

# Retreatment and BioRoot™ RCS for root canal filling

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## Introduction

The traditional single cone technique is still very popular among practitioners being quick and easy to perform. This technique consists in by employing a single cone with a large amount of sealer, which acts as a filling material. Unfortunately, the currently used sealers are poorly resistant to dissolution. As a consequence, with time, the canal is again contaminated with bacteria, leading to treatment failure and the development of an inflammatory apical lesion. Thereby, although being easy to accomplish, the single cone technique is not recommended for root canal filling (Beatty 1987; Pommel et Camps 2001).

However, the single cone technique concept may be reopened and provided new reliability with new proposed biomaterials based on bio-ceramics, developed in the last decades and launched on the market as root canal sealers. BioRoot™ RCS is the newest endodontic root canal filling material based on tricalcic silicate materials benefiting from both Active Biosilicate Technology and Biodentine. The first provides medical grade level of purity and, unlike “Portland cement” based materials, it ensures the purity of the calcium silicate content with the absence

of any aluminate and calcium sulfate. BioRoot™ RCS is bioactive by stimulating bone physiological process and mineralization of the dentinal structure (Camps 2015, Dimitrova-Nakov 2015). Therefore it creates a favorable environment for periapical healing and bioactive properties including biocompatibility (Reichl 2015), hydroxyapatite formation, mineralization of dentinal structure, alkaline pH and sealing properties.

BioRoot™ RCS is indicated for the permanent root canal filling in combination with gutta-percha points and is suitable for use in single cone technique or cold lateral condensation (Camilleri, 2015). Thanks to the use of Active BioSilicate Technology which is monomer free, there is no shrinkage of BioRoot™ RCS during setting for reaching a tight seal of the root canal. Despite the similar composition in terms viscosity and texture with a sealer, BioRoot™ RCS must be considered as an adhesive root filling material. A fitted gutta-percha point is firstly used as a plugger-like carrier to facilitate the flow of BioRoot™ RCS into the canal space and secondly for facilitating the desobturation of the filled root canal in case of retreatment.

## Description of the technique

From an operational point of view, the procedure is very similar to the single cone technique. However, few indispensable differences justify the reliability of BioRoot™ RCS with such a technique. Notably, the single cone technique seals a cone alone. Instead, here the cone is

employed as a carrier, which is left in place to allow the material removal in case of retreatment. Indeed, it must not be considered as the core of the filling. The obturation is made by BioRoot™ RCS itself.

## Case report 1

A pulp necrosis was diagnosed on tooth #16 of a 35 years old female patient associated with a chronic periapical disease (*Fig. 1*). Patient was suffering of chronic sinusitis for over than 2 years and received unseccessful medical treatments.

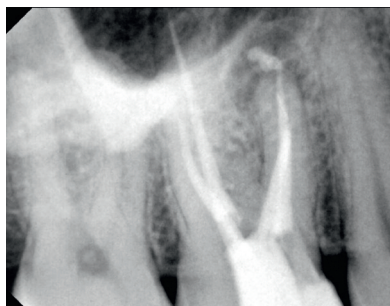
- After having shaped the root canal and obtained an appropriate tapered preparation, the canal was disinfected with a 3% sodium hypochlorite solution activated with mechanical agitation (Irrigatys, Itena, France). A final rinse with 17% EDTA and a final flush with sodium hypochlorite were completed before fitting the gutta percha cones.
- Canals were dried with paper points.
- BioRoot™ RCS was mixed, following manufacturer recommendations.
- BioRoot™ RCS was injected into the root canals with a spiral used with at low speed of rotation (800 r/min). Each gutta percha point was

poured into the mixed material to largely cover the surface of the cone. Afterward, it was gently inserted into the root canal space until reaching the working length.

- The cone was cut at the entrance of the root canal with a heat carrier, and a slight plug was created with a hand plugger.
- The second and the third canal were filled in the same way (*Fig 2*).
- The patient was refered to the general practitioner who restored the tooth with a bonded overlay.
- Patient was recalled at 6 and 12 months after treatment. She didn't suffer of sinusitis anymore and the tooth is asymptomatic. The 12 months recall let show a complete healing of the periapical lesion (*Fig 3*). Thereby, the treatment maybe considered as successful.



*Fig. 1:* Pre-operative X ray of tooth #16 of a 35 years old female patient.



*Fig. 2:* Post-operative X ray after completion of endodontic treatment.



*Fig. 3:* 6 months post-operative recall.



## Case report 2

A 32 years old female was referred to our endodontic department by her general practitioner for treatment on tooth #47 (*Fig. 4*). The patient reports a long painful dental history on this tooth. Root canal treatment had been initiated 6 months before, and several practitioners tried to complete the root canal treatment, unsuccessfully. The patient complained about severe pain and sensation of numbness and loss of sensitivity of the mandible each time the access cavity was closed with a temporary filling.

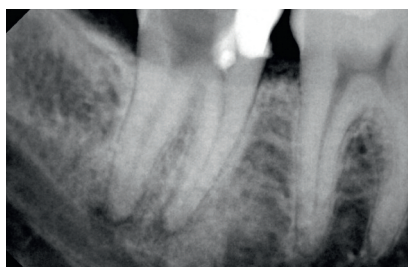
An intra osseous injection (one cartridge articaine + 1/100000 epinefrin (Septodont, France) was completed and root canals were shaped and disinfected with a large volume of sodium Hypochlorite activated with Irrigatys (Itena, France). The canals were dried, and temporary filled with a calcium hydroxide based medication. Access cavity was filled with a temporary filling and the crown was drilled for occlusal reduction.

At the second visit, the root canal treatment was completed. Because the proximity of the inferior dental nerve, everything was done to avoid any extrusion of dental material. Because its excellent bio-tolerance and non toxicity, BioRoot™ RCS was considered as the material of choice for filling the root canals.

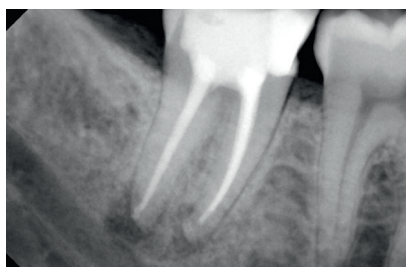
Root canals were rinsed again with Sodium Hypochlorite and 17%EDTA, and then dried. BioRoot™ RCS was placed inside each canal with a spiral (800 r/min) and gutta percha points were poured into the material and gently paced inside the canals up to the working length (*Fig. 5*).

The coronal restoration was completed on a third visit with a CAD/CAM bonded overlay (*Fig 6, 7 and 8*).

The patient never complained on any pain, neither discomfort. The 6 months recall X Ray confirm the complete healing of the apical lesions (*Fig. 9*).



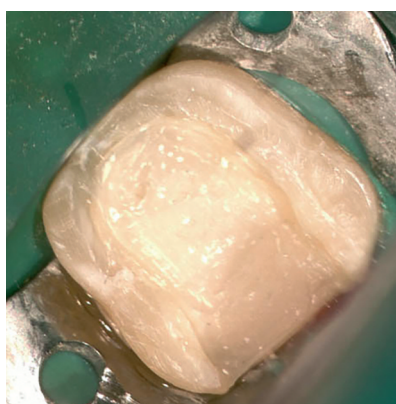
*Fig. 4:* Pre-operative X ray of tooth #47 of a 32 years old female patient..



*Fig. 5:* Post-operative X ray after completion of endodontic treatment.



*Fig. 6:* Occlusal view of the access cavity before coronal restoration.



*Fig. 7:* Pre-prosthetic coronal restoration with a bonded composite resin.



*Fig. 8:* CAD/CAM overlay for coronal restoration.



*Fig. 9:* 6 months post-operative recall.

## Case report 3

A 31 years old female patient was referred for a root canal retreatment on tooth #46 (*Fig. 10*). This tooth had already been retreated twice recently, but the patient still complained about pain and abscesses since the tooth had been restored with a post placed into the distal root. Because the post was not visible on the pre-operative Xray, it was assumed that it might be a fiber post. The shape of the inter-radicular lesion let us suspect a zipping perforation into the interradicular area.

Root canal retreatment was completed in one visit. The fiber post of distal root and root canal filling material were removed with rotary and manual instruments. The four root canals were then reshaped and disinfected with 3% sodium hypochlorite with mechanical activation and 17% EDTA. During the retreatment process, an inter-radicular perforation (mesial side of the Disto-lingual root canal) was highlighted (*Fig. 11*). In the past, this type of disease would have completed into two steps. First step for filling the root canal up to the level of the perforation, with precaution to avoid any extrusion of materials through the perforation, and the second step for filling the last third of the canal with a silicate based material such as Biodentine (Septodont). Because BioRoot™ RCS is a Tricalcium silicate



*Fig. 10:* Pre-operative X ray of tooth #36 of a 31 years old female patient.

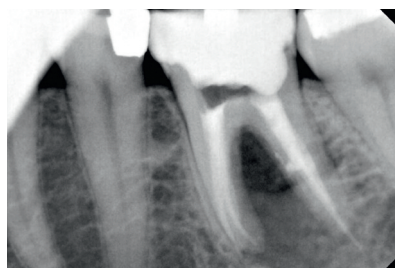
based filling material, it was decided to combine the two steps in one by filling the canals and the perforation in the same time.

Like for the two previous cases, root canals were dried with paper points, BioRoot™ RCS was injected into the canals with a spiral used at low speed (800r/min) and gutta fitted gutta percha points were inserted into each canal up to the working length (*Fig. 12*). A small extrusion of material is visible on the post operative X-Ray, as a confirmation of perforation closure (*Fig. 13*). Tooth was restored with a bonded overlay (*Fig. 14,15*) and the patient was recalled at 6 months post operative (*Fig. 16*).

The tooth is asymptomatic and fonctionnal ; the peridon tal probing is normal, and the 6 months recall X-ray confirm the bone healing of the inter-radicular lesion.



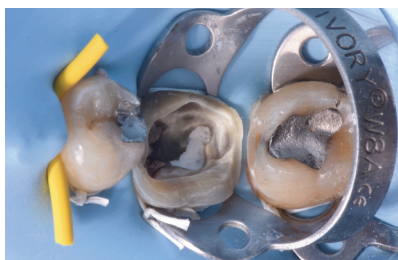
*Fig. 11:* Highlight of the stripping perforation on the mesial side of the distal root canal.



*Fig. 12:* Post-operative X ray after completion of endodontic treatment.



*Fig. 13:* Decentered post operative X-Ray showing the slight extrusion of material in the inter-radicular area.



*Fig. 14:* Clinical view of the acces cavity before restoration



*Fig. 15:* Final prosthetic restoration with a bonded crown (Dr Alexandre Sarfati - Paris).



*Fig. 16:* 6 months post-operative recall.

These cases are used to illustrate some specific situation in which we used BioRoot™ RCS because its valuable properties. These are three of a large number of cases we have completed for the last 18 months. Before the launch of this product, 22 clinical cases were completed in the frame of a randomized clinical trial comparing the succes of an endodontic treatment using

warm vertical compaction of Gutta percha versus the above described BioRoot™ RCS. The RCT registration number is NCT01728532 and the full protocol is available on <https://clinicaltrials.gov> The results are, at the time we are writing these lines, under analysis and very encouraging, which it allows us to consider this technique as reliable enough to be described here.

## Conclusion

Endodontics is continuously under evolution. In the last 20 years, instrumentation research and development have been very active. Currently, disinfection and irrigation procedures are the two most focused aspects of endodontic research. The shaping procedures and root canal disinfection have considerably been simplified. Thereby, every practitioner interested in endodontics is now able to complete any easy/middle difficulty root canal treatment with reproducible results without any issue. Obturation, the final step of the proce-

cedure, is usually the most difficult and time consuming operation. However, with this new approach of root canal filling, this milestone may be overpassed. Considering the fluidity of BioRoot™ RCS as a filler and not only as a sealer, this represents a true paradigm shift. The preliminary results of the randomized clinical trial are very encouraging. More clinical investigations will be necessary in the future to confirm this new vision of a simpler root canal obturation.



### Authors: Stéphane SIMON

Stéphane SIMON has been qualified as Doctor in Dental Surgery in 1994 at the University of Reims. He completed in 2009 his PhD in Pulp Biology in the frame of a co-supervised Thesis between the Paris Diderot University (Paris 7) and the University of Birmingham (UK). In february 2016, he passed his "*Habilitation à diriger des recherches*" (Paris Diderot University). He used to work in a private

practice limited into endodontics for 18 years before joining the staff of Paris Diderot University for a a full time academic career.

To date he is full time teacher/researcher/Hospital clinician, and has been appointed as Professor in Conservative Dentistry and Endodontics in 2016. He is the director of the Postgraduate Endodontic Program at Paris Diderot University (3 years full time program) and is highly involved in teaching and research (Clinical and basic research). His time is 50% devoted to the clinical practice (Groupe Hospitalier Pitié Salpêtrière) and 50% to Basic Science and clinical research about Tissue engineering and dental Pulp healing/regeneration. He works as a Researcher in Paris Diderot University (Laboratory INSERM UMR1138) and as Associate Researcher at University of Birmingham.

Today, his main interest is about Tissue engineering, cell and molecular Biology of pulp tissue (Basic science and clinical practice), and modern techniques for teaching (E learning, flipped classroom, MOOCs, etc.)

He authored 25 scientific per reviewed papers, more than 80 clinical publications (French and international), 6 french books and 6 book chapters.



## References

- Angerame D, De Biasi M, Pecci R, Bedini R, Tommasin E, Marigo L, Somma F. Analysis of single point and continuous wave of condensation root filling techniques by micro-computed tomography. *Ann Ist Super Sanita*. 2012;48(1):35-41.
- Best SM, Porter AE, Thian ES, Huang J. Bioceramics: Past, present and for the future, *Journal of the European Ceramic Society* 2008; 28:1319–1327.
- Beatty RG. The effect of standard or serial preparation on single cone obturation. *Int Endod J* 1987;20:276 – 81.
- Camps et al. Bioactivity of a calcium silicate-based endodontic cement (BioRoot™ RCS): interactions with human periodontal ligament cells in vitro, *J Endod* 2015 Sept; 41 (9): 1469–73
- Dimitrova-Nakov et al., Bioactivity of Bioroot™ RCS, a root canal sealer, via A4 mouse pulpal stem cells in vitro. 2015 *Dental Materials* : available online.
- Dubok VA. Bioceramics yesterday, today, tomorrow. *Powder Metallurgy and Metal Ceramics* 2000; 39(7-8)
- Koch K, Brave D. Bioceramic technology - the game changer in endodontics. *Endodontic Practice US*.2009;12:7–11.
- Koch KA, Brave GD, Nasseh AA. Bioceramic technology: closing the endo-restorative circle, part 2. *Dentistry today*. 2010; 29(3):98-100.
- vKoch KA, Brave D. Endosequence: melding endodontics with restorative dentistry, part 3. *Dent Today*. 2009, 28(3):88-90.
- Pommel L, Camps J. In vitro apical leakage of system B compared with other filling techniques. *J Endod*. 2001 Jul;27(7):449-51.
- Ray HA, Trope M. Periapical status of endodontically treated teeth in relation to the technical quality of the root filling and the coronal restoration. *Int Endod J*. 1995 Jan;28(1):12-8.
- Reichl FX1,2, Rothmund L1,2, Shehata M1,2, Högg C1,2 DNA double-strand breaks caused by new and contemporary endodontic sealers. *Int Endod J*. 2015 Nov 17.
- Schäfer E1, Köster M, Bürklein S. Percentage of gutta-percha-filled areas in canals instrumented with nickel-titanium systems and obturated with matching single cones. *J Endod*. 2013 Jul;39(7):924-8.
- Siqueira JF, Arujo MCP, Garcia PF, Fraga RC, Saboia Dantas CJ. Histologic evaluation of the effectiveness of five instrumentation techniques for cleaning at the apical third of root canals. *J Endod* 1997; 23:499-502.
- Somma F1, Cretella G, Carotenuto M, Pecci R, Bedini R, De Biasi M, Angerame D. Quality of thermoplasticized and single point root fillings assessed by micro-computed tomography. *Int Endod J*. 2011 Apr;44(4):362-9.
- Trope M, Debelian G. Bioceramic Technology in Endodontics. *Inside dentistry*. 2014 nov: 53-57
- Tyagi S, Mishra P, Tyagi P. Evolution of root canal sealers: An insight story. *European journal of dentistry*. 2013; 2(3):199.
- Xuereb et al., 2014 In Situ Assessment of the Setting of Tricalcium Silicate-based Sealers Using a Dentin Pressure Model, *J Endod*. 2015 Jan;41(1):111-24.
- Yang Q, Lu D. Premixed biological hydraulic cement paste composition and using the same. Patent application 2008029909, December 4, 2008.
- Zhang H, Shen Y, Ruse ND, Haapasalo M. Antibacterial activity of endodontic sealers by modified direct contact test against *Enterococcus Faecalis*. *Journal of endodontics* 2009;35(7):1051-5.
- Zhang W, Li Z, Peng B. Effects of iRoot SP on mineralization-related genes expression in MG63 cells. *Journal of endodontics*. 2010; 36(12):1978-82.
- Zhang W, Li Z, Peng B. Ex vivo cytotoxicity of a new calcium silicate based canal filling material. *International endodontic journal*. 2010;42(9):769-74.