*Short Communication*

# In Vivo Study of the Wear of a Reinforced Composite Used to Cover Implant-Supported Frameworks

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The goal of this study was to research the wear shown by a material (Cristobal+) offered as an alternative to ceramics in the covering of an implant-supported fixed prosthesis. Twenty-six active cusps were used in this study; the control group consisted of 12 cusps adjacent to restorations composed of Cristobal+. Five images were obtained from each sample and analyzed using computer software that creates an arch along each cusp, so each image gives the value of the radius described by that arch. If a sample showed any sign of wear, the values for the successive radii would be increasingly larger since a flattened arch would produce a larger radius. An analysis of the paired Student *t* test was applied. After assessing the results, a statistically significant difference in wear was noted ($P < .05$). Within the limitations of this study, it can be concluded that the wear of the cusps under function made with Cristobal+ reinforced composite was greater than that of the natural adjacent cusps. *Int J Prosthodont 2009;22:358–360.*

The success of implant prosthetic treatments involves interdependent factors related to the implant and prosthodontic rehabilitation.[1–4] One of the most important factors is the material with which the metallic framework is covered.

The goal of this study was to research the wear shown by a material (Cristobal+, Dentsply Detrey) offered as an alternative to ceramics in the covering of an implant-supported fixed prosthesis. The null hypothesis was that the rehabilitations made with this material would not show statistically significant wear when compared to natural teeth.

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## Materials and Methods

Ten patients with 26 prostheses restored using Cristobal+ were chosen from the Faculty of Dentistry, University Complutense of Madrid, Madrid, Spain. Fifty plaster casts (five for each patient) were obtained. Twenty-six active cusps (palatal cusps of maxillary premolars and molars and vestibular cusps in the mandible) were used in this study.

The control group consisted of 12 cusps adjacent to restorations made of reinforced composites and was considered a reference to an active cusp in a natural tooth. Since two patients had rehabilitations placed in different quadrants, there were 12 control cusps total in 10 patients.

To register the wear of active cusps, the same space arrangement was obtained for each cast by cutting until the grader indicated that the split cast was parallel to that formed by its natural cusp.

Casts were placed in a noncontact measuring microscope (WD-Ultra, Unceta) and through a visual display unit (QC200, Unceta) and the QC5000 system for Windows, the cast's front-to-back plane was determined to study the wear of the cusps of interest.

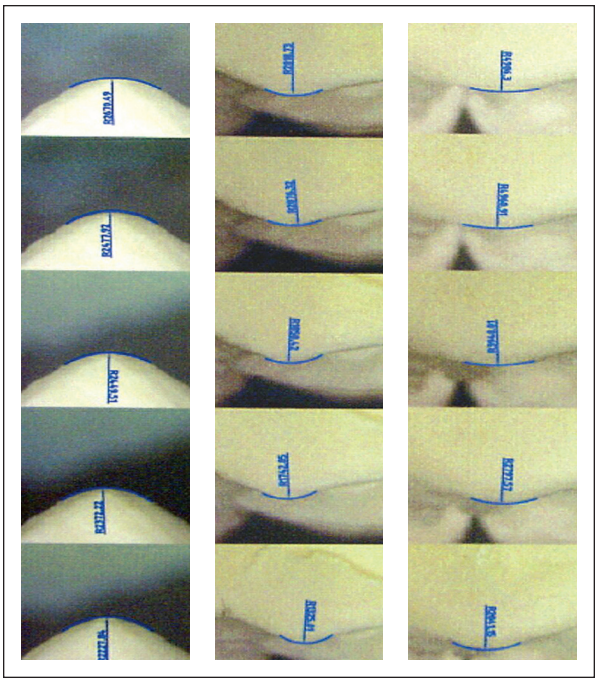

**Fig 1** Series of cusps of natural teeth versus cusps of Cristobal+. Each series is made up of five photographs corresponding to five different moments in time.

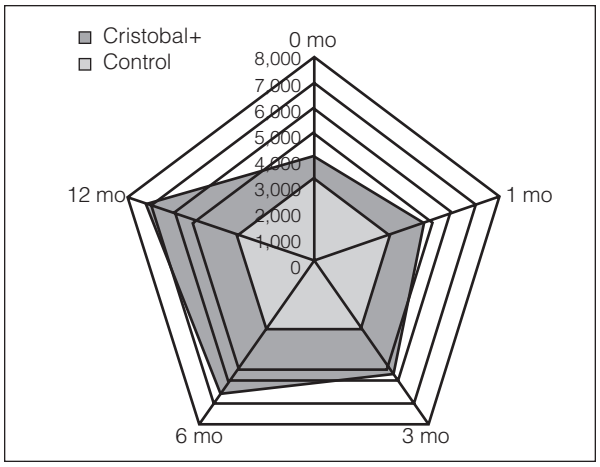


**Fig 2** Difference among radial values between Cristobal+ and natural (control) teeth.

**Table 1** Means and Standard Deviations (SD) of the Radii of the Cristobal+ and Control Cusps

| Time points (mo)* | Mean | SD | Minimum | Maximum |
|---|---|---|---|---|
| Control | | | | |
| 0 | 3,161.00 | 1,753.71 | 1,183.00 | 6,601.00 |
| 1 | 3,199.60 | 1,752.99 | 1,190.00 | 6,609.00 |
| 3 | 3,302.10 | 1,733.41 | 1,201.00 | 6,620.00 |
| 6 | 3,324.50 | 1,732.48 | 1,212.00 | 6,650.00 |
| 12 | 3,376.70 | 1,738.29 | 1,230.00 | 6,705.00 |
| Cristobal+ | | | | |
| 0 | 4,110.40 | 1,673.20 | 1,777.00 | 6,909.00 |
| 1 | 4,785.70 | 1,908.31 | 1,947.00 | 7,867.00 |
| 3 | 5,569.40 | 2,103.06 | 2,044.00 | 8,739.00 |
| 6 | 6,530.20 | 2,395.67 | 2,510.00 | 10,070.00 |
| 12 | 7,215.10 | 2,461.53 | 3,292.00 | 11,066.00 |

*No. of subjects = 10 for all time points.

Upon maintaining that position, a metallographic microscope (Olympus STM, Olympus) allowed the image to be centered. Five images were obtained from each sample the same day they were placed into the mouth and subsequently at 1, 3, 6, and 12 months later, taking five registers (models) of every specimen within the control group at each time point.

Then, the process to record the wear on the active cusps began. The images were analyzed using AutoCAD Architectural Desktop version 3.3 (Desktop). This software allows an arch to be traced and determined using three points by only varying its concavity-convexity, which were copied and superimposed on the images. Each image gives the value of the radius described by that arch (Fig 1). The unit for these measurements is not shown in microns. A randomly designated scale was applied to all measures.

All measurements were taken without knowledge of which cast was being studied. Therefore, the authors did not know the date on which a model was obtained, only that of moment 0 (baseline). A table of data was obtained by placing the images in a series from small to large and showing the date of each picture (Fig 1).

If a sample showed any sign of wear, the values for the successive radii would be increasingly larger since a flattened arch would produce a larger radius.

## Results

One hundred ninety results were obtained: 26 units made with Cristóbal+ (multiplied by 5 for the varying time points) and 12 control cusps (also multiplied by 5). An average of the arches described by the active cusps at each of the five temporal intervals was obtained. Differences among radii of the Cristobal+ and control cusps are shown in Fig 2. Standard deviations and means are reported in Table 1.

**Table 2** Student *t* Test Comparing Wear in Cristobal+ and Control Cusps

| Difference* | Lower CL Mean | Lower CL SD | Mean | SD | Upper CL Mean | Upper CL SD | Standard Error | *df* | *t* | *P* |
|---|---|---|---|---|---|---|---|---|---|---|
| Control_0 – Cristobal+_0 | −1,688.00 | 710.29 | −949.40 | 1,032.60 | −210.70 | 1,885.20 | 326.65 | 9 | −2.91 | .0174 |
| Control_1 – Cristobal+_1 | −2,411.00 | 792.94 | −1,586.00 | 1,152.80 | −761.40 | 2,104.60 | 364.55 | 9 | −4.35 | .0018 |
| Control_3 – Cristobal+_3 | −3,335.00 | 1,026.70 | −2,267.00 | 1,492.70 | −1,199.00 | 2,725.10 | 472.04 | 9 | −4.80 | .0010 |
| Control_6 – Cristobal+_6 | −4,536.00 | 1,279.00 | −3,206.00 | 1,859.50 | −1,876.00 | 3,394.60 | 588.01 | 9 | −5.45 | .0004 |
| Control_12 – Cristobal+_12 | −5,109.00 | 1,221.40 | −3,838.00 | 1,775.70 | −2,568.00 | 3,241.70 | 561.53 | 9 | −6.84 | < .0001 |

CL = confidence limits.
*No. of subjects = 10 for all groups.

An analysis of the paired Student *t* test was applied (Table 2). After assessing the results, a statistically significant difference in wear was noted ($P < .05$).

## Conclusion

Within the limitations of this study, it can be concluded that the wear of the cusps under function made with Cristobal+ reinforced composite was greater than that of the natural adjacent cusps.

## References


1. Kerschbaum T, Naert I, van Steenberghe D, Worthington P. Long-term Prognosis of Conventional Prosthodontic Restoration. Chicago: Quintessence, 1993:33–50.
2. Lindh T, Gunne J, Tillberg A, Molin M. A metal-analysis of implants in partial edentulism. Clin Oral Implants Res 1998;9:80–90.
3. Lekholm U, Gunne J, Henry P, et al. Survival of the Brånemark implants in partially edentulous jaws: A 10-year prospective multicenter study. Int J Oral Maxillofac Implants 1999;14:639–645.
4. Henry PJ, Laney WR, Jemt T, et al. Osseointegrated implants for single-tooth replacement: A prospective 5-year multicenter study. Int J Oral Maxillofac Implants 1996;11:450–455.


*Literature Abstract*

**Measurement of implant stability by resonance frequency analysis and damping capacity assessment: Comparison of both techniques in a clinical trial**


There are many available implant success criteria in the literature. However, there are currently no objective means of predicting implant treatment outcomes. Most practices rely heavily on clinical and radiographic findings but these are of limited value. A quantitative measurement technique that evaluates implant stability has been explored to provide a more reliable prognostication tool. The objective of this study was to evaluate the presumed correlation of the resonance frequency analysis (RFA) technique and the damping capacity assessment of Periotest equipment in a clinical trial. A total of 65 edentulous patients were included in the clinical trial; 45 were patients with loaded implants while 20 had the implants placed and measured immediately postsurgery. Solid screw Straumann implants were used in this clinical trial from June 2004 to April 2005. All measurement of implant stability was performed in triplicate by an experienced clinician with Periotest and Osstell equipment. In total, 105 implants were measured in the maxilla and 108 implants in the mandible. Results showed that the overall mean implant stability quotient was 57.66 ± 8.19 and the Periotest result mean was –5.08 ± 2.02. The correlation of RFA and Pertiotest values with implant diameter was statistically significant. However, no significant correlation was found with that of implant length. In conclusion, it was suggested that Osstell seems to be a more precise instrument for measurement of implant stability compared to Periotest, which displayed a relatively larger standard deviation. The reason for this deviation was attributed to various clinical conditions, such as handpiece angulation and point of measurement, when using the Periotest device.



**Zix J, Hug S, Kessler-Liecht G, Mericske-Stern R.** *Int J Oral Maxillofac Implants* 2008;23:525–530. **References:** 21. **Reprints:** Prof Dr Mericske-Stern, Department of Prosthodontics, School of Dental Medicine, University of Bern, Freiburgstr 7, CH-3010 Bern, Switzerland. Fax: +41 31 632 49 33. Email: regina.mericske@zmk.unibe.ch—*S. K. Lim, Singapore*