

## Thermic Treatments For Some Welded CoCrMo Alloys Used In Removable Partial Dentures Tehnology

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**INTRODUCTION:** Metallic alloys welding (laser welding and microplasma welding) in removable partial dentures technology was studied since 1990 [1,2,3.]. Thermal treatments tend to improve alloys and weldings quality.

**METHODS:** : There were used three alloys: WIRONIT (Bego), „C” alloy (Vaskut Kohaszati-KFT), HERAENIUM CE (Heraeus-Kulzer), which were casted in plate shape in charges. They were welded with Microplasma Welder (Schutz Dental) and then thermal treated using the same parameters (Fig.1).



Fig.1: a one wax pattren charge; b. Welder Schutz Dental, c. casted plates welding

**RESULTS:** 850°C and 950°C thermal treatments induced an increasing of Vickers hardness of welded areas, and fragility of the characteristic areas (BM, HAZ, WM). 1050° C temperature was benefit, the hardness and fragility were reduced (table 1)

Table 1 Welding after thermal treatment - Vickers hardness analyses

HERAENIUM CE (Heraeus Kulzer) Alloy WIROVEST investment material				
No.	Test areas	HV5Hardness		
		Welding after thermal treatments		
		850°C 6.1 + 6.2	950°C 6.3. + 6.4	1050°C 6.5 + 6.6
1	BM <sub>6</sub>	371	336	371
2	HAZ <sub>1</sub>	412	362	349
3	WM	386	473	362
4	HAZ <sub>2</sub>	401	345	345
5	BM <sub>2</sub>	391	367	376
WIRONIT (Bego) Alloy WIROVEST investment material				
No.	Test areas	HV5Hardness		
		Welding after thermal treatments		
		850°C/1h 2.1 + 2.2	950°C/1h 2.3. + 2.4	1050°C/1h 2.5 + 2.6
1	BM <sub>1</sub>	362	349	391
2	HAZ <sub>1</sub>	418	447	429
3	WM	502	396	412
4	HAZ <sub>2</sub>	423	418	401
5	BM <sub>2</sub>	381	371	367

“C”(Vaskut Kohaszati KFT) Alloy WIROVEST investment material				
No.	Test areas	HV5Hardness		
		Welding after thermal treatments		
		850°C/1h 4.1 + 4.2	950°C/1h 4.3. + 4.4	1050°C/1h 4.5 + 4.6
1	BM <sub>4</sub>	462	418	345
2	HAZ <sub>1</sub>	401	401	423
3	WM	447	460	401
4	HAZ <sub>2</sub>	412	412	396
5	BM <sub>2</sub>	460	376	371

After electropolishing thermal treated weldings hardness parameters indicated a small growth and therefore a fragilization of welded characteristic areas (BM, HAZ, WM) appeared. Microscopic structural analyses noticed welding defects, and some cracks in base materials (Fig.2).

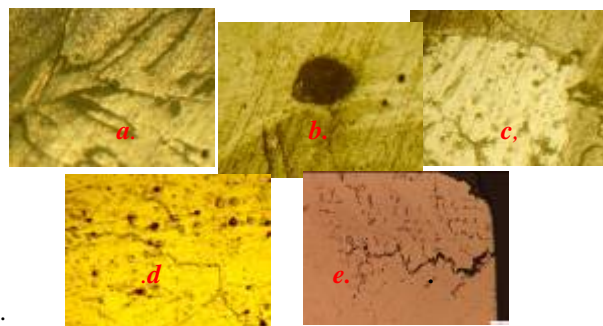


Fig. 2. Welding structural analyses: a. welding, b. welding defect, c. HAZ, d., base material cracks

### DISCUSSION & CONCLUSIONS:

The best behavior to thermal treatment and welding had HERAENIUM CE alloy, the others needed some cooling precautions, possible another thermal treatment at 1050-1150°C. Hardness quality conditions which guarantees prosthetic pieces durability are between 300 HV and 410 HV.

**REFERENCES:** <sup>1</sup>C. Bertrand et al., 2004: *Optimization of operator and physical parameters for laser welding of dental materials.* BDJ 196, 413. <sup>2</sup>B.Ghiban et al. 2007: *Structural features in cobalt based alloys for dental applications,* Bull. Transilvania Univ. Brasov, vol.II:80-86. <sup>3</sup>Wang RR et al. 1998.: *Thermal modeling of laser welding for titanium dental restorations.* J Prosthet Dent. Mar; 79(3):335-41

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