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'Occlusal Sketch'; A Reliable Technique for Technicians to Check that the Occlusion of Models is Correct?

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Abstract - *The aim of this study was to determine whether the occlusal sketch technique can be used as a reliable means of verifying the occlusal contacts on articulated casts. Occlusal markings were made on 30 sets of upper and lower dentate casts and these were recorded using the 'occlusal sketch' technique. Fifteen out of the total 30 pairs of casts were deliberately corrupted by the clinician so that they no longer matched the record on the 'occlusal sketch'. Three dental technicians were asked to judge in which of the 30 casts the occlusal contacts differed from those represented by the occlusal sketch. The results showed almost perfect agreement between the technicians in correctly identifying which casts had marked occlusal contacts which differed from those recorded on the occlusal sketch. The occlusal sketch provides a reliable way of communicating occlusal contacts that occur in a case, between clinician and technician.*

KEY WORDS: Occlusion; Technician; Communication

INTRODUCTION

The construction of an indirect restoration requires the accurate transfer of clinically relevant information between the clinician and dental technician. In order for the occlusion of an indirect restoration to be appropriately recorded, accurate casts of the patient's teeth need to be properly articulated. An articulator greatly facilitates this[1]. In order to relate the maxillary and mandibular casts in the required occlusal relationship, it is common practice to use some form of occlusal or 'bite' registration. There is some evidence that when sufficient teeth are present, simply hand articulating the casts using interdigitation of the teeth, is at least as accurate as bite registration pastes and further that no particular occlusal registration material appears to perform any better than others[2]. Seemingly, the ability of the clinician and technician are as important as the properties of the registration material used[3].

Therefore when articulating maxillary and mandibular casts for the purposes of diagnosis, planning or fabrication of indirect restorations some means of evaluating the occlusal relationship of the casts in the dental laboratory will usually be required as a means of confirming the actual occlusal contacts which pertain clinically.

One means of making this occlusal evaluation is for the technician to use articulating paper to mark the occlusal contacts on the casts in a similar way that the clinician would use in the patient's mouth, and hoping that the relationship of the casts on the articulator is the same as in the patient. In the case of simple indirect restorations, the technician's aim is normally to provide a restoration which contributes to the patient's occlusion without changing the jaw relationship (conformotive approach[4]). If the occlusion of the casts differs from that in the patient, then it is possible that some of the technician's hard work that goes into providing an indirect restoration will be wasted and the likelihood is that the dentist will find that "the bite is wrong" when the restoration is tried on the preparation at the fit stage. This not unfamiliar scenario can be a source of friction between the clinician and technician. Care taken by both parties minimises but does not necessarily eliminate the chance of error. Because both parties rarely work in the same place there may not be the opportunity to jointly discover the reason for the error.

In order to prevent the restoration being made to an inaccurate occlusal relationship it would be helpful to have the means of checking the occlusion of the casts before starting to make the indirect restoration: the E.D.E.C. principle[5] (Examine, Design, Execute, Check) has been proposed as one way of minimising the introduction of unintentional changes in occlusal relationships. If it can be confirmed in the dental laboratory that the models exhibit exactly the same occlusal contacts as the patient the combined skills of the clinician and the technician can potentially result in an indirect restoration with appropriate occlusal contacts. It follows, that the process of occlusal registration during the construction of an indirect restoration requires a reliable system to validate it's accuracy. To date there does not appear to be any simple means of doing this with a proven level of inter and intra operator reliability.

Previously, the 'Occlusal Sketch' has been shown to be a reliable way for clinicians to record marked occlusal

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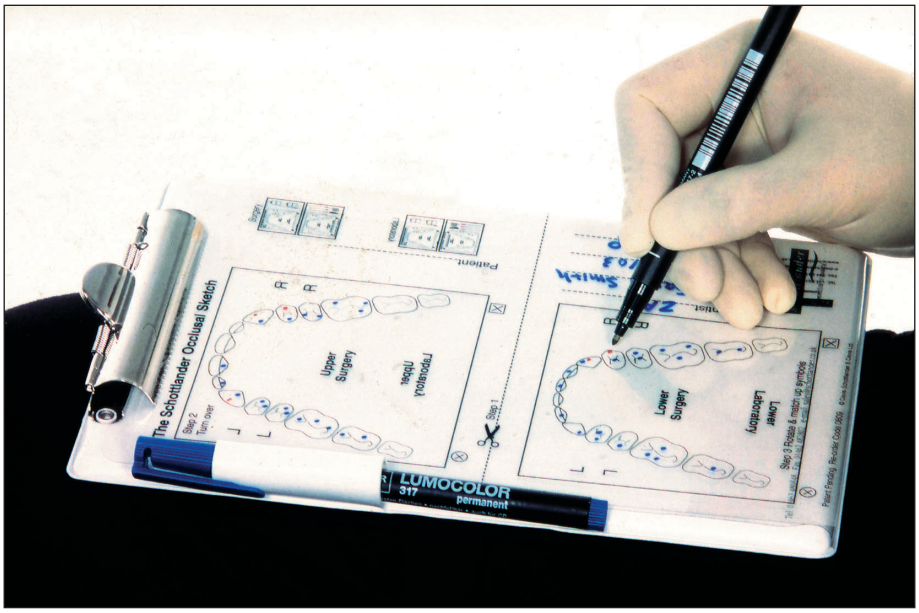

Figure 1. *The 'occlusal sketch'*

contacts[6]. In brief the 'Occlusal Sketch' (*Figure 1*) comprises an acetate sheet which displays diagrammatic representations of the occlusal surfaces of the posterior teeth, the palatal surfaces and incisal edges of the upper anterior teeth; and the lingual surfaces and incisal edges of the lower anterior teeth. It offers the possibility of a geometric approach to recording occlusal contacts. It is configured so that the lower teeth are viewed as if from above by direct vision and the upper arch is a mirror image. This is the same view experienced in a clinical examination of a supine patient. Since the occlusal sketch is made from transparent acetate which allows the sketch to be viewed from both sides, it can be seen from both the clinician's and technician's perspectives.

AIM OF STUDY

The aim of this study was to test whether the 'occlusal sketch' technique could be used as an accurate and reproducible means of communicating occlusal contacts between the clinician and dental laboratory technicians.

OBJECTIVES

To see whether dental technicians were able to detect differences between the occlusion as marked with articulating paper on some articulated casts and the occlusal contacts as marked by a clinician on an 'Occlusal Sketch'.

MATERIALS AND METHODS

The static occlusal contacts of 30 sets of upper and lower casts, (none of which exhibited ideal tooth and arch morphology) were marked using articulating paper (Bausch 010) and then recorded by the 'occlusal sketch' technique, as previously described[6]. All 'occlusal sketches' were completed by a single clinician (SD) and the reliability of this procedure has been previously reported[6].

These 30 sets were randomly assigned to 2 main groups.

Table 1. *Summary of the changes made to marked occlusal contacts*

Group (n)	*Change in marked occlusal contacts*
1 (15)	No change in contacts
2i (5)	Up to 3 additional contacts
2ii (5)	Up to 3 contacts removed
2iii (5)	Up to 3 contacts added or removed

Group 1 comprised 15 casts in which the marked contacts were left unaltered; In Group 2 consisting of the other 15 casts the marked contacts were deliberately changed. In Group 2i 5 models had up to 3 additional occlusal contacts marked. The additional contacts were marked on the casts by applying pressure through the articulating paper onto the stone teeth of the cast by means of a ball-ended burnisher. In Group 2ii a further 5 models had up to 3 marked occlusal contacts removed by carefully scraping with a suitable dental instrument. In the final 5 sets of models (Group 2iii), no more than 3 changes (addition or removal of contacts) were made (*Table 1*). The marked casts were then transferred to the dental laboratory and the sketch reconfigured to facilitate use by the dental technician. This involved cutting the sketch to separate the upper and lower arch records, turning the upper arch record and rotating the lower arch record. The sketch was therefore configured so the arches were viewed from the front, (as opposed to the clinical perspective of viewing a supine patient from above; *Figures 2a* and *2b*).

Three dental technicians, none of whom had any previous experience with the 'occlusal sketch', were asked to view the casts and sketches. Each was invited to independently judge whether the occlusion as marked on the casts was accurately represented by the accompanying 'occlusal sketch'. If the relationships were considered to be inaccurate the technicians were asked to state whether the occlusion on the models had been subjected to addition (extra marks), subtraction (fewer marks) or substitution (same number of marks, some in different locations) (See Guidance to Technicians *Figure 3*).

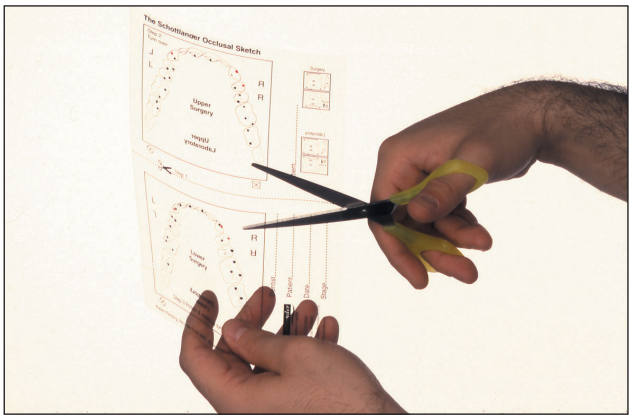

Figure 2a. *The sketch is cut to separate the upper and lower arch records.*

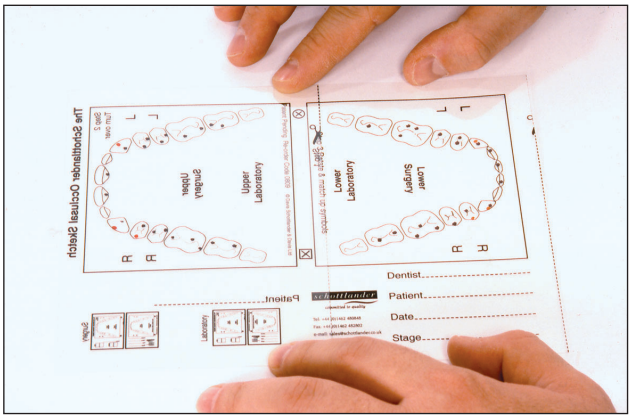

Figure 2b. *The reassembled occlusal sketch for comparison against mounted models.*

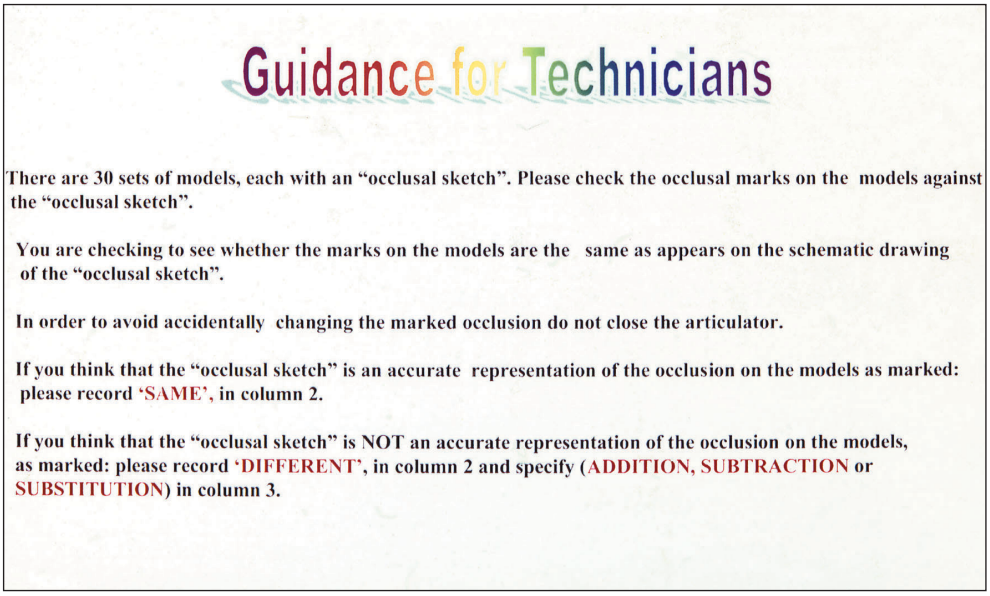

Figure 3. *Guidance for technicians.*

RESULTS

The results were assessed for inter operator reliability by calculating Kappa coefficients[7]. The Kappa statistic reflects the degree of agreement between examiners corrected for chance. The coefficients of Kappa agreement are displayed in *Table 2*.

The strength of agreement between examiners is displayed in *Table 3* and were 0.98, 1.00 and 1.00. This means that there is an almost perfect degree of agreement between three dental technicians who were involved in the study. All three technicians were able to detect changes from the 'occlusal sketch' irrespective of whether occlusal markings had been added, removed or substituted on the casts.

Table 2. *The accepted Kappa strength of agreement.*

Value	*Kappa strength of agreement*
0–0.01	Poor
0.01–0.20	Slight
0.20–0.41	Fair
0.41–0.60	Moderate
0.60–0.80	Substantial
0.80–1.00	Almost perfect

DISCUSSION

No bite registration technique or material is guaranteed to be without error. Even if the perfect material and technique did exist, there still remains the possibility of error when articulating dental casts.

The 'occlusal sketch' technique has been shown to be a reliable means for dentists to record occlusal contacts made using a thin articulating paper. Hence it would be useful if the technician could use this 'occlusal sketch' to check whether the mounting of casts was an accurate representation of the clinically recorded occlusal contacts. If the initial mounting of the casts is not accurate the dentist can either repeat the registration, occlusal record or impression, or alternatively, the technician can make careful deliberate adjustments to the occlusal surfaces of the models (model grooming)[4] before embarking upon the construction of an indirect restoration in order to repli-

Table 3. *The Kappa strength of agreement of the median for each pair of examiners.*

Examiners	*Kappa agreement 'Median'*	*Kappa strength of agreement*[7]
AvB	0.98	Almost perfect
BvC	1.00	Almost perfect
AvC	1.00	Almost perfect

cate clinically determined occlusal contacts on the dental casts. This could subsequently reduce the distressing and common finding at the fit of the restoration that the "bite is wrong". This study confirms the reliability of an 'occlusal sketch' as a means of allowing technicians to compare the occlusal contacts of dental casts with a clinical representation of occlusal contacts in the form of a carefully structured diagram.

MANUFACTURERS' DETAILS

- © Schottlander Occlusal Sketch, Letchworth, UK
- Bausch Dental, Köln, Germany

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