The Reliability of a New Device for Measuring the Proximal Contact Strength

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Introduction

When different investigators use a measuring device within the scope of a study, particularly in multicenter studies, their calibration is essential for the reliability of the results.

Objectives

The purpose of this study was to test the inter- and intra-examiner reliability of a recently developed instrument for measuring the proximal contact strength (Tooth Pressure Meter: TPM, based on the publication of Dörfer et al. 2000).

Material and Methods

Subjects

Ten healthy adults with complete dentition and no signs of periodontitis or caries volunteered in this study. Inclusion criteria were continuous dental arches including the second molars, full eruption and occlusion of teeth, contralateral teeth and antagonists, no orthodontic banding or intra-oral prosthesis.

Measuring device: Tooth Pressure Meter (TPM)

To measure proximal contact strength, frictional forces at removal of a straight 0.05 mm thick metal matrix band inserted between adjacent teeth were recorded. Custom-written software in Excel (MS Office) was used for data acquisition and for the construction of diagrams relating force (N) to seconds (s). Proximal contact strength was quantified as the maximum frictional force. Visible irregularities of the graph, e.g. due to deformations of the metal matrix band during positioning, precluded the inclusion of the data for analysis and led to a repetition of the experiment.
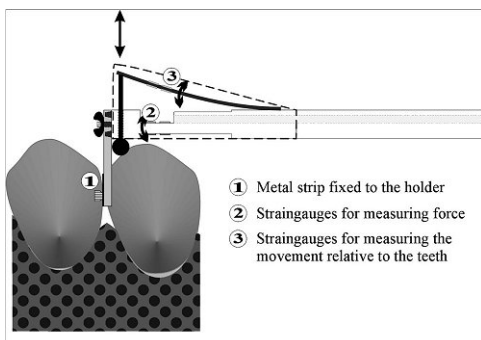

① Metal strip fixed to the holder
② Straingauges for measuring force
③ Straingauges for measuring the movement relative to the teeth

Fig. 1: Schematical diagram TPM, mode of functioning.

Fig. 2: Lateral view (left), frontal view (right).

Study Protocol

All contacts between the canine and the second molar were measured from mesial to distal either in the upper right and lower left or in the upper left and lower right quadrant. The order was randomly selected. Without any prior calibration, two investigators (I1 and I2) measured all interproximal contacts in alternate order two times (T1 and T2) each. The sequence of the investigators was randomly given as well.

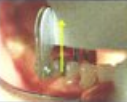Fig. 3: TPM before measurement between the lower right second premolar and first molar.
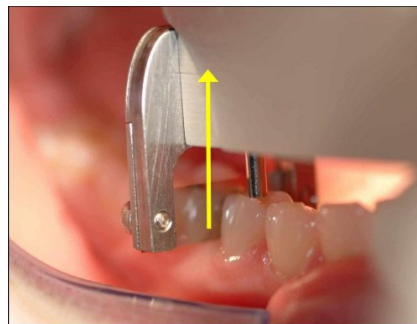
Fig. 4: Removal of metal matrix band of the TPM inserted between adjacent teeth.

Procedure for each interproximal contact:
- A minimum of 3 measurements
- All measurements in a maximum range of 0,5 N
- Avarage of three measurements was used for further analysis

The TPM diagram

Axis of abscissae: Force [N]

Axis of ordinates: Sample [Nr], (500 samples, 1 sample/ 20 ms)

Red graph: Measurement of proximal contact strength [N]

Blue graph: Reference measurement [N]

Fig. 5: TPM diagram relating force (N) to seconds (s).

Statistical Analysis

Intra-examiner reliability: Standard deviations of single measurements between the first and the second measurement separately for both investigators were taken.

Inter-examiner reliability: Standard deviations of single measurements between the two examiners at the first and second measurement were taken.

The Wilcoxon test for paired samples was used for data-analysis.

Results

<table>
<tr><td>Intra-examiner reliability:</td><td>Inter-examiner reliability:</td></tr>
<tr><td>For I1: 0.33 ± 0.28 N;</td><td>On T1: 0.47 ± 0.42 N;</td></tr>
<tr><td>For I2: 0.36 ± 0.31 N (p > 0.05)</td><td>On T2: 0.36 ± 0.35 N (p = 0.04).</td></tr>
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Conclusions

It is concluded that the TPM produced reliable results. The reduction of the inter-examiner reliability between T1 and T2 indicates, that calibration is necessary to generate more reproducible results.

This Poster was submitted by Dr. Diana Wolff.

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