Fracture Performance of Provisional Crown & Bridge Restoration Materials

M. Rosentritt, R. Lang, G. Handel
(Regensburg University Medical Center, Department of Prosthetic Dentistry, Germany)

Universitätsklinikum Regensburg

62

Introduction:

High strength of modern provisional materials is important for extending the time for clinical application. It was the aim of this study to determine fracture resistance and fracture toughness of different provisional restorative materials including an experimental material.

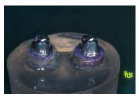
Materials and Methods:

The in-vitro study fracture strength of three-unit bridges of provisional crown & bridge materials was determined. Identical alloy dyes (Biosil F, DeguDent, G) were fixed in resin at a distance of 10 mm simulating a posterior gap. An artificial periodontium was provided with polyether impression material (Impregum, 3M ESPE, USA). All bridges were bonded with RelyX Temp NE (3M ESPE, USA). Ten samples of each group were stored in aqua dist. for 14 days and subsequently submitted to thermal-cycling and mechanical-loading (TCML: 50 N, 480000 loadings; 1200x5℃/55°C). Occlusal wear was determined with 3D scanning. Ten samples of each material were stored for 24 hrs in aqua dist. as a control. All specimens were loaded to fracture (Zwick, G; v=1mm/min). Fracture patterns were determined optically. Independently fracture toughness K1c was determined (n=10). Medians and 25%/75% were calculated.
Statistics: Mann-Whitney-U-Test (α=0.05).

- **Luxatemp Fluorescence (DMG, G)**
- **Integrity Fluorescence (Dentsply, G)**
- **Structur Premium (Voco, G)**
- **Experimental Protemp 3M Espe, USA)**
- **Acrytemp (Pluradent, USA)**

Fracture Test

- identical alloy dies (Biosil F, DeguDent, G)
- distance of 10 mm simulating a posterior gap
- artificial periodontium with polyether impression material (Impregum, 3M ESPE, USA).
- cementation: RelyX Temp NE (3M ESPE, USA).



n = 20

STORAGE (n=10)
24 hours in distilled water
as a control group

TCML (n=10)
14 days in dest water +
Thermal **c**ycling
(1200x5℃/55℃, 2 mins each)
and **m**echanical **l**oading
(480.000x50N)

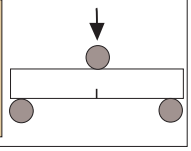
Fracture Test:
Universal testing machine Zwick 1446, G; v=1mm/min; a steel ball, 12.5 mm diameter.

3D Scan:
Willytec (München, G)
Statistical Analysis:
Median and (25%/75%)
Mann-Whitney *U* (α=0.05).

Fracture Toughness

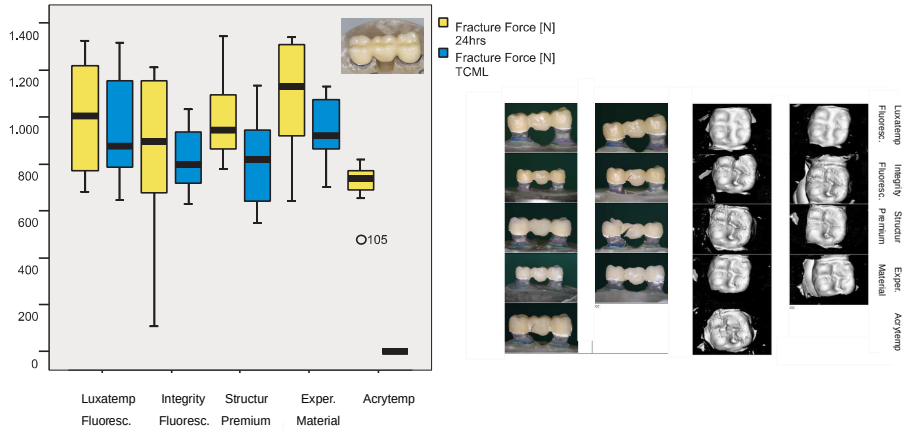
10 specimen (24*5*8mm) were made of each provisional crown & bridge material and were ground flat (grid 1000). With the help of a saw (Diadisc 4200, Mutronik, G) a 1.5 mm deep notch was made in the middle of on one small side. A razor blade was used to prepare a 0.1mm deep crack at the bottom of the notch. The bars were stored in distilled water for one week (37℃) and finally fractured in a three-point bending test (bearing: 20mm; v=0.5mm/min; Zwick 1446, D). The area of failure was measured under a microscope (magnification 10x) and the fracture toughness was calculated.

$$K_Q = \frac{P_Q \cdot S}{B \cdot W^{\frac{3}{2}}} \cdot f\left(\frac{a}{W}\right)$$

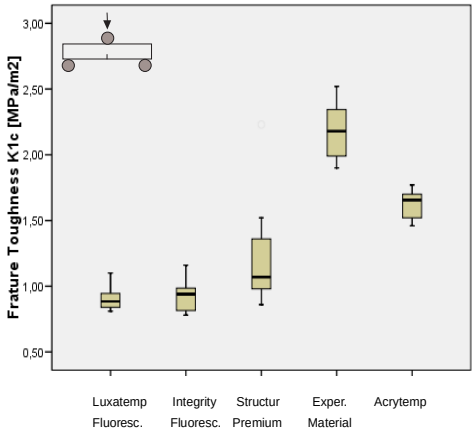


Results:

Fracture Test



Fracture Toughness



Conclusion:

The tested materials loose about 11-19% of their fracture strength due to TCML. One material even failed completely during aging. Among the surviving materials experimental Protemp showed the highest fracture resistance after TCML as well as highest fracture toughness and may be therefore considered for long-term temporization.