

Comparison of Interocclusal Contacts Registered Intraorally and After a Remount Procedure in Complete Denture Patients.

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Abstract - Prosthodontists recommend a remount procedure for identification and correction of occlusal errors in complete dentures rather than the more common practice of placing articulating paper intra-orally, followed by 'spot-grinding' at the chair-side. There is no evidence to support this recommendation. The aim of this study was to compare the number and distribution of occlusal markings obtained using a remount procedure with those achieved using articulating paper intra-orally. 147 edentulous subjects with newly constructed complete dentures participated. In all cases the remount method produced a significantly lower number of occlusal contacts compared with articulating paper used intra-orally ($p < 0.001$). The distribution of occlusal markings was also different between the remount and intra-oral methods. These results suggest that, for complete dentures, articulating paper used intra-orally is inaccurate compared with a remount procedure.

KEY WORDS: Complete denture occlusion; remount; articulating paper (foil)

INTRODUCTION

There has been prolonged debate, over many decades, regarding the preferred occlusion for complete dentures. Much of the debate has centred around various contentious issues such as the correct jaw relationship to be used (there are presently 7 different definitions for centric relation in the Glossary of Prosthodontic Terms)¹; whether the occlusion should be balanced²⁻⁶ or not⁷⁻⁹ and the use of lingualised occlusion¹⁰. However, there does appear to be a general consensus amongst prosthodontists on the analysis and adjustment of complete denture occlusion, once the complete dentures have been finished.

The recommended method for occlusal analysis and adjustment is to remount the dentures in an articulator using a pre-contact interocclusal (or "check-bite") record¹¹⁻¹⁶. There are specific guidelines for the adjustment of complete denture occlusion, giving priorities to the supporting and working cusps of the artificial teeth^{17,18}. Some authors have suggested that a remount procedure should be carried out routinely for all newly constructed complete dentures before they are delivered to the patient^{12,14,17}. Reasons given for this include:-

- processing errors¹⁵⁻¹⁹
- polymerisation contraction of polymethyl methacrylate^{17,18}
- errors in recording centric relation^{12,18}
- displacement of the edentulous mucosa^{20,21}
- unfavourable oral anatomy¹⁸
- improvements in patient comfort¹²

Although there seems to be a general consensus about the merits of a remount procedure, no evidence to support this assertion could be found in the literature. A great deal has been published about the procedures involved in a remount procedure¹¹⁻²⁰.

Despite the majority of prosthodontists recommending a remount procedure¹³ and most dental schools teaching the importance of this approach²²⁻²⁴ the majority of dentists in general practice seem to prefer other quicker and more convenient methods for correcting complete denture occlusion^{23,24}.

Articulating paper, or some other marking medium, is placed between the occlusal surfaces of the denture teeth and the patient asked to bite with or without the clinician stabilising the lower complete denture. The occlusal markings produced are then used to adjust the occlusal surfaces of the denture teeth in an attempt to achieve occlusal harmony^{11,20}.

The aim of this study was to compare the number of occlusal contacts achieved using the recommended remount procedure by means of a pre-contact interocclusal wax (check-bite) record with those achieved using articulating paper intra-orally with and without stabilisation of the lower denture. The hypothesis was that a premature occlusal contact would cause displacement of the dentures giving rise to additional, spurious occlusal markings when using articulating paper intra-orally.

MATERIALS AND METHODS

A total of 147 subjects were included in this study and all subjects were edentulous in both maxillary and mandibular arches. 101 patients were female (69%) and 46 were male (31%). The mean age of the subjects was 67 years with an age range of 39-92 years.

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At the insertion stage of newly constructed complete dentures, articulating paper (Radar Horseshoe 65 μ) was placed intra-orally between the occlusal surfaces of the dentures to identify the initial occlusal contacts both with ('articulating paper, stabilised') and without ('articulating paper, biting freely') stabilisation of the lower denture.

The mandibular denture was stabilised by the operator placing both index fingers intraorally on the buccal flanges with the thumbs extraorally on the chin, whilst guiding the jaw into centric relation (as described in Boucher's prosthodontic treatment for edentulous patients¹⁸).

A photographic record of the occlusal marking scheme on both dentures was made for each method. Figure 1a shows a typical example of the occlusal marks obtained with the subject biting freely on both dentures. Figure 1b shows the marks obtained with the same patient biting on articulating paper with the mandibular denture stabilised by the operator.

A pre-contact interocclusal check-bite record was then made using softened dental modelling wax (Anutex

"toughened" dental modelling wax). The same method, as described above, was used for stabilising the mandibular denture whilst guiding the mandible into centric relation. Care was taken to ensure that the record was pre-contact and that there was no apparent displacement of either denture whilst making the record. The dentures were remounted in the semi-adjustable articulator (Dentatus) used for the construction of the dentures where the original mountings, using a facebow record, had been preserved (split cast method). If new mounting models were required, a new facebow record was made. Articulating paper was again placed between the occlusal surfaces of the dentures and the occlusal contacts were marked with articulating paper. A third photographic record of the occlusal marking scheme was made for both dentures (Figure 1c).

The photographs were developed as slides for projection and the number and distribution of occlusal contacts on each denture, for each of the three different methods, were recorded.



Figure 1a. Occlusal marks obtained - patient biting freely



Figure 1b. Occlusal marks obtained - mandibular denture stabilised



Figure 1c. Occlusal marks obtained - remount procedure

RESULTS

The mean number of teeth with occlusal marks for the three test methods is shown in Table 1. For the remount method the mean number of teeth was 5.7 (SD = 2.8); for the articulating paper lower stabilised method the mean was 8.8 (SD = 2.5) teeth and for the biting freely method the mean was 9.2 (SD = 2.5) teeth.

The mean number of occlusal markings for the three methods is shown in Table 2. For the remount method the mean number of marks was 7 (SD = 3.3); for the 'articulating paper lower stabilised' method was 11.7 (SD = 3.8) and for the 'biting freely' method was 12.7 (SD = 3.7).

The results were compared using one-way analysis of variance (ANOVA) with the level of statistical significance set at $p < 0.05$. There was no difference found between the intra-oral articulating paper methods. However, the mean number of contacts for the remount method was significantly lower than both the intra-oral methods at the $p < 0.001$ level.

In 56 of the 147 (37%) remounted cases only unilateral occlusal markings were obtained. Of those 56 cases only 7 (12.5%) showed unilateral occlusal marks using the intra-oral lower stabilised method.

All the other 140 (95%) intra-oral stabilised cases showed bilateral markings

All (147) biting freely cases showed bilateral markings.

DISCUSSION

Criteria for successful complete dentures must be the ability of the patient to wear the dentures comfortably, be pleased with the aesthetics and be able to function adequately. If the teeth meet evenly all around the arch at first contact and there are no interferences in excursive movements the dentures should prove successful. Patients must adapt to the new dentures and learn to function with them. With time and wear of the occlusal surfaces function should improve. However, with excessive wear of the occlusal surfaces the jaw relationships will alter. Most patients can cope with these gradual alterations but their neuromuscular adaptive abilities create habitual jaw movements and pos-

tures that are difficult (if not impossible) for the dentist to copy when making new dentures. The only reproducible horizontal jaw relationship is centric relation, but patients with an adaptive habitual path of closure may have difficulty in adapting to a new set of dentures, and may also present a challenge to the dentist when new jaw relationships are being recorded. The difficulties of recording jaw relationships for complete denture construction have been well documented in the prosthodontic literature¹⁸.

With gross resorption of the residual alveolar ridges, especially in the mandible, stabilisation of the mandibular denture becomes more difficult. Displaceability of the supporting mucosa can also give rise to stabilisation errors.

Occlusal adjustment of complete dentures should be more of a science, rather than an art. Structured guidelines have been described for occlusal adjustment, which give the correct priority to the cusps of the artificial teeth^{16,20}. However, when occlusal adjustment is attempted intra-orally, displacement of the denture bases after initial contacts have taken place may lead to more numerous and spurious occlusal marks.

Many prosthodontists advocate that a more accurate method for occlusal adjustment is to remount the dentures in an articulator following a pre-contact interocclusal registration, but this is rarely performed outside specialist practice^{22,23}. The reasons for this are numerous and complex, but probably include expediency, cost of additional clinical and laboratory time together with an additional delay in delivering the dentures to the patient. Due to this set of inter-related problems, many general practitioners continue to use articulating paper intra-orally to identify and help correct small occlusal errors by "spot grinding" at the chair-side.

The results of this study lend support to the assertion that this use of articulating paper leads to additional spurious occlusal contacts compared to a remount procedure. When using a remount the mean number of occlusal contacts was 7, while the mean for other two intra-oral methods was always greater (11.7 – 12.7 contacts). This difference was significant at the $p < 0.001$ level. Although these results clearly demonstrate an increased number of occlusal markings using the intra-oral methods, of much greater significance was that the distribution of the marks was different

Table 1. *Number of teeth with occlusal markings*

<i>N = 147</i>	<i>Check-bite record</i>	<i>Lower stabilised</i>	<i>Biting freely</i>
Total teeth	830	1297	1358
Means	5.65	8.82	9.24
Standard Deviation	2.77	2.54	2.49

Table 2. *Total number occlusal markings*

<i>N = 147</i>	<i>Check-bite record</i>	<i>Lower stabilised</i>	<i>Biting freely</i>
Total marks	1030	1712	1860
Means	7.01	11.65	12.65
Standard Deviation	3.31	3.82	3.71

between the methods and that for the intra-oral methods the markings were often on different teeth (or cusps) when compared with the remount procedure.

Of particular interest was the finding that in the majority of cases where the remount procedure produced unilateral marks, there were bilateral marks obtained with both the intra-oral methods. Where the mandibular denture was stabilised the bilateral markings were presumably caused by the maxillary denture tilting downwards.

The choice of 'Radar horseshoe' articulating paper (65µ) for this study was to simultaneously disclose bilateral occlusal contacts where they existed but also to demonstrate that tipping of the denture(s) took place when there was a unilateral premature contact, giving rise to spurious contacts on the opposite side of the arch. If unilateral articulating paper sheets had been used the total number of occlusal markings would have been reduced, but the overall result would have been similar as has been demonstrated by their being only 7 cases of unilateral markings with the intra-oral stabilised method compared with 56 with the remount method and none with the biting freely method. There are many different types of articulating papers / foils available commercially in varying thicknesses. The most commonly used in general practice and technical laboratories for denture work are 'Detex' (40µ Associated Dental Products, Swindon, UK); Bausch (40µ, Nashua, USA.); and 'Radar' (40µ, SVEDIA, Sweden). Another 'horseshoe' articulating paper is produced by Dr Jean Bausch in Koeln, Germany, but is 200µ thick. The thickness of the paper will have an effect on the occlusal marking schemes achieved – the thicker the paper then the more likelihood of it being dragged over the cusp tips and the less likelihood of it being pressed into the fossae. Radar horseshoe is reasonably thin, i.e. comparable with the ordinary sheet papers, but rigid enough to allow it to be manipulated easily over the occlusal surfaces intra-orally.

It is reasonable to assume that the additional marks found when using articulating paper intraorally have been produced by tilting of the denture bases thereby producing spurious contacts. This study strongly suggests it is difficult to adjust complete denture occlusion accurately without remounting the dentures in a dental articulator

At best it would be possible to identify only the initial premature contact. The operator would then need to decide the priority of the cusps for that particular occlusal scheme before attempting any occlusal adjustment. If spot grinding were used, it is likely that the occlusal scheme would be adversely affected. Furthermore, this form of occlusal adjustment would necessitate repeated use of articulating paper until the occlusal markings suggested even contacts all around the dental arch. Another major problem for this method is that it is very difficult for the operator to visualise the occlusion once the patient has closed the teeth together. Also, accurate adjustment of the occlusion for lateral and protrusive excursive movements would be extremely difficult.

Complete denture construction, unlike many other dental restorative procedures, involves several extended treatment episodes and several technical laboratory procedures. It seems pointless to ruin all this effort in only a few minutes by incorrect occlusal adjustment.

CONCLUSIONS

The use of articulating paper intraorally between the occlusal surfaces of complete dentures leads to more numerous, probably spurious occlusal markings compared with the use of a remount procedure. The distribution of the occlusal markings is also different, both in the number of teeth with occlusal markings and the distribution of marks on the occlusal surfaces.

RECOMMENDATIONS

The method of choice for the analysis and adjustment of complete denture occlusion is to remount the dentures in an articulator.

The practice of using an intra-oral marking medium for analysis and adjustment of complete dentures is inaccurate and should be avoided.

Manufacturers' details

Anutex toughened dental modelling wax, Associated Dental Products Ltd, Swindon, UK.

Dentatus model ARL articulator and facebow, Dentatus AB, Hagertsen, Sweden.

Radar Horseshoe 65µm articulating paper, SVEDIA Dental Industri, Enköping, Sweden.

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