DOES INDICATOR TYPE AFFECT MUSCLE ACTIVITY DURING OCCLUSION?

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INTRODUCTION

Occlusal indicators are widely used in the fitting of prosthetic devices [1]. A wide range of indicators exist ranging from articulating ribbons through to the T-Scan pressure measurement system. These devices differ not only in their measurement characteristics but also in their material properties such as thickness and plasticity. Previous studies have focused on comparing the sensitivity, reliability, validity and practical utility (benefit versus cost) of indicators from a marking perspective [1,2]. No study has investigated whether an indicator affects muscle function during occlusion, which represents a further threat to validity since this will, in turn, affect the nature of the occlusion recorded. This study aimed to determine whether four commonly used indicators (Parkell ribbon, articulating silk, T-Scan and articulating paper) affected neuromuscular function during occlusion.

METHODS

Eighteen healthy subjects performed three trials onto four indicators and onto natural dentition (Table 1). In the first trial they slowly brought their teeth together to form a stable occlusion and then bit onto the indicator, the second and third trials were maximum clenches held for 3 – 5 seconds. A bite onto cotton rolls was performed between each indicator to neutralise muscle activity and the order of indicators was randomised between subjects. Indicators were handled by a dental nurse and applied using standard clinical procedures. The same procedure was used for T-Scan as for the remaining three indicators to avoid any differences in neuromuscular function being attributed to the more obtrusive T-Scan mounting system.

Table 1. Indicator thickness.

Indicator	Parkell	Silk	T-Scan	Paper
Thickness (μm)	24	60	96	202

Note: Thickness measurements were obtained using a Sylvac system (www.sylvac.ch) with an accuracy of 0.1 μm.

Surface EMG were recorded bilaterally from the temporalis anterior (TA) and superficial masseter (MS). Maximum and mean amplitude and mean anterior-posterior coefficient (APC; [4]) were obtained from the processed EMG signals which were normalised to the global maximum amplitude. A questionnaire after each indicator asked the subject to rate the indicator on toughness, texture, bite effect and comfort on a scale from -3 to +3. Indicator effects on EMG parameters was assessed using repeated measures ANOVA with Bonferroni post-hoc analysis. Comparisons to natural dentition used paired samples t-tests. Indicator effects in the questionnaire responses was tested using Freidman. All statistical tests assumed a significance level of $p = 0.05$.

RESULTS AND DISCUSSION

There was a significant indicator effect for maximum activity of the MS and for mean APC. The T-scan and articulating paper had higher MS activity and less TA dominance than the Parkell and silk ribbons (p=0.026 and
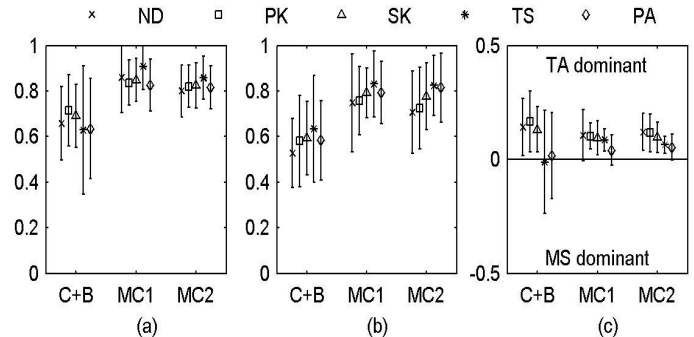
Figure 1. Maximum amplitude of the TA (a) and MS (b) and mean APC (c) in the contact and bite and maximum clenches for each indicator and natural dentition.

0.013 respectively; Figure 1). A significant indicator effect was also observed in the questionnaire results between the T-scan and paper versus Parkell and silk. Comparing each indicator to natural dentition, significant differences were obtained for T-Scan in MS activity and both T-Scan and articulating paper in APC ($p = 0.018$, 0.050 and 0.048). The results indicate that the two thickest indicators, T-Scan and articulating paper, give different neuromuscular function during occlusion compared to natural dentition, whilst the two thinnest, Parkell and silk ribbon, show no difference. Hence, the thickest indicators may not be valid for recording the occlusal contact in natural dentition. Their response is closer to that observed for clenching onto cotton rolls than onto natural dentition [4].

The similarity in neuromuscular response between T-Scan and paper suggests that it is not only indicator thickness that affects neuromuscular response but also material properties. T-Scan was less than half the thickness of paper and closer to silk in this regard (Table 1). However, it was far more plastic than the other indicators and was also much stiffer in compression, reducing its ability to conform to the occluded surface. It may have been these properties, in combination with thickness that generated the observed response.

CONCLUSIONS

T-Scan and articulating paper influence neuromuscular function during occlusion and therefore may not be a valid means of identifying occlusal contacts that are assumed to occur under natural dentition conditions.

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