A New Design for Devices in Zirconia - Ceramic Partially Stratified, Part 1



16 Spectrum dialogue - Vol. 13 No. 3 - March 2014

The socio-economic changes that mark the new millennium, involve all sectors. Each individual is responsible, within his/her powers, to intervene by evaluating and, where necessary, by modifying, if possible positively, the work in progress, which is only the beginning of a new path.

Here, then, we have the dental industry, which was formed 20 or more years ago, going from a consolidated manual dental work, such as, for example, related to metal-ceramic, that it has found itself in a relative short time to deal with computerized methods such as CAD-CAM (Fig. 1 to 3).

As with all changes, it is necessary to follow a learning curve with all its stimuli, frustrations, thoughts, feedback etc. until we are back on track with new enthusiasm.

One of the problems that have plagued the prosthetic dentistry of this period is the exfoliation or the partial fracture of the ceramic coating of the new ZrO₂ (zirconia) structures, also known by the term "chipping".



Figs. 1 to 3: Structure in pre-sintered zirconia realized with A.R.D. (See Aesthetic & Technique of New Materials)

Fig.4: Each innovative proposal is a contribution to the vast "world" in constant flux of prosthetic dentistry especially in times of change with who knows which, and how many new other news...

Fig.5: Initial graphic draft of the new design for structures in ZrO₂ partially stratified

Figs. 6 and 7: Transfer on the pre-sintered zirconia of the functional paths: centric, protrusive and laterality DX and SX



Figs. 8 and 9: I leave in zirconia, the functional paths that starting from the centric points, run through protecting the entire interested area in the frontal sectors

Figs. 10 and 11: Infiltration with dedicated colours of the presintered zirconia with A-FRESCO technique

Figs. 12 and 13: Infiltration and subsequent sintering process for the correct construction of the structures, a fundamental point for the posteriors entirely in zirconia

the clinical performance of these devices. By modulating colours and thicknesses one can get special optical effects of light suitable for the integration of the prosthetic device.

Figs. 14 and 15: I have based myself on recent literature (4, 5 and 6) that highlights the opportunities and benefits of use of zirconia in all functional areas: in the frontal sectors particular to the functional path of the latero-protrusive and of the occlusal board in the posteriors entirely in zirconia

≈ceramill

Make more. With Ceramill.



Make more restorations in-house with the power, precision, and versatility of the Ceramill CAD/CAM system from Amann Girrbach, and you'll see more of some other things as well:

More Business

More Profits

Offer more services to current customers, and attract new ones by providing in-house speed and quality on a range of restorations that your competitors can't match. Expand your in-house offerings far beyond crowns to cover more complex, high-profit restorations, including full-contour bridges of

up to 14 units.

More Satisfaction

Use Ceramill's speed and efficiency to free more resources for complex cases, and position yourself as a valuable resource for clinicians and their patients.

For more information, contact an Amann Girrbach America representative today at **877.960.4393**, or email us at **info@amanngirrbachamerica.com**.



Ready to make more?

See Ceramill in action at a free Ceramill Live event in your area. Register today at **www.CeramillLive.com**, or call us toll free at **877.960.4393**.

Upcoming Ceramill Live Dates:

MARCH 4 Greenwood Vlg, CO march 5 Reno, NV

MARCH 5 Naperville, IL MARCH 6 Lancaster, PA

MARCH 6 Great Neck, NY

MARCH 6 Ft. Collins, CO

MARCH 11 Frederick, MD

MARCH 12 Eden Prairie, MN -

– максн 19 Marietta, GA

– MARCH 19 San Jose, CA

MARCH 20 Colorado Springs, CO

MARCH 25 Ogden, UT

MARCH 27 Greensboro, NC MARCH 6 Knoxville, TN

MARCH 11 Fresno, CA

MARCH 18 Charlottesville, VA

MARCH 19 Bloomington, IL

MARCH 20 Hartford, CT

MARCH 25 Santa Rosa, CA

MARCH 26 Salt Lake City, UT

MARCH 27 Marlton, NJ

AMANNGIRRBACH A M E R I C A

> Amann Girrbach America, Inc. 5265 Parkway Plaza Blvd. Charlotte, NC 28217 877.960.4393 www.AmannGirrbachAmerica.com



"Chipping", as described in a number of works, such as, for example, the "Effect of modified allceramic copings on fatigue fracture resistance", by Baldissara - Smaniotto - Scotti - Castignani, is a problem that is relatively common in studies regarding all-ceramic materials.

According to the literature, the percentage of ceramic coatings chipping within two years seems to recur between 8 and 50 percent, while these percentages for metal-restorations fall between 4 and 10 percent after 10 years (1).

The causes for the chipping are not clearly known, but it is presumed that they may reside in the flexural rigidity of the substructure, in an insufficient adhesion between the coating and the substructure, or in a wrong design of the substructure that supports the ceramic coating (2).

From previous studies, the majority of fractures have origin either at the center of the sample close to the point where it is loaded or in the same region of contact. The failures in this region are justified by the tensile stress that is developed by a flexure of the crown (3). As a result of what has been mentioned above, there has been an influx in recent years of various proposals formulated by various authors, who, basing themselves on previous experiences related to metal-ceramic (Valeriano, Sgro etc.) have because of production needs tested new projects related to the realization of structures in zirconia, not only anatomical but, in light of the above cited drawbacks, modified (altered) with the addition of particular supports, ridge, ribs and whatever else necessary to overcome the chipping.

Here then, in order of presentation (just to mention some Italian authors) is the emergence of various designs of structures such as:

- A.R.D.: Paolo Smaniotto, DT
- X.X.L.: Cristiano Broseghini, DT
- Z.I.L.: Luca Dondi

During these years we have witnessed a strong shift towards the increasing use of structures without metal, stratified at the beginning; subsequently, rather gradually appeared the use of monolithic structures in lithium disilicate and zirconia.

Knowledge is Power Get it for your dental library today

Paolo Smaniotto, MDT and Dr. Alexander Beikircher show the way to a beautiful aesthetic smile.

Paolo Smaniotto Alexander Beikircher

Aesthetics and Techniques for New Materials Achieving success for the Dental Team



With collaboration of Flavio Tura and Giuseppe Pellitteri





In this text, Paolo Smaniotto, MDT and Dr. Alexander Beikircher describe in detail the working methods, they use to solve every clinical case in an aesthetic way.

Discover the theoretical concepts and practical applications that can only create success.

214 pages, 1000 illustrations in colour

\$179.00 + S&H



Mail orders to: Palmeri Publishing Inc., 35-145 Royal Crest Court, Markham, ON L3R 9Z4 Canada Phone orders: 905.489.1970 Fax orders: 905.489.1971 or order online at www.spectrumdialogue.com



Figs. 19 to 21: Different angles of light incidence show the results of integration between the obtained materials, zirconia and ceramic do not have a solution of continuity.

Figs. 22 and 23: The satisfactory characteristics of fluorescence and opalescence

Figs. 24 to 26: A completed prosthetic device: for its realization the technique of "young Eych" was used with the combination of only four ceramic materials.

In this brief presentation, I will not address in depth the physical characteristics relative to the ceramic layering of these materials. I remind you though, that, being these ceramics of glass matrix, do have a great aesthetic advantage compared to monocrystalline structures such as zirconia (7, 8).

I would like to point out that more authors have been proposing original works to combine the advantages offered by the new technologies related to the utilization of zirconia both in the analog and in digital and of the dedicated ceramics. (See www.aiop.com - Meeting Mediterraneo 2013, C. Broseghini, DT).

In this brief presentation (Figs. 4 and 5), urged by the growing demand of metal-free zirconia realizations, I will briefly present a new project, an alternative plan to what has been masterfully addressed by the above mentioned colleagues. Basing my thoughts on some very recent literature (4, 5, and 6) that points out the possibility and the advantages of using zirconia in all the functional areas (Figs. 6 and 7) such as:

- Occlusal in the posterior quadrants,
- A few functional zones in the frontal sections (Figs. 8 to 11), unlike of what had already previously presented by my other colleagues:
- I leave in zirconia, the functional paths that starting from the centric points, run through protecting the entire interested area in the frontal sectors,
- I eliminate in the frontal sectors zirconia in those areas where it is possible to contribute to improve the metameric effect which is typical of glass matrix ceramic (See pictures and captions),
- I propose to utilize the physical properties of zirconia and the esthetics of ceramics (Figs. 12 to 15) taking advantage of what is cited in the literature that emphasizes how the correct

Introducing the **(Zirlux**[®] Family



polishing of the surfaces in zirconia (Figs. 16 to 18) is fundamental to control the potential degree of abrasiveness and then wear, where research speculate that glass matrix ceramics are even more aggressive of the same zirconia (4, 5).

Conclusion

Longitudinal data on the development of zirconiaceramic devices experience about 94% clinical success; there isn't currently any data regarding monolithic zirconia and/or partially stratified.

It has been reported by several sources that the development index is heading towards:

- 1. Implementation at a technological level
- 2. New proposals at a commercial level, <u>index of</u> <u>development more and more directed towards</u> <u>the use of CAD/CAM tools and structures for</u> <u>the realization of monolithic zirconia structures</u> <u>in the posterior sectors and of partially</u> <u>stratified in the aesthetic areas (Figs. 19 to 26).</u>
 - Why is the market oriented in this way?
 - What technical measures should we be adopting so that we can correctly compare ourselves with the developments in prosthetic dentistry increasingly more computerized?
 - What added value can the individualization of craftsmanship take that only dental technicians with new informative skills can provide?

These, other questions and, for our sector, new topics that have never been discussed such as:

- What is multidimensional uncertainty?
- What is volumetric compensation?
- Why is it necessary to calibrate the machine tools volumetrically?
- What is the relationship between linear compensation, measurement uncertainty and volumetric compensation?

will be discussed in depth in the next article published in this journal realized by Paolo Smaniotto with the contribution of Prof. Francesco Simionato.

... to be continued in the next issue

Bibliography:

- 1) State of the art of zirconia for dental applications. Denry I, Kelly JR. Dent. Mater. 2008 Mar; 24(3)299-307
- 2) Factors essential for successful all-ceramic restorations. Donovan TE. J Am Dent Assoc.2008 Sep; 139 Suppl:14S-18S. Review
- 3) Influence of glass ceramic thickness on Hertzian and bulk fracture mechanisms. Tsai YL, Petsche PE, Anusavice KJ, Yang MC. Int J Prosthodontic. 1998 Jan-Feb; 11(1):27-32
- 4) A.H. Aref Sabrah THE EFFECT OF FULL-CONTOUR Y-TZP CERAMIC SURFACE ROUGHNESS ON THE WEAR BOVINE ENAMEL AND SYNTETIC HYDROXYAPATITE: AN IN-VITRO STUDY - Indiana University- School of Dentistry - December 2011
- 5) T.R. Tambra, M.E. Razzoog, B.R. Lang, RF Wang, B.E. Lang. U.K.-IN VITRO WEAR OF HUMAN ENAMEL OPPOSING YTZP ZIRCONIA And varius polisched dental porcelain surfaces
- 6) A. Laciulli, F. Masiello, M. Polti TRIBOLOGIA e APPLICAZIONI TRIBOLOGICHE parte 2 - Università Studi Lecce- Facoltà
- Ingegneria Corso Ingegneria dei materiali a.a. 2003 2004 7) P. Smaniotto-A. Beikircher- ESTETICA E TECNICA DEI NUOVI
- 7) P. Smaniotto-A. Beikircher- ESTETICA E TECNICA DEI NUOVI MATERIALI, Ed. teamwork media srl – Brescia 2008
- 8) F. Simionato SCIENZA DEI MATERIALI DENTALI Vol. 1 e 2 – Ed. Piccin - Padova

