Influence of different parameters during polishing: a pilot study with 10 dental technicians

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Introduction
A surface as smooth as possible is unavoidable. Admittedly, the mirror finish during the CAM process is not possible yet. In this way polishing with the aid of a dental hand-piece is a really alternative to the conventional final firing for dental ceramics.

Objectives
The aim of this study was to examine different parameters during the dental polishing process (Fig. 4) by ten different dental technicians concerning their individual way to work. Emerging contact forces and emerging temperature were two of the parameters examined in this study. Another one was to find out how long the technicians would need to polish a defined surface area and how the different materials would behave. Finding the right method for the temperature measurement was our problem therefore we decided to make the measurement with infrared to the surface of the probes [1].

Material and Methods
Four different materials were tested. 1) Profix (Merz), 2) CAD Temp (Vita), 3) Zeno CAO temporary PMMA (Wieland Dental & Technik) and 4) Mark II (Vita). Every sample 10x8x2 mm was made out of cerec-blanks (Fig 2.). The plastic interim arrangements were polished with Technik Polisher medium and fine (EVE), the leucite ceramic with Diapol medium and fine (EVE). The contact pressure was measured by a load cell (Lorenz K13); its measurement range is 0.01 N - 10 N, the accuracy is 0.5 N (Fig. 1) The surface temperature in direct nearness to the polishing process was detected by infrared and additionally the warming of the whole sample by direct contact measurement (Testo temp Sensor 845) (Fig. 3).

**Results**

In chart 1 and 2 you can see the individual contact force of each technician. You can see this also in chart 3 showing the average contact force over the four different materials. If you oppose this to chart 4 and if you take the mean of the contact forces you will get the average force of 1.15 N (SD 0.68 N).

Chart 5 and 6 show different temperature maxima measured on the sample surfaces. The warming of the samples caused by the polishing process is measured by a thermocouple element. The average warming in chart 7 and 8 was 36.92 °C with a statistical spread of 6.52 °C in chart 7 plus a clear adjustment to the mean in chart 8. This fact is valid for all tested materials. The average time used to polish the samples is 46 sec. This was detected after 80 stages.

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**Chart 1** The individual contact forces on the sample Zeno CAO temporary PMMA (Wieland Dental & Technik) of each technician.

**Chart 2** The individual contact forces on the sample Mark II (Vita) of each technician.

**Chart 4** Describes the contact force over all technicians depending on the materials.

**Chart 3** Shows the average contact force of each technician over the four materials.

**Chart 5** The average temperature on the sample Zeno CAO temporary PMMA (Wieland Dental & Technik) during the polishing process of the technicians.

**Chart 6** The average temperature on the sample Mark II (Vita) during the polishing process of the technicians.
Conclusions

The average contact force was determined and generated by ten dental technicians with 80 sample runs. The average force of 1.15 N which we found out is similar to the forces 1N for a medium polishing wheel and 1.3 N for a fine polishing wheel which was used in the test by Ahmad [2]. The mode of operation for each technician is individual and independent from the qualities of the used materials. Considering the cross check, leucite ceramic Mark II (Vita), you can see that the processing forces have the same average value as the plastic ones. The same goes with the temperature. No material attracts attention deviating from the average. The question which comes into our mind is: why is it that although some of the probates had an obvious higher contact force the temperature did not rise the same way? Is it because of the polishing process duration? But also a longer duration of the process does not mean that the temperature is going higher.

There might be some more parameters not described in this poster as a reason for this like the rapidness of the moved polisher since they were not subject in this study.

Summarizing it can be said that:

- The mode of operation for each technician is individual, concerning the contact force and the time used for polishing.
- The measurement cycles with the highest rate of contact force and longest used handling time do not make the highest rate in temperature. Minor contact force and short process time does not guarantee a low warming.
- We can say that all the data produced are close to the arithmetical average.

Literature


This Poster was submitted by Harald Zugfil.
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Influence of different parameters during polishing: a pilot study with 10 dental technicians

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Introduction

A surface as smooth as possible is unavoidable. Admittedly, the mirror finish during the G90 process is not possible yet. This is why polishing with the aid of a dental hand-piece gets more and more important than the conventional fine filing or the polishing in stages.

Aim of the study

The aim of this study was to examine different parameters during the dental polishing process by ten different dental technicians concerning their individual way to work.

Emerging contact forces and emerging temperature were two of the parameters examined in this study during a polishing process by a dental technician. Another one was to find out how long the technician would need to polish a defined surface area and how the different materials would behave.

Materials and Methods

Four different materials were tested: 1) Prele (Dental), 2) CAD Temp (Vita), 3) Zeno CAD temporary fillings (Aesthetic Dental & Technology), and 4) Mark II (Vita). Every sample 16x8x2 mm was made out of structurally similar plastic (Fig 1). The plastic internal arrangements were polished with the dental abrader medium and fine discs, the lauramine with Diamax medium and fine (DIF). The contact pressure was measured by a load cell (Lombard Y3), its measurement range is ±100 N. The data is 0.1 N if Fig 1.

The surface temperature in direct measurement in the polishing process was detected by infrared and additionally the warming of the whole sample by direct contact measurement (Testo temp sensor 045) (Fig 3).

Results

In charts 1 and 2 you can see the individual contact force of each technician. You can see this also in chart 3 showing the average contact force of the samples. If you compare this to chart 4 and if you take the mean of the contact force you will get the average force of 1.6 N (± 0.02 N).

Charts 5 and 6 show different temperature maxima measured on the samples. The warming of the sample was caused by the polishing process and measured by a thermocouple element. The average warming in chart 7 and 8 was 30.2°C with a temperature spread of 8.89°C in chart 7 plus was used adjustment to the mean in chart 8. This fact is valid for all tested materials.

The average time used to polish the samples is 86 seconds. This was detected after 60 stages.

Discussion

The average contact force was determined and generated by 10 dental technicians with 80 sample runs. The mode of operation for each technician is individual and snapshotted from the qualities of the used materials. Considering the same shade, two equally ceramic Mark II (Vita), you can see that the processing force has the same average value as the plastic ones. The same goes with the temperature. No material affects attention during a polishing even the average. The question which comes into our minds is why it is that although some of the products had a slightly higher contact force the temperature did not rise the same way? It is because of the polishing process duration but also a longer duration of the process does not mean that the temperature is going higher.

There might be some more parameters not described in this poster as a reason for this like the experience of the newest polishers since they were not subject in this study.

Summary

- The mode of operation for each technician is individual, concerning the contact force and the time used for polishing.
- The measurement cycles with the highest rate of contact force and duration used.
- Loading time does not make the highest rate in temperature. Minor contact force and short process time does not guarantee a low warming.
- We can say that all the data produced are close to the arithmetic average.

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