International Poster Journal IPJ of Dentistry and Oral Medicine

Int Poster J Dent Oral Med 2009, Vol 11 No 4, Poster 461

Optimization of processing parameters involved in dissimilar welding of dental alloys

Language: English

Authors:
Assist. Prof. Dr. Sorin Porojan, Assoc. Prof. Dr. Liliana Sandu, Assist. Prof. Dr. Florin Topala, Prof. Dr. Cristina Maria Bortun,
"Victor Babes" University of Medicine and Pharmacy Timisoara, University School of Dentistry, Timisoara, Romania
Techn. Marian Iacob,
National R&D Institute for Welding and Material Testing Timisoara, Romania

Date/Event/Venue:
September 24-27, 2008
FDI Annual World Dental Congress
Stockholm, Sweden

Introduction

Differences between clasps removable partial dentures and composites dentures are functional and aesthetical. The last ones need the using of some special maintaining, support and stabilization systems associated with high precision millings. The retention is assured by the attachment, and the high precision millings, meaning the shoulders and interlocks, guides support and stabilized the prosthesis. The composite solutions implies specific acknowledgments and performing laboratory endowment (1-6). Their technology brings often the need for joining dissimilar alloys.

Objectives

The aim of the study was to provide information for successfully joining of used alloy combinations.

Material and Methods

Microplasma welding allow to combine telescopic crowns with other types of attachments through secondary crown welding with metallic saddle of removable partial dentures, separately cast (Fig. 1-4). This manouevre is necessary for achieving of a high precision joining which doesn't deform the shape and position of telescopic crown.

Fig. 1: Telescopic crown framework with medial extention for welding

Fig. 2: Removable partioal denture framework after deflasking

Fig. 3: Welded framework applies on the cast

Fig. 4: Welding detail of telescopic crown to removable partial denture framework

The main advantages of microplasma welding are represented by the fact that the welding can be done directly on the working cast and one can work near the resigns or ceramics without affecting them. This fact determines time saveing. The reduced thermal influence implies minimal deformation of the metalic framework.
The welding present some particularities depending on alloys composition and structures which must be welded. Because of, in the case of composite denture manufactory, it is necessary to combine two differtent alloys, one used for fixed compounds and other for removable compound, experimental analyses of dissimilary bonds were made.
Cast plates from Ni-Cr (Wiron 99, Wirocer plus, Bego, Bremen, Germany) and Co-Cr (Wironit extrahard, Bego, Bremen, Germany) dental base alloys were cast. They were welded using microplasma welding device (Schütz Dental, Rosbach, Germany) in butt joint configuration, with and witout filling material. The folowing process parameters were varied: power, time delay, meanwhile the argon quantity was maintain constantly. For plates welding folowing parameters were used: power 5, time delay 40 ms, argon quantity 5 liters/min. For filling material deposition the parameters were: power 4, time delay 35 ms, and the sane argon quantity. For modeling and smoothing: power 2, time delay 45 ms.
Welded specimens were analyzed macroscopically, microstructural and the microhardness were determined in the base metal (BM), welded metal (WM) and heat affected zone (HAZ).

Results

Metallographic analyses (Fig. 5, 6) and microhardness tests showed structural changes particularly in the HAZ, with precipitates of some compounds, which harden the respective area. The microhardness increasing in HAZ is not significant (table I). The cracks appear in welded material (WM) mostly at joints without filling material. Microcracks appeared also in Ni-Cr alloy. Wasn't observed significant differences at welding with different materials.

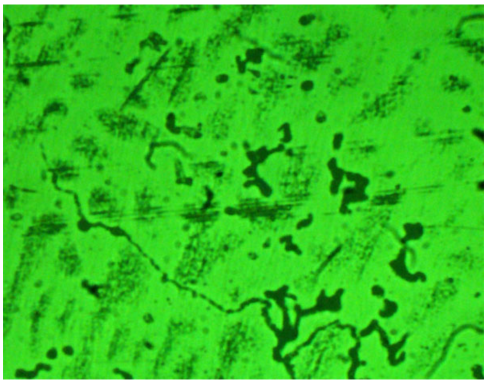

Fig. 5: Microcracks in base material (BM for Ni-Cr alloy)

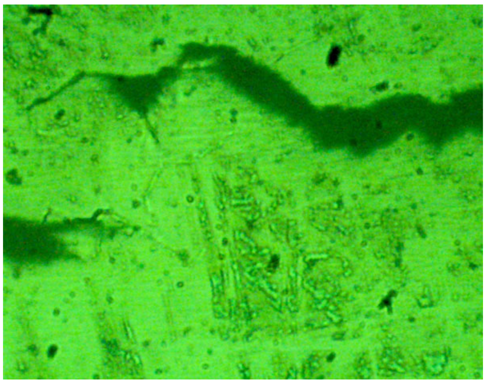

Fig. 6: WM cracks

Case	Welded alloys	Examinated area	Microhardness HV1
		BMNi	178, 171, 178
		HAZNi	290
1	Wiron 99 Wironit extrahard without filling material	WM	305
		HAZCo	439
		BMCo	378, 368, 378
		BMNi	182, 175, 178
		HAZNi	193
2	Wiron 99 Wironit extrahard with filling material (Co-Cr)	WM	313
		HAZCo	439
		BMCo	368, 389, 378
		BMNi	182, 189, 178
		HAZNi	197
3	Wiron 99 Wironit extrahard with filling material (Ni-Cr)	WM	321
		HAZCo	482
		BMCo	321, 313, 305
		BMNi	178, 175, 185
		HAZNi	201
4	Wirocer plus Wironit extrahard without filling material	WM	358
		HAZCo	401
		BMCo	378, 389, 368
		BMNi	185, 178, 175
		HAZNi	210
5	Wirocer plus Wironit extrahard with filling material (Co-Cr)	WM	269
		HAZCo	358
		BMCo	401, 368, 401
		BMNi	205, 201, 193
		HAZNi	305
6	Wirocer plus Wironit extrahard	WM	330

with filling material (Ni-Cr)	HAZCo	482
	BMCo	368, 358, 368

Tab. 1: Microhardness Hv1

Conclusions

Microplasma welding is appliable in joining of alloys wtih different composition. It makes possible obtaining of some high precision prosthetic pieces, which can satisfy actual exactigness. The microstructure depends on the processing parameters and the composition of the filler material.

Acknowledgments: This study was supported by the Grant CNCSIS 171/2007 from the Ministry of Education, Research and Youth Romania.

Literature

1. A.B. Carr, G.P. McGivney, D.T. Brown: McCracken's Removable Partial Prosthodontics. 11th ed. St. Louis: Mosby (2004).
2. T. Schneiderbanger: Der Einsatz des Lasers am Beispiel eines Klammerbruchs, dental-labor 2 (2000), pp. 207-209.
3. L. Hassan, A.S. Juszczyk, R.K.F. Clark: Immediate replacement removable partial dentures with cobalt-chromium frameworks: rationale, technology and a case report, J Oral Rehabil 32 (2005), pp. 772-775.
4. C. Bertrand, Y. Le Petitcorps, L. Albingre, V. Dupuis: Optimization of operator and phisical parameters for laser welding of dental materials, Br Dent J, 196(7) (2004), pp. 413-418.
5. G.E.P. Henriques, S. Consani, J.M.D. de Almeida Rollo, F.A. e Silva: Soldering and remelting influence on fatigue strength of cobalt-chromium alloys, J Prosthet Dent, 78 (1997), pp.146-152.
6. C. Bertrand, Y. Le Petitcorps, L. Albingre, V. Dupuis: The laser welding technique applied to non precious dental alloys procedure and results, Br Dent J, 190(5) (2001), pp. 255-257.

This Poster was submitted by Assist. Prof. Dr. Sorin Porojan.

Correspondence address:
Assist. Prof. Dr. Sorin Porojan
"Victor Babes" University of Medicine and Pharmacy Timisoara
University School of Dentistry
2 L. Blaga Str., App. 5
code 300002, Timisoara, Romania

Poster Faksimile: