372

The influence of cement type on separation of the framework from prosthetic abutment after exposure to temperature

T.Linkevicius[1 2 3], E.Vindasiute[2 3], A. Puisys[2], T. Mickeliunas[4]

1 Vilnius University, Institute of Odontology 2 Vilnius Implantology Center 3 Vilnius Research Group 4 D.Pranulienes Dental Laboratory
Vilnius, Lithuania

Topic: Material research

Background and Aims

It is well known that cement-retained restorations on implants experience mechanical failures during the years of the service. Sometimes the complications are so severe that veneering porcelain correction or remaking of the prosthesis becomes valid options. In that case the restoration is usually retrieved together with prosthetic abutment from an implant, if permanent cement had been used for the fixation of the prosthesis. Therefore, it is important to separate the crown from the abutment without any damage to both.

The aims of the study were: 1) to determine the influence of type of cement on framework separation from the abutment; 2) to establish mechanical factors that have an impact on the strength of restoration adherence to the prosthetic abutments; 3) to estimate the average disintegration temperature for each cement.

Fig. 1. The occlusal view of cement-retained implant restoration after location of abutment holes.

Fig. 2. The restoration is retrieved together with the prosthetic abutment from the implant

Methods and Materials

120 prosthetic implant abutments (Prodigy; BioHorizons, Birmingham, AL, USA) of various diameter, namely 40 units of 3.5-mm (33.3%), 64 abutments of 4.0-mm (53.3%) and 16 units of 5.0-mm (13.3%) diameter were used in this study. The same amount of cobalt-chromium frameworks with occlusal openings were fabricated and placed on abutments with following cements - glass ionomer, modified with resins (RGIC) Fuji Plus (GC America, Alsip, IL), zinc phosphate (ZPC) Hoffmann's (Dental Manufaktur GmbH, Berlin, Germany) and dual cure resin (RC) luting cement Panavia F2.0 (Kuraray Medical, Osaka, Japan).

All specimens were divided into 4 groups: 1) polished abutments and passive frameworks; 2) polished abutments and non-passive frameworks. Every specimen was placed in a dental furnace (Vacumat 40T; Vita Zahnfabrik, Bad Sickingen, Germany) for 5 minutes in 300 Cº temperatures. The abutment and metal framework were tried to be separated. If not successful, the specimen was put to oven for 5 min increasing temperature for 50 Cº till 700 Cº.

Fig. 3. Before cementing

Fig. 4. Specimens after luting

Fig. 5. Separated frameworks

Results

1) RGIC exhibited the lowest separation temperature (p .05), but there was no difference between ZPC and RC (p> .05);
2) The passivity of the framework did not influence the height of the separation temperature (p> .05). Sand-blasted abutments correlated with a higher separation temperature only for ZPC (p< .0,5) and RC (p< .05);
3) Average separation temperatures: RGIC 306±23 C, RC - 363±71 C.

Cº	RGIC	RC	ZPC
300	37	20	17
350	1	0	3
400	2	13	0
450	-	3	0
500	-	4	0
550	-	-	0
600	-	-	11
650	-	-	0
700	-	-	1
Total	40	40	32

Table 1. Number of separated specimens

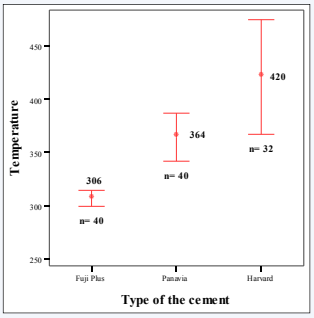

Fig. 6. Average separation temperature

Discussion

It seems, that temperature was a sufficient factor to cause cement burn out or become weakened, allowing the removal of suprastructure from the prosthetic abutment. Glass-ionomer cement disintegrated at the lowest temperature, followed by resin cement and zinc phosphate, and this resulted in statistically significant difference. In addition, 8 specimens in ZPC group could not be separated at all despite high temperature and physical efforts.

The maximum temperature of 700 Cº was selected to avoid the negative influence of the heat on titanium abutment and porcelain (Anusavice KJ, Gray AE). Oxidized layers appear on the titanium surface under exposure to temperature of approximately 750 Cº (Malinov S, Sha W, Voon CS). The process of surface oxidation may preclude the use of the same titanium abutment as it may not fit the implant. This is the reason why the possibly lowest cement disintegration temperature is desired. The results of this study are in the agreement with the case report by Alysiabi and Felton, who used temperature to separate cemented implant restorations from the prosthetic abutments affected by the abutment screw loosening. After successful disconnection abutments had been retightened back to the implants and new restoration were fabricated.

Manual separation technique may be listed as one of the limitations of the experiment. Nevertheless, it was chosen to simulate the dental technicians natural attempt to detach restoration from the abutment without any mechanical damage to both.

Conclusions

1) The separation of the framework from the prosthetic abutment was the most simple when RGIC was used;
2) Regarding 8 unseparated specimens and the highest separation temperature it could be concluded that frameworks cemented with ZPC were the most complicated to remove.

References

1. Anusavice, K. J. and A. E. Gray. "Influence of framework design, contraction mismatch, and thermal history on porcelain checking in fixed partial dentures." Dent.Mater. 5.1 (1989): 58-63.
2. Malinov, S., W. Sha, and C. S. Voon. "In situ high temperature microscopy study of the surface oxidation and phase transformations in titanium alloys." J.Microsc. 207.Pt 3 (2002): 163-68.
3. Alsiyabi, A. S. and D. A. Felton. "Technique for removing cement between a fixed prosthesis and its substructure." J.Prosthodont. 18.3 (2009): 279-82.

Presented at the 18th Annual Scientific Meeting of the European Association of Osseointegration – 30 September-3 October 2009, Monaco, France

EAO Monaco 2009