. Occlusal registrations were obtained from each patient using 12-µm, 40-µm, 80-µm, and 200-µm articulating paper. Photographs of the occlusal registrations were obtained, and pixel measurements of the surfaces were taken and overlapped for comparison. The results showed that the thicker the articulating paper, the larger the occlusal contact area obtained. The differences were statistically significant. In all cases, the occlusal registrations obtained with the thinnest articulating paper were contained within the area marked on the thickest articulating paper. The results suggested that the use of thin articulating papers (12-µm or 40-µm) can avoid unnecessary grinding of veneering material or teeth during occlusal adjustment. *Int J Prosthodont 2015;28:360–362. doi: 10.11607/ijp.4112*

Articulating papers of different thicknesses (ranging from 12-µm to 200-µm) are routinely used in prosthodontics without a clearly defined criterion. Thicker papers provide a more visible occlusal contact, characterized by greater color intensity and a larger surface marking when compared to thinner papers. However, this does not automatically translate into removal of all identified occlusal contact.[1,2] The aim of this preliminary study was *(1)* to evaluate whether articulating paper thickness was related to the area of the occlusal contact registered and *(2)* to determine if the occlusal contact surface registered with a thinner articulating paper was contained within the occlusal contact area marked on a thicker articulating paper.

Materials and Methods

Subjects

A convenience sample of 15 patients (9 men and 6 women, with an average age of 53.6 years) was selected. They were treated at the School of Dentistry, University of the Basque Country (Spain), with an implant-supported fixed dental prosthesis on premolars or molars, opposed by a natural or restored dentition. All of the patients presented without signs or symptoms of temperomandibular disorder and voluntarily signed consent forms as per the university's research protocol.

Records

The uncemented prostheses were placed in the patients' mouths at the biscuit bake stage. All patients were seated in dental chairs with the Frankfort plane parallel to the floor. Occlusal contacts were registered applying maximum occlusal force, which is a

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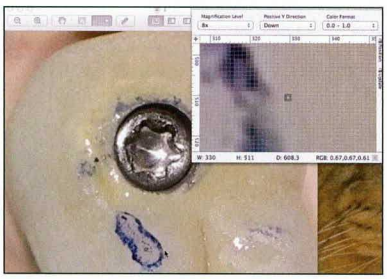

Fig 1 Occlusal contact obtained using 40-µm articulating paper. PixelTools software was used to measure the surfaces.

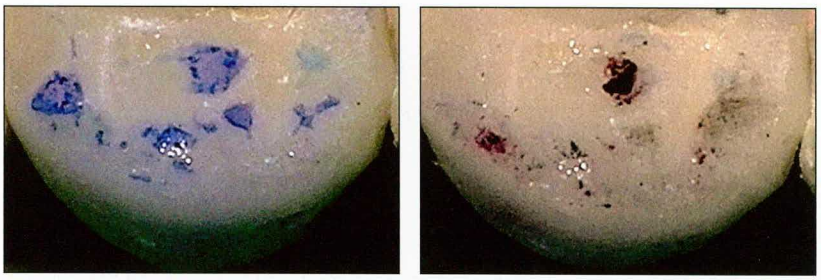

Fig 2 The 200-µm articulating paper generates a less uniform and larger occlusal contact area on the same premolar *(blue)* than the occlusal contact area obtained using a 12-µm articulating paper *(red)*.

standardized method characterized by the high repeatability of the load applied.[3] Four different registrations were made with 12-µm articulating paper (Coltène), and 40-µm, 80-µm, and 200-µm articulating paper (Bausch). Once the occlusal contacts had been registered, the crowns were placed on an ad hoc positioner and photographs were taken with a Pentax ×90 digital camera (Ricoh Imaging) used in manual mode, without flash, placed on a tripod, standardizing both focal length and the length in respect to the positioner. The photographs were then saved in jpg format on a personal computer and assigned an identification code. The images were examined by an independent observer, blind to the type of paper used, measuring the total surface area (in pixels) of the occlusal surface marks using PixelTools software (Sol Robots) and overlapping the occlusal registrations obtained in each case with the four thicknesses of articulating paper (Fig 1).

Statistical Analysis

The variables were compared using nonparametric tests, the Kruskal-Wallis test and the Mann-Whitney test, to compare them two at a time with a significance level $P < .05$.

Results

Table 1 shows the average number of pixels and other statistical data for each thickness of articulating paper. The lowest average number of pixels for the occlusal contacts was registered by the thinnest articulating paper (12-µm). The average number of pixels registered was found to be directly proportional to the thickness of the articulating paper with statistically significant differences between the four groups ($P = .006$). When they were compared two at a time, we found statistically significant differences between the 12-µm articulating paper and the 80-µm and 200-µm articulating papers ($P = .0279$ and .007, respectively) and between the 40-µm articulating paper and the 200-µm articulating paper ($P = .029$). We found that, in all cases, the occlusal contact registrations obtained with the thinnest articulating paper were contained within the area marked on the thickest paper; also, the thickest articulating paper generated a less uniform and larger occlusal contact area than the occlusal contact area marked with the thinnest articulating paper (Figs 2 and 3).

Table 1 Average Number of Pixels for Each Articulating Paper Thickness and Other Statistical Data

	Articulating paper thickness			
	12 µm	40 µm	80 µm	200 µm
Average	98.40	154.27	313.67	419.20
Median	75	102	144	215
Standard deviation	80.86	140.19	376.14	422.90
Asymmetry coeficient	1.63	1.89	2.06	1.35
Minimum	10	15	41	90
Maximum	321	562	1409	1481

Discussion

The results of this preliminary study suggest a direct relationship between the articulating paper thickness and the surface area of the occlusal contact when measured in pixels. Thicker articulating paper means a higher number of pixels on the occlusal contact registration and thinner articulating paper means fewer pixels; this result correlates with findings from other studies.[1,4]

Furthermore, in all cases, registered occlusal contacts using the thinnest articulating paper (12-µm or 40-µm) were contained within, or correlated with,

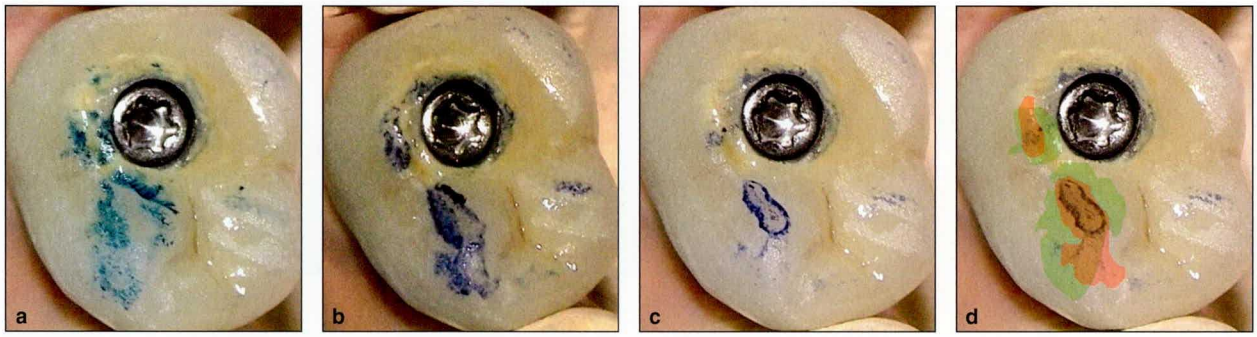

Fig 3 Occlusal contact registrations using **(a)** 200-µm, **(b)** 80-µm, and **(c)** 40-µm articulating papers and **(d)** overlapping of the occlusal registrations.

the central registration area of lower color intensity as observed on the thickest articulating paper. This clinically relevant observation suggests that before making an occlusal adjustment with thick articulating paper, the dentist needs to take into account that the occlusal area registered with a thick articulating paper does not have the same clinical significance as a whole.

Conclusions

The peripheral area of the occlusal registration with a higher chromatic intensity that is obtained with a thick articulating paper should not be eliminated during occlusal adjustment. The central area of the registration with a lower chromatic intensity is the real occlusal contact and correlates with the results obtained using a thinner articulating paper.

Acknowledgments

The authors reported no conflicts of interest related to this study.

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Literature Abstract

Detecting and treating occlusal caries lesions: A cost-effectiveness analysis

This study compared combinations of visual-tactile (VT), radiographic (RA), or laser-fluorescence–based (LF) detection methods with one of three treatments initiated at different cutoffs (treating all or only dentinal lesions) in populations with low or high caries prevalence. The treatment strategies were noninvasive (topical fluoridation), microinvasive (sealing using resin or glass-ionomer cement [GIC] sealants) or invasive (one-surface composite resin restoration). A Markov model was constructed to follow an occlusal surface in a permanent molar in an initially 12-year-old male German patient over his lifetime. Results suggested that, in populations with low caries prevalence, combining VT or RA detection with microinvasive treatment retained teeth longest (mean: 66 years) at lowest costs (329 and 332 Euro, respectively), while combining RA or LF-based detections with invasive treatment was the least cost-effective (< 60 years, > 700 Euro). In populations with high prevalence, combining RA detection with microinvasive treatment was most cost-effective (63 years, 528 Euro), while sensitive detection methods combined with invasive treatments were again the least cost-effective (< 59 years, > 690 Euro). Using more sensitive methods to detect occlusal caries lesions increases the chance of overdiagnoses, especially in populations with low caries prevalence. The different detection methods generated only limited differences of cost-effectiveness, with more sensitive methods being moderately advantageous in populations with high caries prevalence and risk. More importantly, performing micro- or noninvasive instead of invasive treatments after detecting a lesion was found to greatly influence tooth retention and long-term costs.

Schwendicke F, Stolpe M, Meyer-Lueckel H, Paris S. *J Dent Res* 2015;94:272–280. **References:** 49. **Reprints:** F. Schwendicke, Charité–Universitätsmedizin Berlin, Department for Operative and Preventive Dentistry, Aßmannshauser Str. 4-6, 14197 Berlin, Germany. Email: falk.schwendicke@charite.de—*Tee-Khin Neo, Singapore*