INTERNATIONAL
Dentistry
AFRICAN EDITION

VOL. 9 NO. 1

IN THIS ISSUE

mectron

medical technology

MICROPIEZO S ultrasound technology

- **Electronics**

latest generation digital technology
far more power than with traditional ultrasound systems

- **Adjustment knob**

for constant power and liquid adjustment

- **Liquid**

continuously adjustable
by pressing a button it may be interrupted

- **Water connection**

the water circuit enables pressure values between 1 and 6 bars

- **Water filter**

prevents the passage of suspended particles
easy to clean without needing any tools

PIEZOSURGERY®

- **Micrometric cuts**

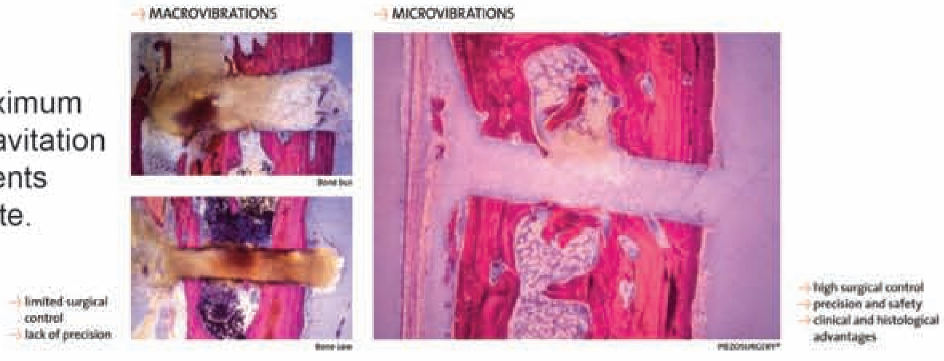
PIEZOSURGERY ® provides micrometric cuts for minimally invasive surgeries with maximum surgical precision and intra-operative tactile sensation.

- **Selective cuts**

Selective cuts protects any kind of soft tissue.
Nerves, vessels and membranes will not be injured while cutting bone. Thus PIEZOSURGERY® offers maximum safety for surgeons and patients.

- **Cavitation effect**

PIEZOSURGERY® offers maximum intra-operative visibility. The cavitation effect of the ultrasonicmovements lead to a blood-free surgical site.



www.interafricadental.com

NTI New Technology Instruments

An Instrument set for perfect CEREC crown and bridge preparation designed by Dr Klaus Wiedhahn.

The set contains all the essential instruments for Crown and bridge preparation, from removing old crowns to safe exposure of the cervical preparation margin using the tissue trimmer.

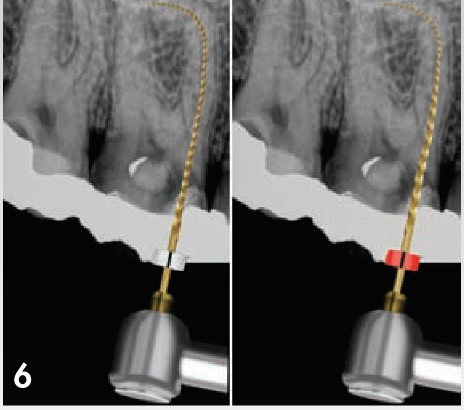
The set includes course and fine preparation instruments.
These Facilitate rapid preparations for crowns and bridges fabricated using CAD/CAM.

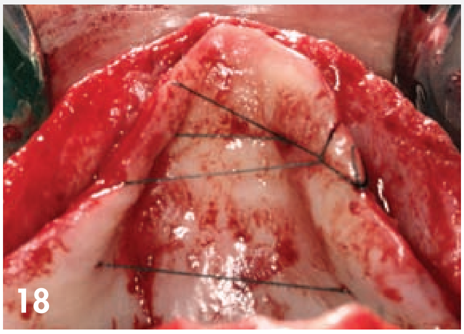
The low number of instruments simplifies the preparation sequence.

The CeraGlaze polishers in the set create the same surface texture as that produced following standard glaze firing, without any risk to the marginal seal of the restoration or delayed crack formation.

Zirconia & Ceramic Polishers

NTI polishers are made of the highest quality raw materials and are specially designed for polishing the different dental materials. The NTI polishing system CeraGlaze achieves outstanding results in polishing all ceramics and zirconia.
For the **Practice** and **Lab**.





Contents

February/March 2019
Volume 9 No.1

Straumann® BLX

Excellence in immediacy
Innovation meets heritage

BEYOND IMMEDIACY

Perfected for immediacy,
excellent for all indications.

DYNAMIC BONE MANAGEMENT

Unique properties redistribute native bone along the implant and give control over insertion torque to achieve optimal primary stability in all bone types.

ESTHETIC EASE CONCEPT

Simplified but versatile portfolio, featuring one connection and under-contoured prosthetics ensure esthetics with ease.

REAL CONFIDENCE

Swiss precision and quality with best-in-class technologies Roxolid® material and SLActive® surface.

Contact your local Straumann representative or visit **www.confidence-in-you.com**.

Straumann Group South Africa
15 Huising Street
Somerset West
Cape Town, 7130
Phone +27 21 850 0823

straumann

INTERNATIONAL Dentistry AFRICAN EDITION

Vol. 9 No. 1, February/March 2019
ISSN 2226-1567

DESIGN & LAYOUT
C Designz

PRINTED BY
Paarl Media Paarl

International Dentistry African Edition is published by Modern Dentistry Media CC,
PO Box 76021 Wendywood 2144 South Africa
Tel: +27 11 702-3195
e-mail: dentsa@iafrica.com
www.moderndentistrymedia.com

Published in association with

FMC DENTISTRY'S INFORMATION CENTRE

Clinical application of crosslinked gutta-percha core obturators

Peet J. van der Vyver[1] and Martin Vorster[2]

The purpose of this article is to demonstrate the clinical use of crosslinked gutta-percha core obturators for teeth requiring endodontic treatment that present with simple and complex root canal anatomy.

Successful root canal treatment relies not only on proper shaping and disinfection but it also requires a proper three dimensional obturation of the entire complexed root canal system in order to prevent reinfection (Schilder, 1983).

Cold lateral compaction, warm vertical compaction and core-carrier techniques remain the most commonly used endodontic obturation techniques up to date. A study by Li et al (2014) showed carrier-based obturation to have a lower incidence of interfacial gaps and voids compared to warm vertical and cold lateral compaction.

Buchanan (2009) advocates the use of carrier-based obturators in long, narrow and severely curved canals. The flexibility of the carrier allows for obturation of these canals; however, the stripping of the gutta-percha may cause direct contact between the plastic carrier and the dentine wall in curved canals (Leung, Gulabivala, 1994). This problem has been attributed to procedural errors such as improperly shaped canals (Buchanan, 2009).

GuttaCore cross-linked gutta-percha core obturators (Dentsply Sirona) were introduced to overcome these clinical challenges. GuttaCore consists of a carrier/core manufactured from a cross-linked, thermoset elastomer of gutta-percha coated in regular gutta-percha (Figure 8). The core is a polyisoprene polymer cross-linked with peroxide for strength, designed to facilitate removal during retreatment and/or post space preparation by simply trephining through the core (Alhashimi et al, 2012).

Gutmann (2012) recommends that for the GuttaCore material to flow into the canal

Figure 1: Preoperative periapical radiograph showing the presence of a large composite restoration and an access cavity preparation that extends into the pulp chamber.

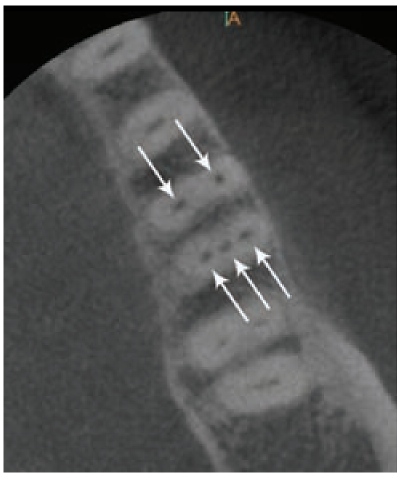


Figure 2: An axial slice of a high resolution CBCT scan (Carestream 8100, Carestream) revealed five root canal systems (arrows). Two root canals in the mesial root and three root canals in the distal root.

[1] Prof. Peet J van der Vyver
Studio for Endodontics, Restorative Dentistry and Dental Education (www.studio4endo.com); Part-time lecturer at the University of Pretoria, School of Dentistry, Pretoria, South Africa, President of the South African Society for Endodontics and Aesthetic Dentistry (SASEAD)
(peetv@iafrica.com)

[2] Dr Martin Vorster
Lecturer/ Dentist at the University of Pretoria's School of Dentistry, Pretoria, Gauteng, South Africa.
(martin.vorster@up.ac.za)

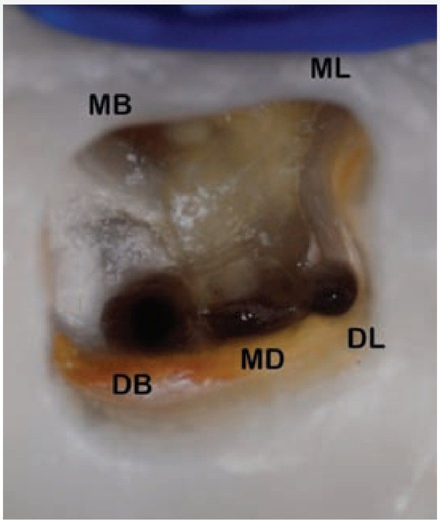


Figure 3: High magnification view of the pulp chamber floor outlining the position of the enlarged canal orifices (MB-mesiobuccal; ML-mesiolingual; DB-distobuccal; MD-middistal,; DL-distolingual).

Figure 4: Length determination periapical radiograph.

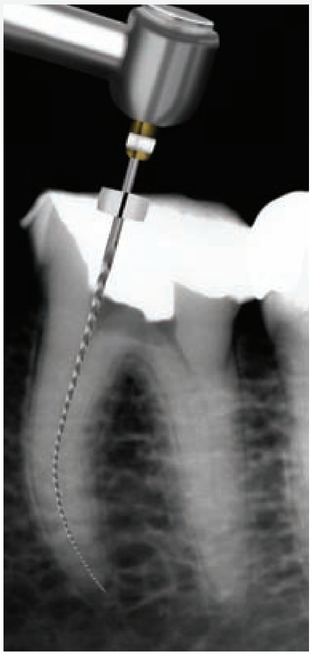


Figure 5: The ProGlider single file rotary glide path instrument was used to enlarge the reproducible glide path that was secured with hand instruments.

intricacies the canals should be shaped and enlarged to a minimum of ISO size 25 and a taper of 6%. This is also the minimum size and taper that is recommended for root preparation (Gutmann, 2012; Khademi, Yazdizaheb, Feizianfard, 2006; Paqué, Ganahle, Peters, 2009) to ensure thorough canal debridement (Boutsioukis et al, 2010a; Boutsioukis et al, 2010b).

The purpose of this article is to demonstrate the clinical use of crosslinked gutta-percha core obturators for teeth requiring endodontic treatment that present with simple and complex root canal anatomy.

Case report 1:

The patient, a 51-year-old male, presented with spontaneous pain on his mandibular left first molar after an temporary root canal treatment. Clinical examination revealed that the tooth was restored with a large composite restoration. Radiographic examination confirmed the presence of a large composite restoration and access cavity preparation that extends into the pulp chamber (Figure 1). An axial slice of a high resolution Cone Beam Computed Tomography (CBCT) scan (Carestream 8100, Carestream) revealed five root canal systems. Two root canals in the mesial root and three root canals in the distal root (Figure 2).

After the administration of local anaesthetic, an access cavity, ensuring straight-line access into all the root canal systems was prepared. Five root canal orifices were located and canal negotiation was initiated with a size 10 K-File (Dentsply Sirona). Coronal restrictive dentine was removed from the canal orifices with a SX instrument from the ProTaper Universal system (Dentsply Sirona), using it in a backstroke cutting motion. Figure 3 shows a high magnification view of the pulp chamber floor outlining the position of the enlarged canal orifices.

Using an alternating combination of size 08 C+ and size 08 K- Files (Dentsply Sirona), the canals were negotiated to patency. A Propex Pixi (Dentsply Sirona) Apex Locator was used to establish working lengths for the five root canal systems and confirmed radiographically (Figure 4).

Initial glide paths were established by moving the size 08 K- File in short amplitude vertical strokes of 0.5-1mm from working length, ensuring removal of restrictive dentine by withdrawing or carving in a clockwise direction as proposed by West (2010). This process was repeated in each canal until the file felt loose at this distance. The same procedure was repeated by withdrawing the file 2mm, 3mm and 4mm from the working length, ensuring that the file felt loose in the canals. The same protocol was followed with a size 10 K-

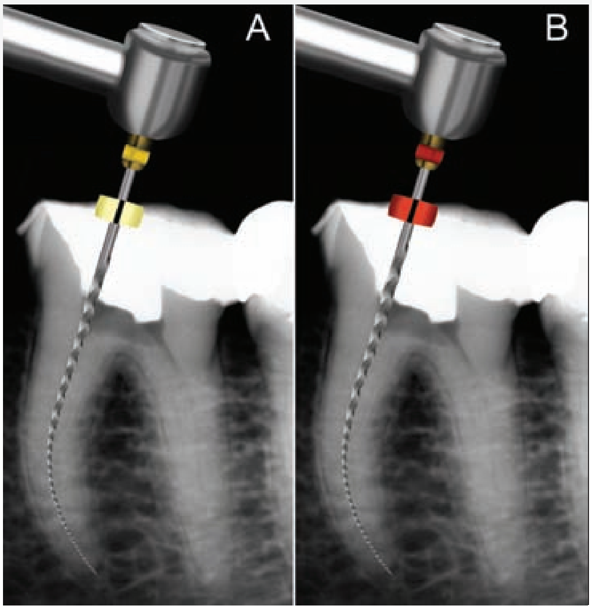


Figure 6: (a) ProTaper Next X1 and (b) ProTaper Next X2 instruments were used to complete root canal preparation.

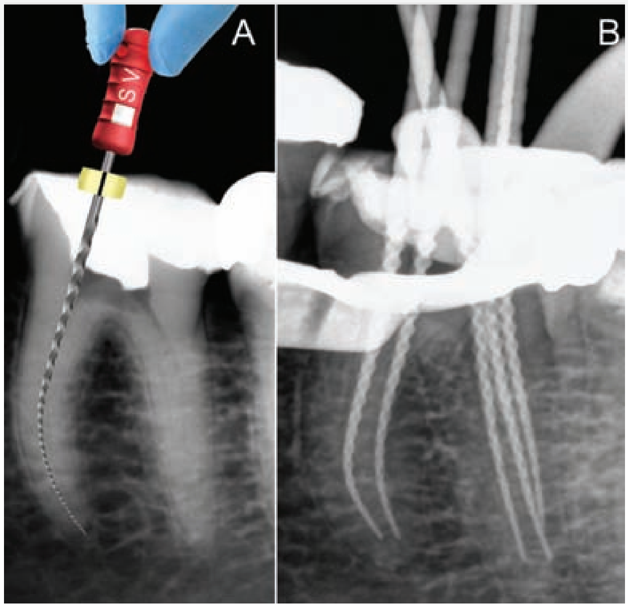


Figure 7: (a) Size 25 GuttaCore Verifier was used to check the root canal preparation; (b) the fit of the verifiers were confirmed radiographically.

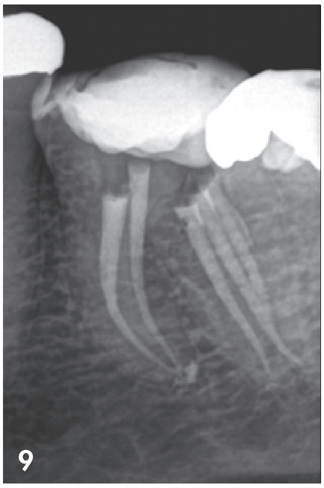


Figure 8: The five canals were obturated with size 25 GuttaCore obturators.

Figure 9: Postoperative obturation result. Note the apical curvature in the mesiobuccal root canal systems that were maintained during glide path preparation and root canal preparation with ProGlider and the ProTaper Next instruments.

File. A reproducible glide path was confirmed in each canal, by ensuring that the size 10 K- File could travel freely from 4-5mm from working length to patency, using light finger pressure.

A ProGlider single glide path instrument (Dentsply Sirona), operating at 300rpm and a torque of 4 Ncm, was introduced (Figure 5). The file was allowed to progress and enlarge the secured glide paths up to working lengths in all the root canals.

ProTaper Next X1 and X2 instruments (Dentsply Sirona) (Figures 6a and 6b) were used according to the technique outlined by Van der Vyver and Scianamblo (2013) to complete root canal preparation.

Adequate canal preparation was confirmed when a size 25 nickel titanium hand file fitted snug at working length in all five root canal systems. Five, size X2 GuttaCore Verifiers (Dentsply Sirona) were placed up to the working length in each of the prepared root canals (Figure 7a) and confirmed radiographically (Figure 7b). The five root canal systems were obturated using Pulp Canal Sealer (Kerr) and size 25 GuttaCore crosslinked gutta-percha core obturators (Dentsply Sirona) (Figure 8). Figure 9 shows the final result after root canal obturation.

The clinical procedure of this case can be viewed on the following link or QR code:https://youtu.be/WITfx0SdPt0.

Scan me

Figure 10: Periapical radiograph of the non-vital maxillary left central incisor with evidence of a small periapical infection around the tip of the root.

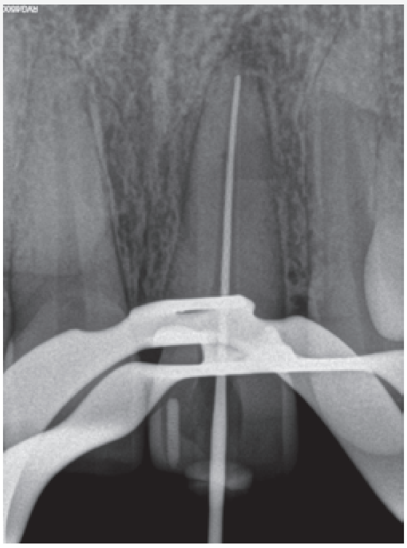


Figure 11: Length determination periapical radiograph.

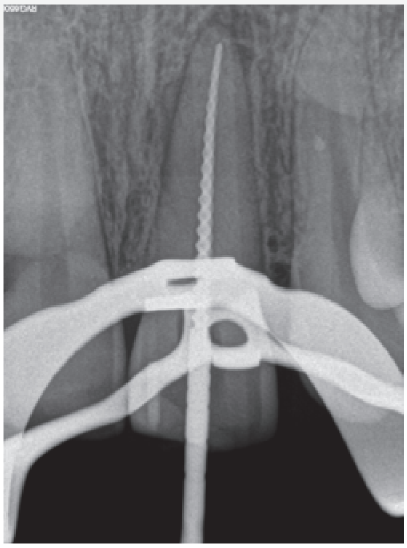


Figure 12: Periapical radiograph confirming the fit of the size 40 GuttaCore Verifier.

Case report 2:

The patient, a 40-year-old female, presented with a non-vital maxillary left central incisor with evidence of a small periapical infection around the tip of the root (Figure 10). Length determination was done and confirmed radiographically (Figure 11). Root canal preparation was done with a WaveOne Large 40/08 instrument (Dentsply Sirona). A size 40 GuttaCore Verifier was used to verify the canal preparation as well as the apical extend of the canal preparation (Figure 12). Figure 13 shows the final result immediately after obturation with a size 40 GuttaCore obturator and Pulp Canal Sealer. Figure 14 shows a postoperative periapical radiograph at a five-year follow-up visit. Note the resorption of the excess sealer in the midroot lateral canal as well as at the apical foramen of the root canal system. Complete healing of the periapical infection is also observed on this follow-up radiograph.

The clinical procedure of this case can be viewed on the following link or QR code: https://youtu.be/WlTfx0SdPt0

Scan me

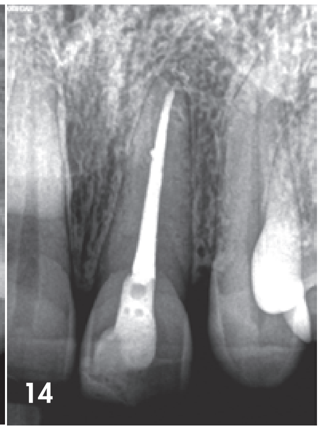


Figure 13: Postoperative result after obturation with the size 40 GuttaCore obturator and Pulp Canal Sealer.

Figure 14: A periapical radiograph taken at a 5-year follow-up visit. Note the resorption of the excess sealer in the midroot lateral canal as well as at the apical foramen of the root canal system. Complete healing of the periapical infection is observed.

Case report 3:

A 29-year-old female presented with discomfort on her non-vital maxillary right first and second molars (Figure 15). After access cavity preparation on the first molar, four root canal systems were located. A length determination radiograph revealed severe curvatures in the apical third of the two mesiobuccal root canal systems (Figure 16). After glide path preparation with a WaveOne Gold Glider (Dentsply Sirona)


EDENTULOUS PATIENTS
Straumann® Pro Arch Edentulous Solutions > Removable
Straumann® Mini Implant System
Mini Implant. Maximum trust.
SLA®
SCIENTIFIC EVIDENCE
High and consistent survival rates are documented in several long-time studies.
Roxolid®
PROVEN QUALITY
The successful use of Roxolid®, our high-strength implant material, is documented in numerous clinical studies.
DURABILITY & EFFICIENCY
The space-saving design of Optiloc® provides excellent wear resistance and reduces maintenance.
Contact your local Straumann representative or visit www.straumann.com/mini-implants.

(Figure 17a) the four root canal systems were prepared using a Primary WaveOne Gold instrument (Dentsply Sirona) (Figure 17b). After irrigation the four root canal systems were obturated with size 25 GuttaCore obturators in combination with AH Plus Root Canal Cement (Dentsply Sirona) (Figure 18). At a subsequent visit a root canal treatment was performed on the second molar using the same materials and instruments. Figure 19 depicts a postoperative result after root canal treatment on both maxillary molars.

Case report 4:

A 46-year-old female patient presented with a decemented crown on her lower right second molar that form part of a three unit bridge. Figure 20 shows a periapical radiograph of the tooth. After removal of the bridge there was evidence of secondary caries (Figure 21). After removal of the caries, a large pulpal exposure with pulp stones in the pulp chamber was visible (Figure 22).

Following access cavity preparation three root canals were

Figure 15: Periapical radiograph of the non-vital vital maxillary right first and second molars.

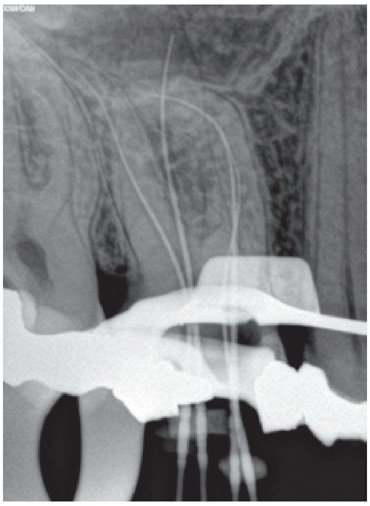


Figure 16: Length determination periapical radiograph. Note the severe curvatures in the apical third of the two mesiobuccal root canal systems.

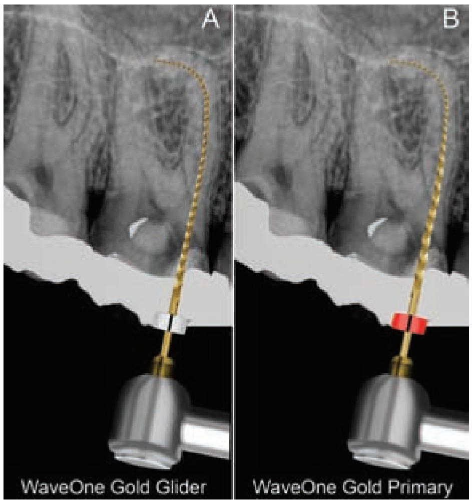


Figure 17: (a) Glide path enlargement was done with a WaveOne Gold Glider; (b) root canal preparation was done with a Primary WaveOne Gold instrument .

Figure 18: Postoperative result after root canal preparation, irrigation and obturation with four size 25 GuttaCore obturators in combination with AH Plus Root Canal Cementin.

Figure 19: Postoperative result after root canal treatment of both maxillary molars. All seven canals were prepared with a Primary WaveOne Gold instrument and obturated with size 25 GuttaCore obturators.

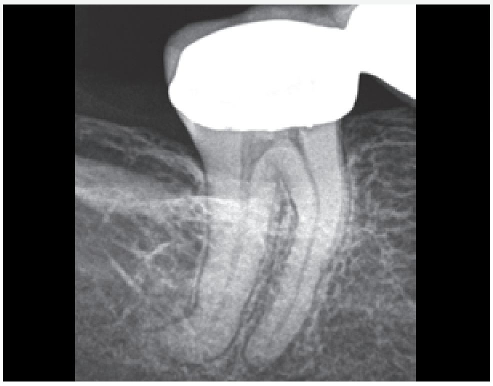


Figure 20: Periapical radiograph of the lower right second molar that form part of a three unit bridge.

located (Figure 23) and length determination was done using a Propex Pixi Apex Locator and confirmed radiographically (Figure 24). Root canal preparation was done with ProTaper Universal instruments (Dentsply Sirona) and fit of three size 25 GuttaCore Verifiers were confirmed radiographically (Figure 25). After irrigation, the mesial canals were obturated with size 25 GuttaCore obturators and the distal canal with size 30 GuttaCore obturator in combination with AH Plus Root Canal Cement. Figure 26 shows the postoperative result after root canal obturation.

The clinical procedure of this case can be viewed on the following link or QR code: https://youtu.be/LHd3tTnfzyc

Scan me

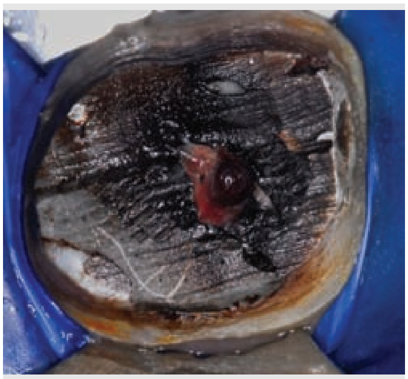
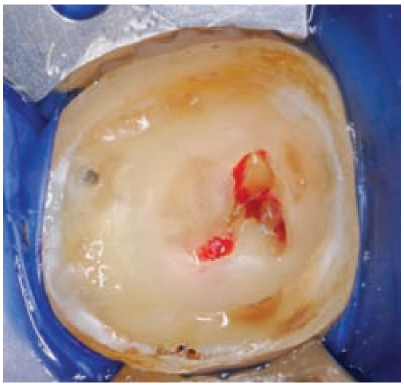


Figure 21: Extensive caries of the remaining tooth structure after removal of the decemented bridge.



aFigure 22: After caries removal a pulp exposure was evident with pulp stones in the pulp chamber.

Figure 23: Access cavity preparation and location of three root canal systems

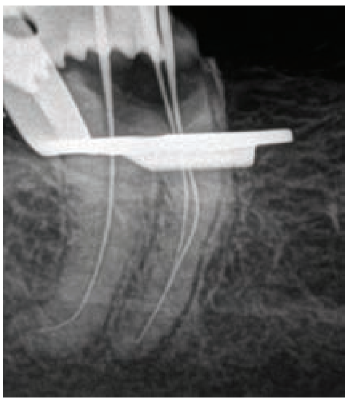


Figure 24: Length determination periapical radiograph. Note the apical curvature in the distal root canal system.

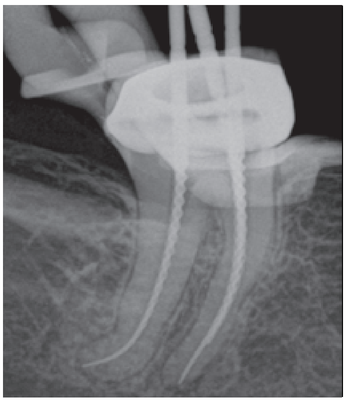


Figure 25: Periapical radiograph confirming the fit of the three size 25 GuttaCore Verifiers.

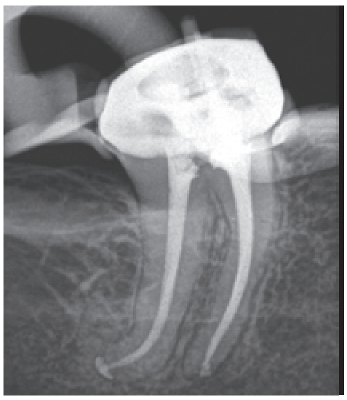


Figure 26: Postoperative result after obturation with three GuttaCore obturators in combination with AH Plus Root Canal Cement.

Case report 5:

A 48-year-old male presented with irreversible pulpitis on his maxillary left first premolar. Radiographic examination revealed a previously placed composite restoration very close to the pulp (Figure 27). After access cavity preparation two root canal systems were located. A length determination radiograph showed "S"-curvatures in the buccal and lingual root canal systems (Figure 28).

After glide path preparation with a ProGlider instrument (Figure 29) the two root canal systems were prepared using the ProTaper Gold instruments (S1, S2, F1 and F2) (Dentsply Sirona) (Figure 30) and fit of two size 25 GuttaCore Verifiers were confirmed (Figure 31a). After irrigation the two root canal systems were obturated with size 25 GuttaCore obturators in combination with AH Plus Root Canal Cement (Figure 31b). Figure 32 shows the postoperative result after

Figure 27: Preoperative periapical radiograph. Note the previously placed composite restoration very close to the pulp.

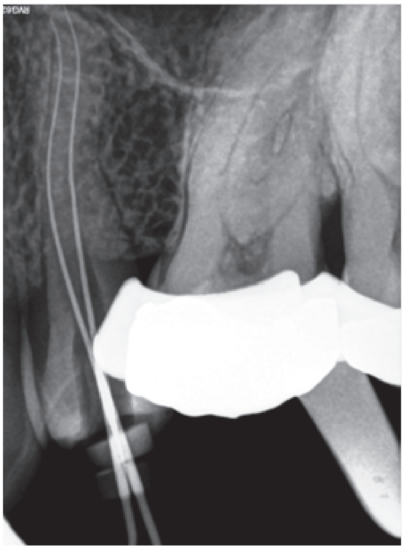


Figure 28: Length determination periapical radiograph.

Figure 29: The ProGlider single file rotary glide path instrument was used to enlarge the reproducible glide path that was secured with hand instruments.

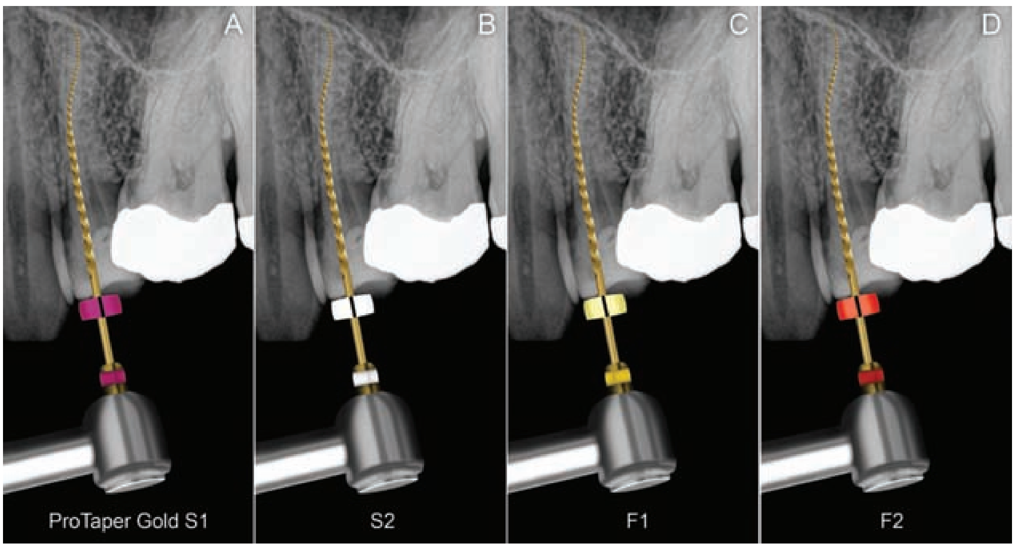


Figure 30: ProTaper Gold (a) S1; (b) S2; (c) F1 and (d) F2 instruments used to complete root canal preparation

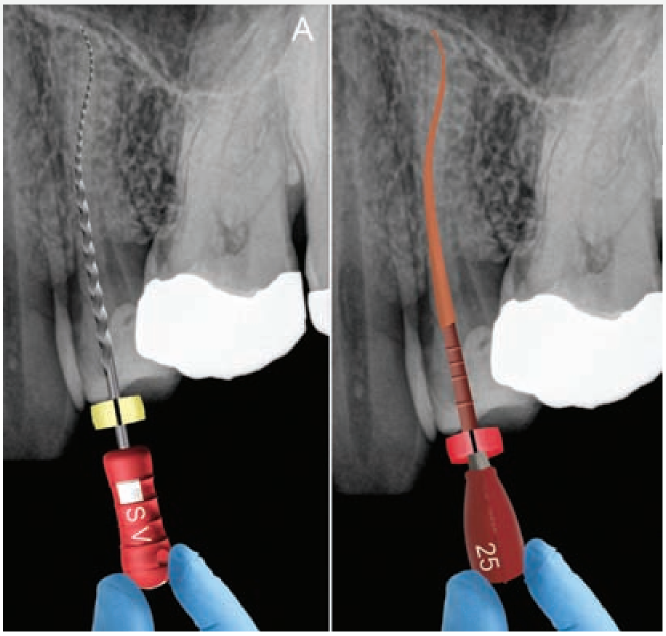


Figure 31: (a) The fit of size 25 GuttaCore Verifier was confirmed in the prepared root canals; (b) both root canal systems were obturated with size 25 GuttaCore obturators in combination with AH Plus Root Canal Cement.

Figure 32: Postoperative result after root canal preparation, irrigation and obturation with two size 25 GuttaCore obturators in combination with AH Plus Root Canal Cement.

obturation and core build-up using Core.X Flow (Dentsply Sirona) and a red X.Post (Dentsply Sirona).

Conclusion

In this article the authors illustrate the use of GuttaCore obturation in different challenging clinical scenarios after shaping and disinfection of the root canal system. Operator skill and experience as well as the complexity of the clinical case need to be considered when choosing the ideal obturation technique. Practitioners might find the GuttaCore carrier-based technique a reliable and predictable alternative in obturation compared to cold and warm compaction, both in simple and complex endodontic cases.

References

Alhashimi RA, Mannocci F, Foxton RM, Deb S (2012) Synthesis and preliminary evaluation of a polyolefin-based core for carrier-based root canal obturation. J Endod 38(7): 983-986

Buchanan SL (2009) Common misconceptions about carrier-based obturation. Endod Prac 12(4): 30-34

Boutsioukis C, Gogos C, Verhaagen B, Versluis M, Kastrinakis E, Van der Sluis LW (2010a) The effect of apical preparation size on irrigant flow in root canals evaluated using an unsteady Computational Fluid Dynamics model. Int Endod J 43: 874-881

Boutsioukis C, Gogos C, Verhaagen B, Versluis M, Kastrinakis E, Van der Sluis LW (2010b) The effect of root canal taper on the irrigant flow: evaluation using an unsteady Computational Fluid Dynamics model. Int Endod J 43: 909-916

Gutmann JL (2012) Innovative changes in core-carrier root canal obturation. Endod Prac 15(1): 12-18

Li G, Niu L, Selem L, Eid A, Bergeron B, Chen J, Pashley D, Tay F (2014) Quality of obturation achieved by endodontic core-carrier system with crosslinked gutta-percha in single root canals. J Dent 42:1124-1134

Khademi A, Yazdizaheb M, Feizianfard M (2006) Determination of the minimum instrument size for penetration of irrigants to the apical third of the root canal systems. J Endod 32: 417-420

Leung SF, Gulabivala K (1994) An in-vitro evaluation of the influence of canal curvature on the sealing ability of Thermafil. Int Endod J 27(4): 190

Paqué F, Ganahle D, Peters OA (2009) Effects of root canal preparation on apical geometry assessed by micro-computed tomography. J Endod 35: 1056-1059

Schilder H (1983) Vertical compaction of warm gutta-percha. Techniques in clinical endodontics. WB Saunders,Philadelphia: 76-98

Palatal implant placement, crestal sinus lift and palatal bone regeneration in a severely atrophic maxilla – nine years of follow-up

Antonio J. Flichy[1]

[1] Dr. Antonio J. Flichy
DDS, MS, PhD
- Degree in Dentistry from University of Barcelona and PhD "cum laude" from the University of Valencia.
- International expert and speaker on bone regeneration in implantology, teaching in Spain, Portugal, China, Iran, Switzerland, UK, Italy, Austria, Romania, Colombia, Mexico, USA.
- Private practice in Spain specialized in implantology and oral surgery with a focus on full-arch rehabilitation in severe bone atrophy.

Maxillary edentulous patients often present with severe horizontal bone atrophy, which can rule out standard implants as an option, unless extensive bone reconstructions are performed.

This case report shows how a minimally invasive augmentation procedure combined with narrow-diameter Straumann® Roxolid® SLActive® Bone Level Implants produced a predictable and successful outcome, as demonstrated by nine years of follow-up documentation.

Initial situation

The patient, a 58-year-old female non-smoker in good general health, presented at our dental practice with an already edentulous maxilla (Figs. 1, 2). A CBCT scan was recorded for diagnosis and treatment planning. We observed severe atrophy in bone height and width in the posterior segment (Fig. 3).

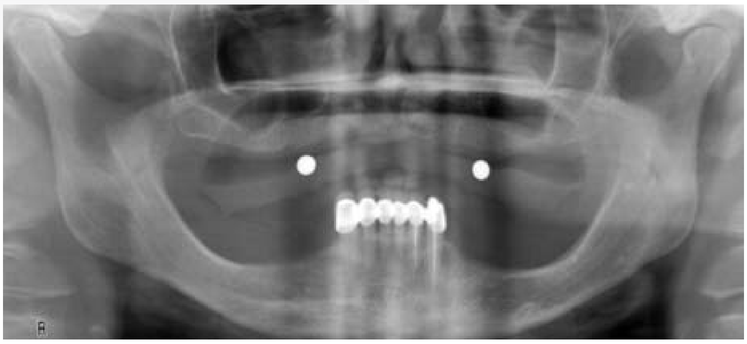


Figure 1

Figure 2

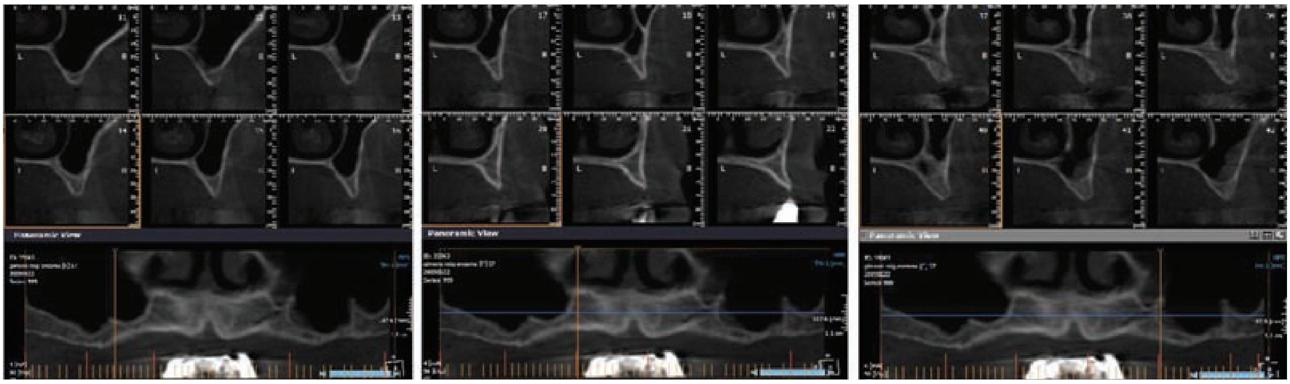


Figure 3

Treatment planning

In these types of clinical cases it is possible to draw up separate plans for the bone reconstruction and the arch rehabilitation.

For the bone reconstruction, some professionals opt for bone block grafting from the iliac crest, but our patient preferred to avoid additional invasive surgeries. We suggested a less traumatic alternative with implant placement via a palatal approach with palatal bone reconstruction. In this technique the crestal bone (between 2-3 mm wide) remains as the new buccal plate. The implants are placed in the palatal area with the rough surface exposed to the palatal side, followed by bone regeneration in this area to cover the exposed surface.

The planning includes the placement of five Roxolid® SLActive® 3.3 mm implants, which reduces the invasiveness of the procedure while keeping the implant resistance together with the SLActive® surface, which is proven to optimize GBR procedures and improve the outcome in such difficult clinical cases. A crestal sinus lift using osteotomes was also planned for the posterior implants. Since the patient required improved lip support, the restorative planning included the fabrication of an overdenture with retentive bar and metal retainers without plastic attachments or similar. With this prosthesis, the feeling for the patients is similar to that with a hybrid fixed prosthesis, without any type of mobility, but with the advantage of being able to take it out and clean it. After one year of maxilla restoration, four implants were placed in the mandible and restored with a Locator®-retained overdenture.

Surgical procedure

After incision, a muco-periosteal flap was raised in the maxilla (Fig. 4), and the osteotomy was started in the palatal area taking care to leave at least 2 mm of crestal bone as a buccal plate. After using the first drill, we continued expanding the bone with osteotomes to maintain more bone around the implant while lifting the sinus floor for the bilateral crestal sinus lift (Fig. 5). This type of surgery requires careful prosthetically-driven thinking with the aim of avoiding excessively palatal placement of the implant, which can impair the subsequent correct emergence of the abutments.

Four 3.3 x 10 mm Straumann® Bone Level (Roxolid® SLActive®) implants and one 3.3 x 12 mm Straumann® Bone Level (Roxolid® SLActive®) implant (Figs. 6, 7) were placed in total. After the implant placement, the palatal area of the implant was regenerated with Straumann® Bone Ceramic®. The palatal tissue thickness provides excellent retention and stability for the biomaterial. The flap was closed free of tension (Fig. 8), and a postoperative radiograph was taken after the surgery (Fig. 9). After four months of healing, a second stage procedure was

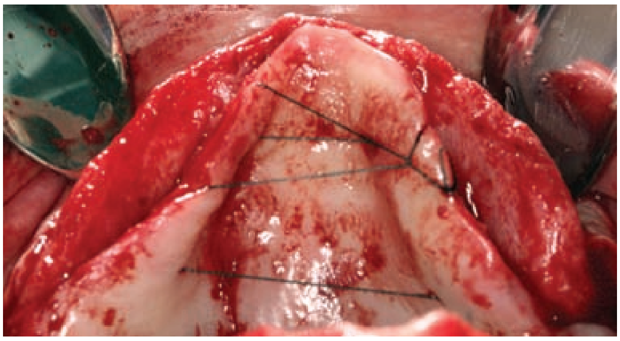


Figure 4

Figure 5

Figure 6

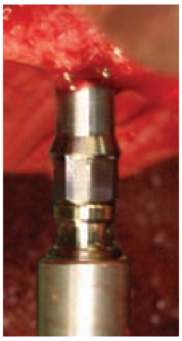


Figure 7

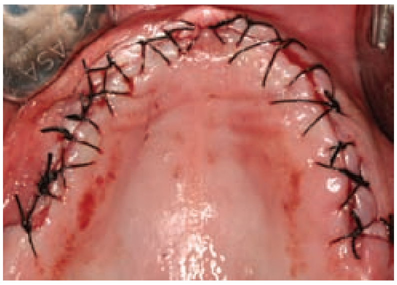


Figure 8

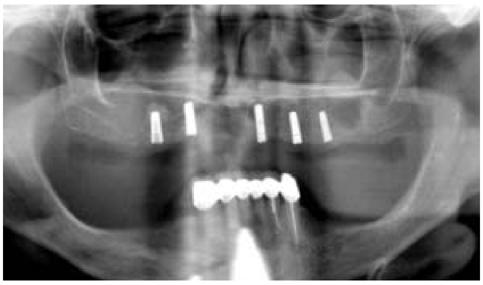


Figure 9

Figure 10

Figure 11

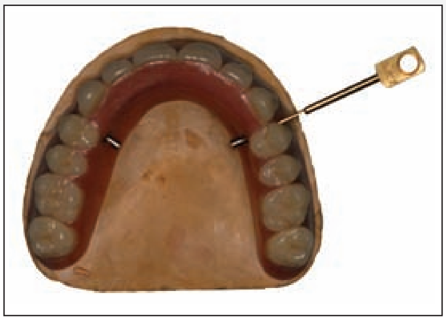


Figure 12

Figure 13

performed to expose the implants and place the healing abutments.

Two weeks later, the soft tissues were observed to be well structured with a substantial regenerated area around the implants (Fig. 10).

Prosthetic procedure

An overdenture prosthesis with retentive bar was designed by Javier Ortolá. This had three metal support points with friction retention and two metal retainers (Figs. 11, 13). This type of prosthesis provides excellent stability and never loosens, in contrast with classical bars with plastic retentions. It functions like a hybrid fixed prosthesis, with the advantage that the patient can easily remove and clean the bar and the prosthesis, which is better for the maintenance of the implants and peri-implant health.

The bar was adapted to the implant using the multi-base abutment from Straumann® which, according to the literature, is better for bone maintenance around the implants. The patient can remove the prosthesis using a key that pushes the metal retainer located between the canine and first premolar, or between the two premolars, normally in the vestibular to palatal direction (Fig. 12). When the patient wants to lock the prosthesis, it only needs to be placed on the bar and the retainer pushed with the finger in the palatal to buccal direction (Fig. 14).

Figure 14

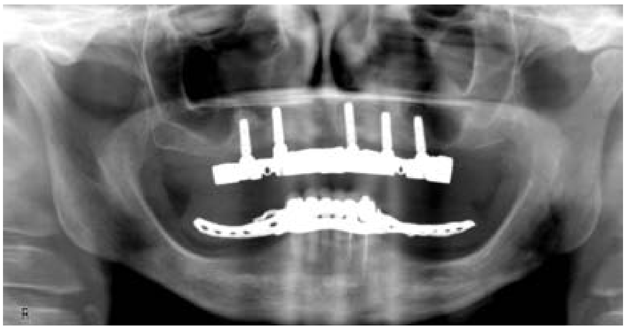


Figure 15

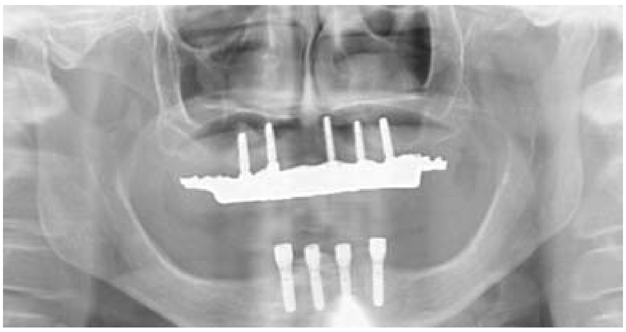


Figure 16

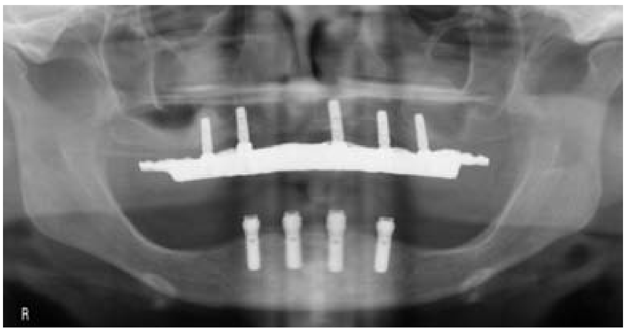


Figure 17

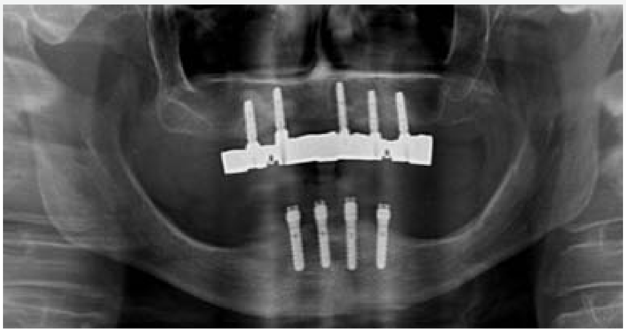


Figure 18

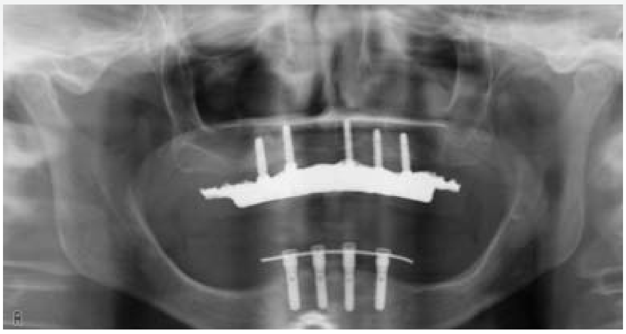


Figure 19

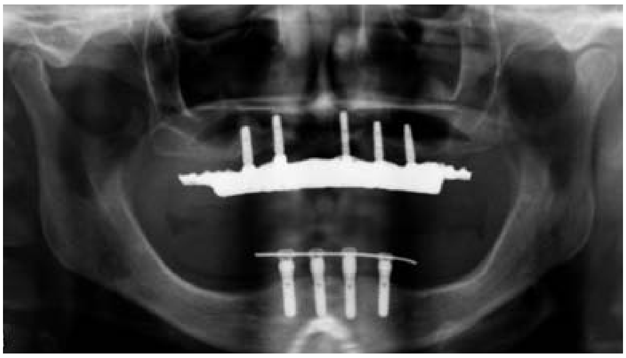


Figure 20

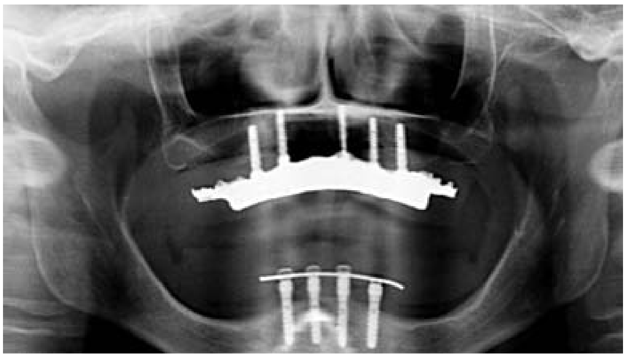


Figure 21

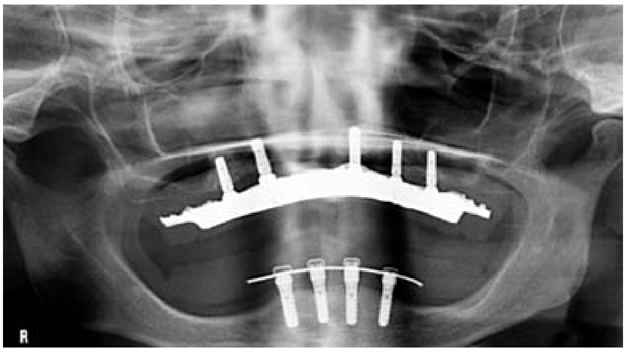


Figure 22

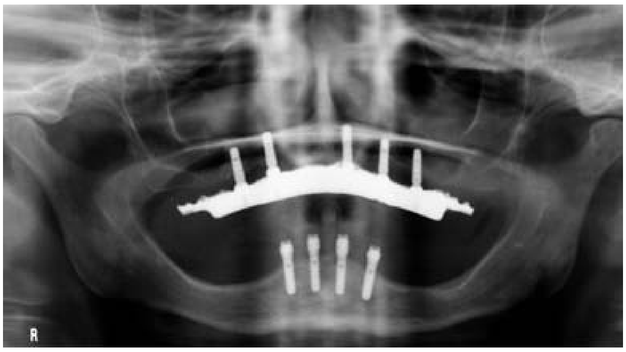


Figure 23

Treatment Outcome

The finished full-arch rehabilitation prosthesis showed good results, as regards both functional and aesthetic parameters, and the patient was highly satisfied (Fig. 14). Clinical follow-up was done every six months, and radiological follow-up every 12 months. We currently have nine years of follow-up and can observe good maintenance of the bone around the implants, making the treatment plan a good option using Straumann® Bone Level implants with platform switching (Figs. 15-23).

Conclusion

With Straumann® Bone Level Implants, we can obtain sufficient primary stability in cases with severe maxillary atrophy. Roxolid® allows us to reduce the diameter of the implant, keeping the occlusion resistance while avoiding the fracture of the implant, and preserving more bone around the implant. With this type of implant and surgical technique, after nine years of follow-up we observed good bone maintenance around the implants.

Reprinted with permission by Starget

The Dental Warehouse - A Henry Schein Company

Leigh Spamer

At the Henry Schein company, The Dental Warehouse, a number of exciting developments have occurred over the most recent months. This is what Leigh Spamer, Sales and Marketing Director, at The Dental Warehouse would like dental professionals to know about:

On the 23rd of October 2013, 40 years after being founded, The Dental Warehouse became part of Henry Schein, a solutions company for health care professionals powered by a network of people and technology. The company serves more than 1 million customers globally and is the world's largest provider of Business, Clinical, Technology and Supply Chain solutions to office-based dental, animal health, and medical practitioners. The Kahma Group still holds a minority stake in the business.

Over the past five years, the company has experienced many advancements. We have secured new exciting supplier partners meeting your expectations for high quality products at affordable pricing. We have expanded our product offerings including implant, laboratory, hand pieces and small equipment repair solutions. All this was added to support the development of a comprehensive solution, reducing the need for busy practices to lose valuable time shopping from multiple distributors and to help ensure that they get what they need from their trusted advisor.

We have responded to the rapid digitisation of the dentistry by adding a team of highly experienced digital sales consultants and very shortly, we will be able to support you with the integration of a complete digital workflow to help facilitate the transition to digital dentistry.

To put it simply, we are committed to supporting dental professionals so that they can enhance the patient experience, deliver quality dentistry, and improve their efficiency of their practice.

In August, we relocated our offices from Long Meadow to Midrand, where we now share a premise with our partners, the Kahma Group. This is a very exciting move for us as it will further our efforts to collaborate with the Kahma Group to further enhance and enlarge the service we provide to our customers.

Most recently, Nomo Khumalo, who has been playing an instrumental role in the development of The Dental Warehouse has stepped away from his position as Managing Director of the Dental Warehouse, remaining on the Board of Directors and as such much a part of our team. We would like to recognise Nomo's contribution and are happy to continuously benefiting from his guidance as a board member.

The South African team now form part of Henry Schein's EMEA region and connect directly into the United Kingdom, reporting to Patrick Allen, Managing Director for Henry Schein UK, Ireland and Africa who is with Henry Schein for more than 20 years. We are very fortunate to work under Patrick's dynamic leadership to drive the business forward.

I joined the company as Sales and Marketing Director in September this year. Coming to the organisation with many years of experience within the industry, I have spent the past 14 years at Dentsply Sirona. I am happy to share with the team my knowledge of the dental industry and a proven track record of working within the sales and marketing division to grow market share.

Our vision at The Dental Warehouse is to become the number one preferred dental company within Southern Africa. We have expanded our team to ensure we are well positioned to continue to offer you health care solutions including new products, services, and the excellent customer service you have come to expect.

We thank you for your loyalty during these times of change and look forward to an exciting and dynamic future together.

You can rely on us to deliver the solutions necessary to improve the performance of your practice so you can improve the lives of patients.

TOLLFREE: 0800 111 796

THE DENTAL WAREHOUSE
A HENRY SCHEIN® COMPANY
www.dentalwarehouse.co.za

Using cross-polarised photography as a guide for selecting resin composite shade

Carlos Andres Villavicencio-Espinoza[1], Mayara Hana Narimatsu[2] and Adilson Y Furuse[3]

Discoloured teeth are classic problems that impair the aesthetics of anterior teeth. When affecting multiple teeth, systemic aetiologies are usually associated, and ceramic veneers are good treatment options (Fu ruse et al, 2016).

On the other hand, a single discoloured tooth is often related to root canal treatment (Barber and King, 2014a), and severely discoloured teeth require the combination of walking bleach and external whitening treatments for the bleaching to be more effective (Barber and King, 2014b).

However, a major problem is the recurrence of discolouration. In this case, the aesthetic solution is frequently to cover the discoloured tooth with dental crowns or veneers.

While crowns should be precisely indicated to avoid unnecessary dental preparation (Prevedello et al, 2012), more conservative treatments, such as indirect and direct veneers, have become alternatives for patients with aesthetic problems with their anterior teeth (Fahl, 2006; Gomes and Perdigao, 2014; Korkut et al, 2013).

Direct veneer resin composites associated with adhesive systems have shown good mechanical properties and colour stability, as well as excellent aesthetic results (Ferracane, 2011). The current assortments of resin composites with different hues, chromas, and values make it possible to use the layering technique to create restorations that are indistinguishable from the natural dentition (Reis et al, 2009).

However, one of the greatest challenges when employing resin composites for veneering single discoloured teeth is the shade selection of natural teeth. Although some methods have been suggested in the literature, the success is considered subjective and highly dependent on the clinical experience of the operator (Haddad et al, 2011; Paolone et a l, 2014).

Different alternatives have been developed to facilitate the colour selection, such as the use of spectrophotometers or colorimeters (devices for colour measurement).

However, these devices have some disadvantages related to high cost. Moreover, sometimes the device does not properly indicate the correct colour, or the selected shade may not be compatible with the resin composite to be used (Bahannan, 2014; Zenthofer et al, 2014).

An interesting approach that can be very helpful for selecting the shade of resin composites is the use of polarising filters associated with digital photography, known as cross-polarised photography (Fleming et al, 1989).

This technique uses two linear polarising filters: one in front of the lens and the other in front of the flash (light source).

If the two filters are placed in the same plane of polarisation, they are parallel and do not eliminate all reflections. However, when one of the filters is rotated 90 degrees to the other, providing crossed planes of polarisation, near-tozero light interference is produced, and the clinician can then observe the teeth in a new way, without reflections (Fleming et al, 1989; Kim et al, 2012; Pekarek, 1993).

[1]Carlos Andres Villavicencio-Espinoza DDS MS PhD
Department of Operative Dentistry, Endodontics, and Dental Materials, Bauru School of Dentistry, University of Sao Paulo, Brazil.

[2]Mayara Hana Narimatsu DDS MS
Department of Operative Dentistry, Endodontics, and Dental Materials, Bauru School of Dentistry, University of Sao Paulo, Brazil.

[3]Adilson Y Furuse DDS MS Phd
Department of Operative Dentistry, Endodontics, and Dental Materials, Bauru School of Dentistry, University of Sao Paulo, Brazil.

Figure 1: Preoperative frontal view showing a discolouration on maxillary right central incisor.

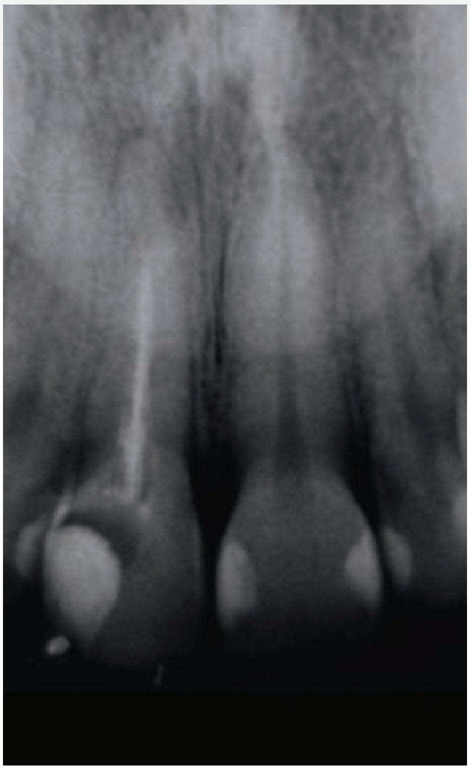


Figure 2: - Radiographic evaluation revealed an inadequate endodontic treatment with an alteration in the periapical area.

Figure 3: Initial colour of the discoloured tooth evaluated with cross-polarisation imaging. An A4 shade was observed with a Vita shade guide.

The advantage of this technique is that it allows a better understanding of the depth, details, characteristics, and transparencies of the dental structure. Additionally, the characteristics of the underlying dentine can be evaluated. In other words, this technique enables easier and straightforward appreciation of colour.

The purpose of this case report is to describe a step-by-step clinical case in which the patient had a discoloured maxillary anterior tooth restored with a resin composite veneer.

The use of cross-polarised photography for choosing dentine, enamel, and incisal shade is described.

Clinical report

A 30-year-old female patient was referred for treatment, complaining about the aesthetic appearance of her maxillary right central incisor. The clinical evaluation showed a single discoloured tooth and unsatisfactory old resin composite restorations (Figure 1).

The main cause of the discolouration was attributed to endodontic treatment. No sensitivities to percussion were detected horizontally or vertically. However, radiographic evaluation revealed inadequate endodontic treatment with an alteration in the periapical area (Figure 2).

Figure 4: Different setups for obtaining cross-polarised photography. Left: a single flash with a polarised niter on the camera. Right: a twin flash using two polarising niters. Both options always had a polarised niter adapted in front of the lens

Figure 5: Final appearances after bleaching treatment.

Figure 6: Evaluation of the shade of the sound central incisor with cross-polarised photography. It is possible to note an Al shade for the dentine.

Figure 7: Greyscale photography used for evaluation of value of the resin composites to be used in the stratincation.

Figure 8: Cross-polarised photography used for evaluation of the shade of the resin composites to be used in the stratincation.

The treatment plan included the following phases:

1. Root canal retreatment, a non-vital tooth bleaching using a combination of walking bleach and in-office bleaching techniques
2. Cementation of a fibre-reinforced post and a resin composite buildup on the palatal surface
3. Direct resin composite veneer.

Phase one

After root canal retreatment, the initial shade of the discoloured tooth was selected using cross-polarised photography and a Vita Classic shade guide (Vita, Vita Zahnfabrik). An A4 darkened tooth shade was observed (Figure 3). In contrast, the natural shade of the patient's teeth was B1.

For cross-polarised photography, polarising filters were adapted to both a Sigma macro 105mm lens attached to an SLR Nikon D5300 camera and the built-in flash in a way that the filters were rotated 90 degrees to one another to provide crossed planes of polarisation.

The camera was adjusted in manual mode to f/11, 1/100, and ISO 400. Figure 4 shows different setups for obtaining cross-polarised photography.

After rubber dam isolation, removal of coronal endodontic sealer until 1 mm apical to the cementoenamel junction, and resealing of the obturated canal with a glass ionomer cement (Vidrion R, 55 White), the walking bleach agent was prepared with a mixture carbamide peroxide and glycerin.

This bleaching agent was applied to the pulp chamber, and a temporary restorative material was used (Coltosol F, Coltene).

The walking bleach product was replaced every seven days for three weeks. In the third week, external/internal in-office bleaching was applied only on the affected tooth.

Phase two

Two weeks after bleaching, a post space was prepared, a fibre-reinforced post (Whitepost DC-E, FGM) was cemented using a self-adhesive resin cement (U200, 3M Espe), and a resin composite reconstruction of the palatal surface was made with 81 dentine and enamel shades (Opallis, FGM).

This selection of shades was based on the colour of the sound teeth and was made to avoid any possible decrease on brightness due to the thickness of the remaining facial dentine.

Phase three

The final post-bleaching shade of the maxillary right central incisor was evaluated, and A 1 was selected. Cross-polarised photography and a Vita Classic shade guide were used as previously described.The conventional shade selection of the sound maxillary left central incisor using a Vita Classic shade guide showed a 81 shade (Figure 5).

Wave-shaped white bands could be detected in the

Figure 9: Dental preparation finished.

Figure 10: An opaque flowable resin composite was applied over the discoloured dentine substrate to match the value of the natural tooth.

Figure 11: A3 dentine shade applied in cervical and middle thirds and A2 dentine shade applied in middle and incisal areas.

cervical and middle thirds, while an opalescence effect was observed at the incisal third. With cross-polarised photography, it was possible to observe that the dentine of the sound maxillary left central incisor had an A1 shade (Figure 6).

The shade selection for the resin composite was made on the sound central incisor. Small portions of resin composites were applied and light activated on the tooth's facial surface. During the shade selection, greyscale and cross-polarised pictures were taken (Figures 7 and 8). The greyscale picture was taken to evaluate the value of the resin composite to be used. These photographs were also used as a reference in the stratification of the final restoration.

Afterward, modified rubber dam isolation and the silhouette technique were used for tooth preparation. A round #1014 diamond bur (KG Sorensen) was used at high speed under water cooling to create cervical and proximal grooves. A tapered, round-ended #2135 diamond bur (KG Sorensen) was used for preparing vertical grooves and reducing the incisal edge. These grooves were used as depth cuts to facilitate the facial and incisal reduction of the veneer preparation.

In order to facilitate the cervical finishing, a #000 retraction cord (Ultradent) was used for gingival displacement (Figure 9). The tooth was etched with 35% phosphoric acid for 15 seconds. After rinsing with water, an adhesive (Am bar, FGM) was applied and light activated according to the manufacturer's guidelines.

Initially, an opaque white flowable resin composite (Kolor Plus, Kerr) was applied over the discoloured dentine substrate to match the value of the patient's natural tooth (Figure 10).

After this step, a thin layer of an opaque resin composite (OP, Opallis) was applied.

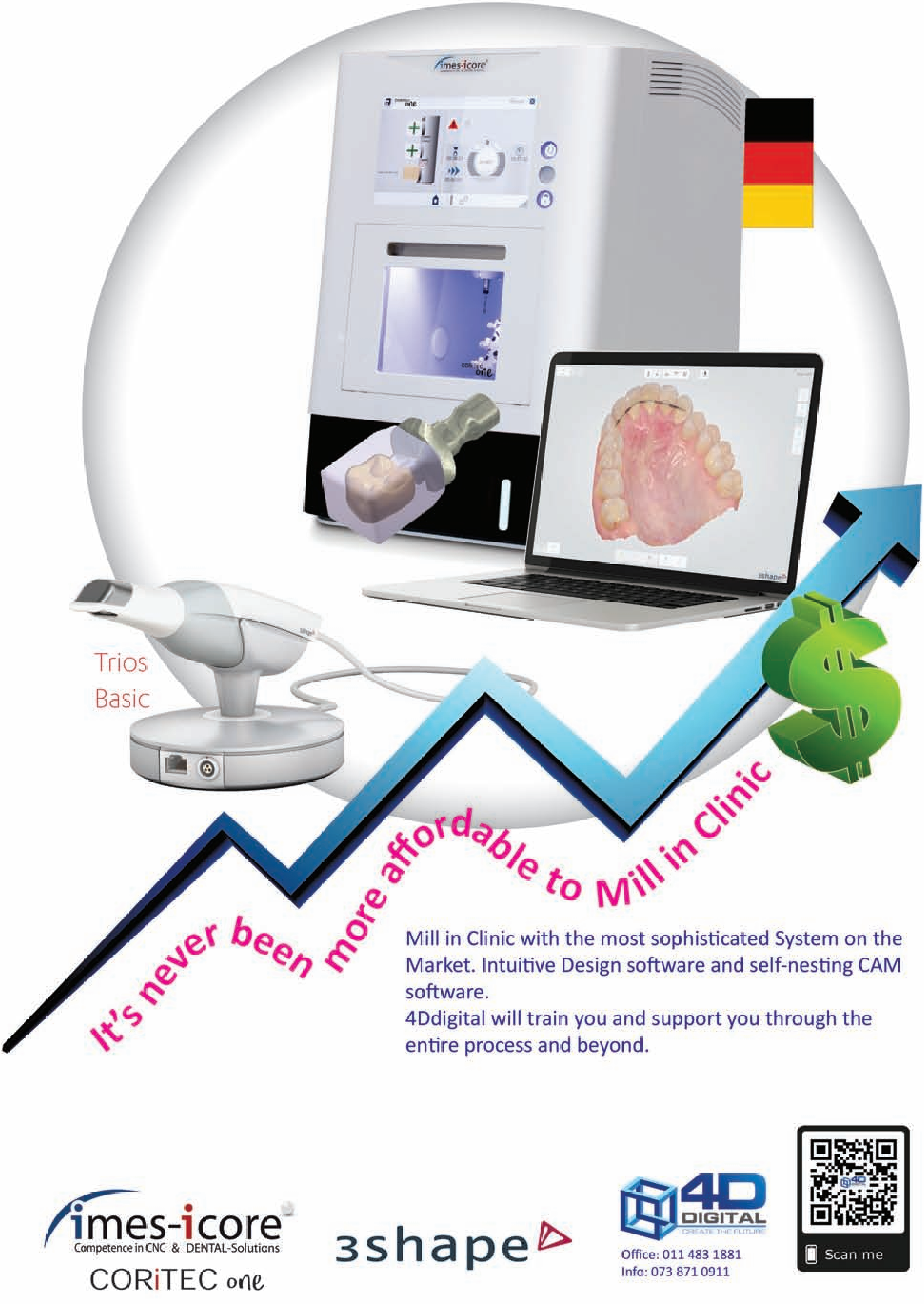
Afterward, a small layer of dentine shade (A3, Opallis) was applied to the cervical and middle thirds, and the dentine shade (A2, Opallis) was placed in the middle and incisal areas (Figure 11). These two procedures were performed separately, and both increments were light activated for 40 seconds.

Before adding the enamel layer, the intrinsic characteristics and highintensity hue of the adjacent teeth were accomplished with the aid of tints (Kolor Plus). In this stage, a white stain was used to reproduce wave-shaped bands in the cervical and middle thirds, and a blue stain was applied between dentine lobes to create an opalescence-like bluish effect at the incisal third.

All tints were applied with a thin brush (Figure 12). The last layer of artificial enamel was made with B1 enamel shade (EB1, Opallis) for the cervical third and bleached enamel shade (E-Bleach, Opallis) for the middle and incisal thirds. The two portions of resin composite were applied from the cervical to incisal area with a flat spatula to completely cover the underlying resin layers in one step (Figure 13). The facial surface was light activated for 40 seconds.

After the restoration was completed, finishing was accomplished with a #12 surgical blade (Lamedid) to remove resin composite excess in the cervical area. A pencil was used to highlight line angles of both central incisors, and a caliper was used to analyse light-reflecting areas (Figure 14). Sharp transitions between line angles were softened with a coarse finishing disc (TDV).

The restoration was polished with a sequence of polishing discs from coarse to superfine (TDV) and a silicone disc (TDV). The final polishing was accomplished with a felt disc and a 40-1 m diamond-based paste (TDV). The final restoration can be observed in Figure 15.



Trios
Basic
It's never been more affordable to Mill in Clinic
Mill in Clinic with the most sophisticated System on the Market. Intuitive Design software and self-nesting CAM software.
4Ddigital will train you and support you through the entire process and beyond.
imes-icore
Competence in CNC & DENTAL-Solutions
CORiTEC one
3shape
4D DIGITAL
CREATE THE FUTURE
Office: 011 483 1881
Info: 073 871 0911
Scan me

Figure 12: Colour characteristics were established using white stain in cervical and middle areas to reproduce wave-shaped bands. A blue stain was applied between dentine lobes to obtain an opalescence effect at the incisal third.

Figure 13: Application of the enamel layer.

Figure 15: Two-month follow-up showing the final result of the restored tooth.

Figure 14: A pencil was used to highlight the line angles, and a caliper was used to check the symmetry between central incisors. Blue stain was applied between dentine lobes to obtain an opalescence effect at the incisal third.

Discussion

The presented clinical situation reports an approach to a common problem when restoring maxillary anterior teeth and how to evaluate the inner characteristics of the dentine.

While dentine has a role in the reflection and absorption of light, being responsible primarily for the shades of natural teeth and saturation, enamel is rich in minerals and behaves like a translucent glass-like object that allows light to pass through it Uoiner, 2004). This phenomenon results in light dispersion and scattering.

Other determining factors of a successful restoration include the tooth shape, surface characterisation, and propagation of light inside the restoration (Vanini, 1996). As demonstrated in the present case report, these last factors can be more easily observed and corrected using a pencil to highlight line angles of both central incisors and a caliper to analyse light-reflecting areas.

Shade selection of natural teeth is a complex process because it involves subjective factors that depend directly on the observer, light source, and reflection of light by the object.

Moreover, the time employed for colour observation, observer's experience, and type of shade guide, as well as the material's composition, are other subjective factors that critically influence the shade selection.

In general, shade guides for use in dentistry follow Munsell's colour parameters (Sproull, 2001), in which three dimensions are defined: hue (basic colour), chroma (saturation}, and value (brightness).

In the case of direct restorations, employing resin composite shade guides, although recommended for the initial evaluation of colour, may be confusing and, despite several attempts to define a protocol for use, still rely on the clinical experience of the observer and the inoffice illumination.

Moreover, due to the optical phenomena occurring on natural teeth, it is necessary to select colours for dentine, enamel, and incisal translucent areas to obtain a better layering technique.

Over the past decade, there has been an increasing interest in illumination techniques for use in dental photography. Digital pictures can help minimise errors in clinical practice, especially during the shade matching of natural teeth. The protocol based on cross-polarisation, eliminating the superficial enamel light reflection, allows unobstructed visualisation of surface and subsurface enamel characteristics.

This technique enables easy and more accurate selection of the hue and chroma of the dentine (Bazos and Magne, 2011).

Moreover, as demonstrated, the use of polarising filters associated with digital photography is a simple and straightforward method for better understanding the colour of natural anterior teeth (Hein and Zangl, 2016).

For a better use of this resource, the authors recommend three pictures: the maxillary anterior teeth with a black background, the maxillary anterior teeth with a black background and the shade guide, and the maxillary anteriorteeth with a black background and small portions of cured resin composites.

The first picture of this protocol enables the evaluation of the characteristics of both enamel and dentine, providing an understanding and estimation of how opaque each structure is.

The second picture is taken after the usual colour selection, employing shade guides, and serves to compare the general colour selected for the entire tooth with the estimated colour of the dentine.

The third picture is taken after selection of the specific resin composites for each layer and serves to check if the selection is appropriate.

It should be noted that not every resin composite system is equal, and, despite the shade specification made by each manufacturer, the colour itself may vary. This means that the A 1 dentine shade specified by one manufacturer may not correspond to the A 1 dentine shade specified by another.

Moreover, the shade selection using only shade guides may be misleading if custom-made shade guides produced with the actual resin composite are not used. For this reason, this third additional step will help the selection of the correct shade of a specific system.

In the present case report, in the evaluation of the colour of the sound central incisor with cross-polarised photography (Figure 6), the A 1 shade was selected with a shade guide originally designed for ceramics, which is not specific for the resin composite system used in the restoration.

For the specific resin composite system employed, after the application of the two opaquers (ie, a first layer of a white opaque flowable resin composite and a second layer of a conventional opaque OP resin composite), the A 1 dentine shade would have an artificially bright effect instead of reaching the desired colour. Thus, A3 and A2 dentine shades were used to reproduce the colour variation of the dentine from cervical to incisal thirds.

Another interesting use of digital photography to help the clinician improve predictability when restoring discoloured teeth is the provisional application of a thin layer of an opaque resin composite after dental preparation followed by the evaluation of the change in brightness using greyscale photographs (Fahl, 2007).

This technique can help reproduce the brightness (value) of the adjacent teeth and could be added to the photographic protocol proposed in the present case report. However, one should take care not to over-dehydrate dental tissues during restorative procedures, as brightness is elevated.

When taking digital photographs, the reflection of the flash on the enamel of the adjacent teeth may increase the brightness, especially when ring flashes are used. For this reason, twin flashes are better for taking pictures of anterior teeth.

Bouncers adapted to twin flashes are other interesting accessories that can modify tooth chromaticity (Hein and Zangl, 2006), as well as perceivable changes of brightness on the tooth. For this reason, their use is recommended, except for in cross-polarised photography.

As suggested in the present case, the use of cross-polarised photography to assess the chromaticity and brightness (value) should be done as soon as possible (ie, in a short time) during the restorative procedure due to the natural dehydration of teeth.

In addition, photographs with polarisation modalities can improve the evaluation of the level of brightness of resin composites and teeth when taken in greyscale because they remove the interferences of both environmental light and photographic equipment. interferences of both environmental light and photographic equipment.

Conclusions

The evaluation of hue, chroma, value, and colour characteristics exhibited by natural dentition using cross-polarisation may help achieve more predictable outcomes during the stratification technique with resin composites.

This study was conducted in accordance with all the provisions of the local human subjects oversight committee guidelines and policies of the Bauru School of Dentistry, University of Sao Paulo, Brazil.

The authors of this article certify that they have no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this article.the local human subjects oversight committee guidelines and policies of the Bauru School of Dentistry, University of Sao Paulo, Brazil.

References

Bahannan SA (2014) Shade matching quality among dental students using visual and instrumental methods. J Dent 42(1): 48-52

Barber A, King P (2014a) Management of the single discoloured tooth. Part I: Aetiology, prevention and minimally invasive restorative options. Dent Update 41(2): 98-100, 102-104

Barber A, King P (2014b) Management of the single discoloured tooth. Part 2: Restorative options. Dent Update 41(3): 194-196, 198-200, 202-194

Bazos P, Magne P (20 I I) Bio-emulation: Biomimetically emulating nature utilizing a histoanatomic approach; structural analysis. Eur J Est/Jet Dent 6(1):8-19

Fahl N (2006) A polychromatic composite layering approach for solving a complex class IV/direct veneer diastema combination: Part I. Pract Proced Aesthet Dent 18(10): 641-645

Fahl N (2007) A polychromatic composite layering approach for solving a complex class IV/direct veneer/ diastema combination: Part 11. Pract Proced Aestl,et Dent 19(1) 17-22

Ferracane JL (201 I) Resin composites - state of the art. Dent Mater27(1): 29-38

Fleming CM, Beal J F, Levine RS (1989) Photographic technique for the recording of children's teeth for signs of enamel mottling. J Audiov Media Med 12(I): 16-18

Furuse AY, Soares JV, Cunali RS, Gonzaga CC (2016) Minimum intervention in restorative dentistry with V-shaped facial and palatal ceramic veneers: A clinical report. J Prosthet Dent 115(5): 527-530

Gomes G, Perdigao I (2014) Prefabricated composite resin veneers - a clinical review. J Est/Jet Res Dent 26(5): 302-3 I 3

Haddad HJ, Salameh Z, Sadig W, Aboushelib M, Jakstat HA (20 I I) Allocation of color space for differentage groups using three-dimensional shade guide systems. Eur J Est/Jet Dent 6(I): 94-102

Hein S, Zangl M (2016) The use of a standardized gray reference card in dental photography to correct the effects of five commonly used diffusers on the color of 40 extracted human teeth. Int J Est/1et Dent 11 (2): 246-259

Joiner A (2004) Tooth colour: A review of the literature. J Dent 32(Suppl I): 3-12

Kim E, Son T, Lee Y, Jung B (2012) Development of polarization dental imaging modality and evaluation of its clinical feasibility./ Dent 40(Suppl I): el8-e25

Korkut B, Yarnkoglu F,Gtinday M (2013) Direct composite laminate veneers: Three case reports./ Dent Res Dent Clin Dent Prospects 7(2): I 05-111

Paolone G, Orsini G, Manauta J, Devoto W, Putignano A —(2014) Composite shade guides and color matching. Int/ Est/Jet Dent 9(2): 164-182

Pekarek D (I 993) The use of cross-polarized illumination for patient photography./ Biol Phot ogr61(3): 95-97

Prevedello GC, Vieira M, Furuse AY, Correr GM, Gonzaga CC (2012) Esthetic rehabilitation of anterior discolored teeth with lithium disilicate allceramic restorations. Gen Dent 60(4): e274-e278

Reis A, Higashi C, Loguercio AD (2009) Reanatomization of anterior eroded teeth by stratification with direct composite resin. J Est/Jet Res Dent 21(5): 304-316

Sproull RC (2001) Color matching in dentistry. Part II. Practical applications of the organization of color. J Prost/Jet Dent 86(5): 458-464

Vanini L (1996) Light and color in anterior composite restorations. Pr.1ct Peri odontics and Aesthet Dent 8(7): 673-682

Zenthofer A, \Viesberg S, Hildenbrandt A, Reinelt G, Rammelsberg P, Hassel AJ (2014) Selecting VITA classical shades with the VITA 3D-master shade guide. Int/ Prost/Jodont 27(4): 376-382

Reprinted with permission by ADT August 2018

A skilful combination of CAD/CAM and manual work

Aiham Farah[1] and Anas Aloum[2]

The aim of a restorative treatment is to re-establish the esthetic properties of the tooth structure to ensure that it blends in with the shade and vitality of the natural surroundings whilst using the least invasive methods possible. Severe discolourations often aggravate the initial preoperative situation in addition to misalignments, damaged teeth and/or existing restorations. Extensive reconstructions require the combination of modern materials and technologies with manual skills. Outstanding results can be achieved by carefully selecting suitable materials, masking discoloured preparations and implementing an optimum preparation design. The success can be seen in restorations that remain stable and intact over many years.

This report describes the restorative treatment with a lithium disilicate glass-ceramic – a material that features excellent long-term clinical properties. A CAD/CAM manufacturing process was chosen to enhance the efficiency of the treatment. After a try-in in the blue (non-crystallized) state, the restoration was finalized and customized by hand in the laboratory to provide a final result with excellent esthetic properties.

Questions to explore

1. How can CAD/CAM technologies be combined with manual skills to achieve outstanding restorative results?
2. How to select suitable materials to mask discoloured substrates and take advantage of an intelligent app (SNA) to select an appropriate shade and translucency?
3. How can severely discoloured tooth preparations be masked and their shade matched to the shade of the neighbouring teeth?

Preoperative situation

A 29-year-old female patient consulted the practice with the wish to have a natural beautiful smile. She was dissatisfied with her upper anterior restorations and the appearance of the surrounding soft tissue. She wished for a functional and esthetic solution (Fig. 1). Photographs of the oral situation were taken during medical history-taking and the patient's expectations were discussed. The intraoral examination revealed severe discolouration, devitalized teeth and poor esthetics. In addition to an inappropriate shade, the upper anterior crowns and veneers were out of proportion, causing an inharmonious smile line (Fig. 2). An X-ray confirmed the suspicion that the endodontic fillings on the two central incisors were defective. The lateral incisors had been repaired with large composite restorations. Due to the inadequate contouring of the underlying composite, the patient showed clear signs of periodontitis in the area of all four anterior teeth.

An impression of the situation was taken. The study model provided a physical reference that was used to mark the relevant lines and planes, align the longitudinal axes, adjust the lengths and implement cosmetic optimizations in line with the digital design concept (Fig. 3). A diagnostic wax-up was created. Then, a silicone key was produced from the wax-up for the fabrication of the temporaries. The silicone key also served as a guide in the preparation of the teeth.

[1] Aiham Farah, MDT
Cosmetic Ceramist,
Trainer and Material Consultant
Dubai, United Arab Emirates
aihamfarah@gmail.com

[2] Anas Aloum, BDS, FACP
Medical Director and Prosthodontist
Abu Dhabi, United Arab Emirates
anasaloum@yahoo.com

Figure 1: Initial appearance of the smile.

Figure 2: Preoperative oral situation with periodontitis, discoloured restorations and devitalized teeth. Inadequate esthetic characteristics of the individual teeth and inharmonious smile line.

Figure 3: Smile design with newly proportioned length and width of the incisors in line with the digital smile design concept.

Preliminary treatment

The existing restorations on the upper anterior teeth were removed. Teeth UR2 to UL2 were prepared with a rounded shoulder of 1 to 1.2 mm and equigingival margins, according to the preparation guidelines for all-ceramic crowns. The depth varied slightly due to the shade of the preparation and degree of discolouration. The dark discolouration on the dentin of the right central incisor required a deeper preparation in order to be able to mask the shade of the remaining tooth structure (Fig. 4). Teeth UL3 and UR3 were prepared for veneer placement with an equigingival chamfer, 0.5-mm buccal reduction and 1-mm incisal reduction (Fig. 5). An impression of the resulting situation was taken using A-silicone and then direct temporaries were created with the help of the silicone key (Fig. 6). The periodontal situation was monitored over the following two weeks. Gingival healing was uneventful. The temporary restorations allowed the final result to be visualized. At this stage, intraoral adjustments could be made to achieve a harmonious symbiosis between the lips, smile and face.

Shade selection

The desired tooth shade and the existing shade of the tooth preparations were determined under daylight conditions.When photos of the teeth were taken, darker and lighter shade tabs were held against the natural teeth, the flash was turned off and all photos were taken from a similar angle. These photos were also very helpful in the fabrication of the restorations in the laboratory (Figs 7a and b).

Material selection in favour of clinically proven properties

The decision fell on a tried-and-tested glass-ceramic that offers long-term clinical stability along with high strength and impressive esthetics: IPS e.max® lithium disilicate. This material is suitable for both conventional press methods and CAD/CAM applications. It can be processed to provide fully anatomical restorations or restorations that can be customized with veneering ceramics. As this case had already taken us onto a digital route with the 2D smile design software, we decided to continue with the digital option. The situation was digitalized with a D2000 scanner (3Shape).

Figures 4: Crown preparations of central and lateral incisors and veneer preparation of both canines.

Figures 5: A deeper preparation was required in the buccal area of the upper central incisor on the right because of the pronounced dark discolouration present in that area compared with the neighbouring tooth.

Figures 6: Direct temporaries created on the basis of the smile design wax-up.

The restorations were designed in the software in line with the proportions previously established and then ground from IPS e.max CAD blocks using a Zenotec select hybrid CAD/CAM machine (Fig. 8). The IPS e.max blocks were processed in their crystalline intermediate stage ("blue" phase), which is optimally coordinated with the grinding process, providing highly accurate results. Subsequently, the restorations were crystallized in a conventional ceramic furnace, in the course of which they acquired their final material properties (e.g. shade). Once crystallized, the strength of the material increases up to 530 MPa (mean biaxial strength). IPS e.max CAD blocks are available in different translucency levels, ranging from medium opaque to highly translucent (MO, LT, MT, HT), and in two opalescent shades. The material can be used to create frameworks for veneering or to fabricate monolithic restorations (e.g. veneers, inlays, crowns and three-unit bridges). It is also indicated for hybrid abutment restorations. IPS e.max CAD is suitable for an unrivalled wide range of indications for CAD/CAM glass-ceramics. It is even suited for minimally invasive restorations such as thin veneers (0.4 mm) and adhesive crowns (1 mm).

Block selection with an app

In terms of colour saturation, shade 1M2 (Vita 3D-Master) was ideal and would have come closest to the A1 shade (A-D shade guide). However, the brightness in the central third was higher than that of the IPS e.max CAD LT block in shade A1. And yet, the colour saturation of a brighter block (e.g. LT BL4) would have been too high for the veneer. The IPS e.max CAD HT (High Translucency) blocks in the Bleach shades might have been a suitable choice. However, using highly translucent materials in restorations with slightly increased wall thicknesses always entails the risk that the restoration may be less bright and the chroma could be higher than the actual shade. For these reasons, the HT block was not seen as ideal for the crowns on teeth UL2 and UR2.

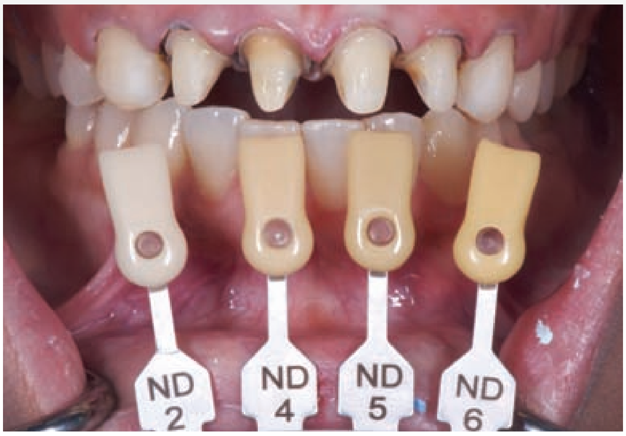
The IPS e.max Shade Navigation App (SNA) was used to find the most suitable material. This app takes all the factors affecting the shade of a restoration into account to identify the block that is best suited to achieve the given shade. The app is fast and easy to use. You only have to enter the data pertaining to the case at hand. The app delivers an excellent result.

Initial input for the crowns:

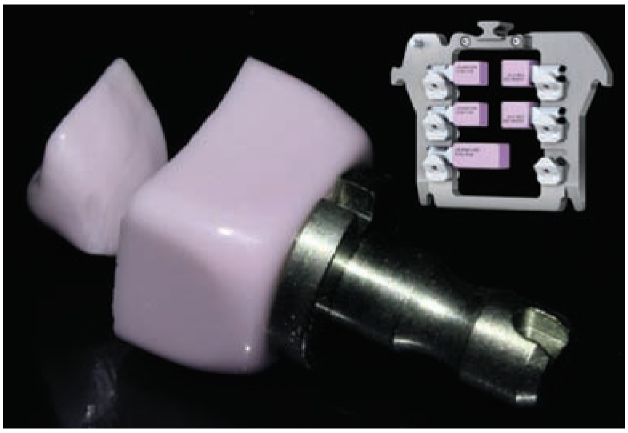
- Desired tooth shade: 1M2 (= A1)
- Indication: crowns for UL1, UL2, UR1, UR2
- Preparation shade: ND2
- Material thickness: 1.2 mm
- Material: IPS e.max CAD

Based on the data entered, the app recommended an IPS e.max CAD block in shade MT BL4. This block was required to mask the small area of discolouration (ND4) on the UL1 and to offset the slight drop in hue and value caused by the

Figures 7a: Determining the shade of the lower teeth.



Figures 7b: Selecting the shade of the tooth preparations using the IPS Natural Die Material shade guide.



Figures 8: Lithium disilicate block (IPS e.max CAD) in the blue intermediate crystalline stage on the e.matrix holder (for the Zenotec select millling machine) ready for wet machining.

buccal reduction and the ceramic veneering.

To identify a suitable block for the veneers on teeth UL3 and UR3, "Add new restoration" was activated on the app and the following data was entered:

- Desired tooth shade: 1M2 (= A1)
- Indication: veneers for UL3 and UR3
- Preparation shade: ND1
- Material thickness: 0.5 mm
- Material: IPS e.max CAD

The "Free selection" option was used to see if the shade was also suitable for the crowns. It was possible to assess if the MT BL4 was appropriate for all restorations, which it was. So, the MT BL4 shade was employed for both the crowns and the veneers.

Try-in and insertion

After the grinding process, a clinical try-in was performed while the restorations were still in their blue intermediate crystalline stage (Figs 9 and 10). The evaluation was carried out with the dentist's specifications and the patient's expectations in mind. In this context, photos of the lips and face of the patient play an essential role for the quality of the technician's work. Adjustments can be applied as required and the photos can be viewed from various angles.

Layering OR staining?

A straightforward and uniform result could have been achieved by simply glazing/staining and crystallizing the "blue" restoration in a single firing process. In this case, however, we are talking about an esthetically demanding situation. The crowns and veneers were therefore completed with the IPS e.max Ceram layering ceramic after they had been crystallized to attain a natural looking result, increase the translucency and achieve an optimum match in terms of depth, chroma, value and hue. Initial characterizations were already applied to the cervical and interdental areas during the crystallization process (e.g. with IPS e.max CAD Crystall./Shades).

Transferring the preparation shade to the model

The dentin shade of the tooth preparations had to be transferred to the model before the layering scheme and ceramic veneering materials could be selected. This is essential to keep a consistent shade match throughout the manufacturing process up to the insertion of the restoration. Model dies were created using IPS Natural Die Material.

NEW TO SA

Kerr™

ENDODONTICS

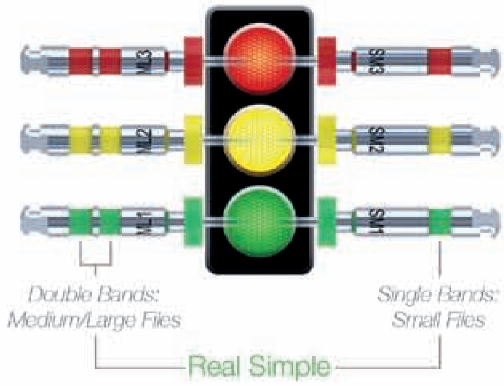
TF®

ADAPTIVE

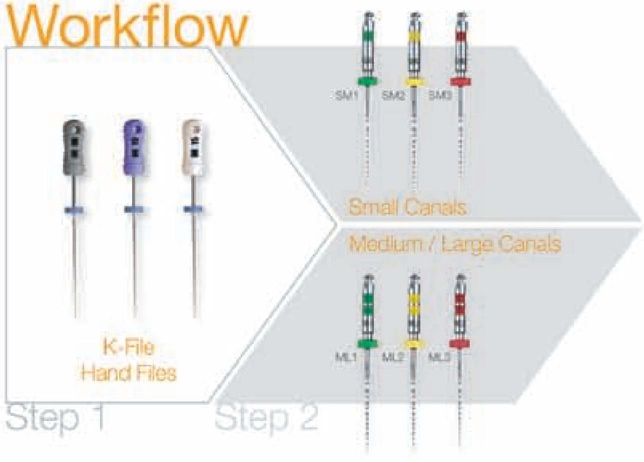
Keep it simple

Intuitive, colour-coded file identification

An intuitive colour-coded system designed for efficiency and ease of use. Just life a traffic light...start with green and stop at red.



TF Adaptive Technique



EXCLUSIVE DISTRIBUTOR

THE DENTAL WAREHOUSE

A HENRY SCHEIN® COMPANY

www.dentalwarehouse.co.za

TOLLFREE: 0800 111 796

Figures 9: Restorations in transmitted light prior to crystallization (blue stage): note the differences in material thickness.

Figures 10: Try-in of the restorations in the blue intermediate crystalline stage.

Even some of the existing orange spots on the dentin (e.g. cervical area of right central incisor) were reproduced on the model dies (using light-curing characterization materials from the SR Nexco® range).

Finalizing the restorations

Following a simple cut-back in the incisal third, a natural-looking transition was created between the layers using the IPS e.max Ceram Mamelon and Opal materials as well as a variety of brighter shades (Fig. 11). After firing, a great deal of care was invested in perfecting the texture, contours and surface characteristics (Fig. 12). At the end, the shade match was checked on the model dies. A variety of (try-in) materials can be used to adjust the brightness between veneers and crowns at the try-in and subsequent seating of the restorations. In addition, a natural-looking lustre blends in harmoniously with the natural surroundings in the patient's mouth. Glaze firing is therefore an important and criticalfiring process. It should be the result of the interplay between manual polishing, quality of gloss and the firing parameters (Fig. 13).

Cementation and recall

The crowns and veneers were placed adhesively using

Figures 11: Restorations on the working model: restorations in the blue stage on one side and the result on the other, i.e. tooth-coloured restorations after crystallization and veneering with IPS e.max Ceram.

Figures 12: Verifying the contours and microtexture with gold powder.

Figures 13: Examination on unsegmented model: closed interdental spaces after Glaze firing and manual polishing.

Figures 14: Result after four weeks. Note the soft feminine alignment of the teeth.

Figures 15: Restorations after six months. The restorations harmonize with the teeth in the lower jaw – the slightly lighter shade was requested by the patient.

Figures 16: Restorations after 4.5 years: The four crowns and two veneers are durable, their shade has remained stable and the soft tissues surrounding them looks healthy.

Variolink® Esthetic luting composite. This material is ideally suited for the permanent cementation of demanding ceramic restorations. Excess composite was removed with the help of fine diamond burs, rubber finishers and polishers. Occlusal interferences were eliminated. At the first recall, the restorations were inspected and some last modifications implemented (Fig. 14).

Conclusion

Ceramic restorations have been used in cosmetic dentistry for over thirty years. Past experience has shown that the quality and longevity of these restorations depend to a considerable extent on the experience of the treatment team. Modern materials, however, are offering ever more reliability and flexibility. The restorations described in this report were re-inspected after approx. 4.5 years (Figs 15 and 16). They continued to be in very good condition, reflecting the effectiveness of the material and the manufacturing process.

Reprinted with permission by Reflect 2/2018

Furcation perforation: current approaches and future perspectives

Manal Farea,[1] Adam Husein[2] and Cornelis H Pameijer[3]

[1] Manal Farea is a dentist with a BDS degree from Sana'a University, Sana'a, Yemen in 2003. She received her MSc degree in endodontics from Universiti Sains Malaysia (USM), Malaysia in 2010. In 2015, she completed her PhD degree at the USM in regenerative endodontics. Dr Manal was granted a scholarship from Sana'a University, Yemen in 2007 and a fellowship from USM in 2011.

[2] Professor Dr Adam Husein is a senior lecturer in the restorative unit (prosthodontics) and the dean of School of Dental Sciences, Universiti Sains Malaysia. He got his BDS from University of Adelaide, Australia in 1996. In 2004, he optained his graduate diploma in clinical dentistry, doctor in clinical dentistry and fellowship of the Royal Australasian College of Dental Surgeons (FRACDS) from the University of Adelaide.

[3] Cornelis H Pameijer DMD MScD DSc PhD graduated from the University of Utrecht with a DDS in The Netherlands in 1967 and went on to further his studies at Boston University in the USA. He is currently professor emeritus at the University of Connecticut in Farmington, Connecticut, USA. He has lectured extensively worldwide and has published more than 300 publications in mostly peer-reviewed journals.

During root canal treatment many procedural accidents may occur of which perforation of the root canal system plays a significant role. Perforation is defined by the American Association of Endodontics (AAE) Glossary of Endodontic Terms (2003) as a mechanical or pathological communication between the root canal system and the external tooth surface, which is caused by caries, resorption or iatrogenic factors. It has been identified as the second greatest cause of endodontic failure that accounts for 9.6% of all unsuccessful cases (Pitt Ford et al, 1995).

As a result of furcation perforation, destruction of the periodontal tissues may occur, which ultimately lead to loss of the tooth (Arens, Torabinejad, 1996; Tsesis, Fuss, 2006). The prognosis of the tooth depends upon several factors:

1. The severity of initial damage to the periodontal tissue
2. The location and size of perforations
3. The bacterial contamination
4. The sealing ability or cytotoxicity of the repair materials (Tsesis, Fuss, 2006; Sinai, 1977; Balla et al, 1991).

Even if a biocompatible material is used to treat a perforation, extensive injury may cause irreversible damage to the attachment apparatus at the furcation area (Sinai et al, 1989).

In large perforations, the complete sealing of the defect with a repair material is problematic and allows irritants to continuously penetrate into the furcation area (Balla et al, 1991). Perforations close to the gingival sulcus produce persistent inflammation and a down-growth of sulcular epithelium into the defect (Tsesis, Fuss, 2006). Sinai (1977) stated that coronally located perforations including furcal perforations were more serious than those in the middle and apical third of a canal. It is the objective of this review to collect and review the data that is available in the scientific literature and to reach a conclusion as to the best treatment options.

Methods

Retrieval of literature

An English-limited Medline search was performed of articles published from 2002 to 2015. The searched keywords included 'perforations and endodontics', 'furcation perforation', 'root canal and perforation', and 'perforation and mineral trioxide aggregate (MTA)'. Then, a hand search was done of the references of collected articles to determine if more papers relevant to the topic should be included.

Results

A total of 820 articles were found, which, in order of their related keywords, accounted for the following: perforations and endodontics: 285; furcation perforation: 92; root canal and perforation: 299; and perforation and mineral trioxide aggregate (MTA): 144.

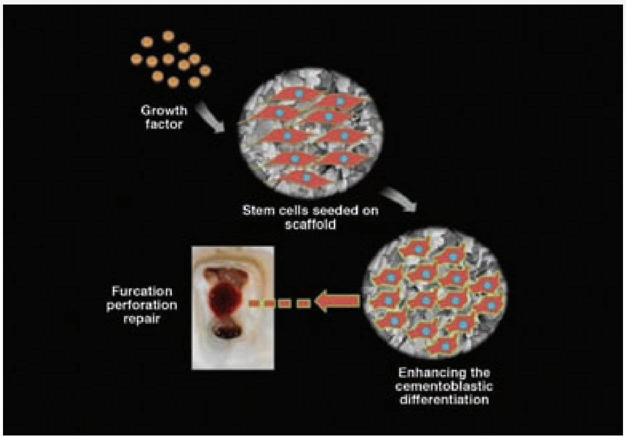


Figure 1: This illustration depicts a furcation perforation repair using stem cells, scaffold and growth factor. This method has the potential to open new avenues in furcation repair treatment in the foreseeable near future. This image relates to the text under 'future perspectives for the perforation repair' on page 40.

Perforation repair techniques and their prognosis

Surgical and non-surgical approaches have been utilised for periodontal tissue re-establishment at the perforation site. In both surgical and non-surgical approaches, two factors should be considered:

1. An appropriate material selection
2. The use of a matrix (Clauder, Shin, 2009).

The repair material should be selected based on the following criteria:

- Perforation site accessibility
- Biocompatibility (be nontoxic and noncarcinogenic)
- Ability to induce osteogenesis and cementogenesis
- Moisture control
- Easy handling
- Aesthetic considerations (Clauder, Shin, 2009; Bryan, Woollard, Mitchell, 1999; Yildirim et al, 2005; Samiee et al, 2010).

Matrix use

Controlling haemostasis and placement of the repair material in the perforation site without extrusion into surrounding periodontal structures are essential prerequisites for the success of a perforation repair. In order to achieve a fluid-tight seal, haemostasis has to be controlled (Clauder, Shin, 2009). Delayed perforation repair can lead to extrusion of repair materials as a result of breakdown of the surrounding periodontium that is replaced by granulation tissue. Thus, in an attempt to avoid extrusion of the repair material, internal matrices such as calcium sulfate, hydroxyapatite, collagen, demineralised freeze-dried bone and Gelfoam have been used (Clauder, Shin, 2009; Roda, 2001; Bargholz, 2005).

The internal matrix concept was introduced by Lemon (1992) in order to adequately seal the furcation perforation and avoid extrusion of the material. He also recommended the use of hydroxyapatite as a matrix under amalgam. Calcium sulfate and calcium hydroxide prevented extrusion of composite resin when used as a furcal repair material (Imura et al, 1998). In 1999, Jantarat and colleagues demonstrated that amalgam placed with plaster of Paris as a matrix for furcal perforation repair improved its sealing ability. Hapset (65% non-resorbable hydroxyapatite and 35% plaster of Paris) and hydroxyapatite showed similar healing responses when used as internal matrices under amalgam (Rafter et al, 2002). Rafter et al (2002) further reported that there was marked extrusion of amalgam into the underlying bone with an associated severe inflammatory response when used alone without a matrix.

Although it has been reported that without using an internal matrix the optimal strength and excellent sealability of MTA was achieved in the presence of moisture (Arens, Torabinejad 1996; Holland et al, 2001; Torabinejad et al, 1994), conflicting results have been reported by some authors regarding the use of an internal matrix under MTA. In 2004, Kratchman suggested that the perforation site should be soaked with sodium hypochlorite after haemostasis had been achieved and that a physical barrier such as collagen or calcium sulfate must be used at the perforation site to prevent MTA from being packed into the bone.

According to Bargholz (2005), excellent clinical results were achieved when collagen matrix was used under MTA. A study by Al-Daafas and Al-Nazhan (2007) showed that calcium sulfate prevented extrusion of the repair material. However, an unfavourable inflammatory reaction – epithelial tissue migration into the defected perforation and the inability to induce bone regeneration – were detected. Thus, the authors concluded that using calcium sulfate as an internal matrix for MTA is not recommended. When used as an internal matrix for furcal perforation repair, calcium sulfate and Collaplug (Calcitek, Carlsbad, CA) did not improve the sealing ability nor reduce the incidence of MTA overextension. Therefore, the authors concluded that these two materials are not recommended as an internal matrix for MTA (Zou et al, 2008). Furthermore, calcium sulfate and hydroxyapatite did not improve the sealing ability of MTA when used as internal matrices for furcation perforation repair (Taneja, Kumari 2011).

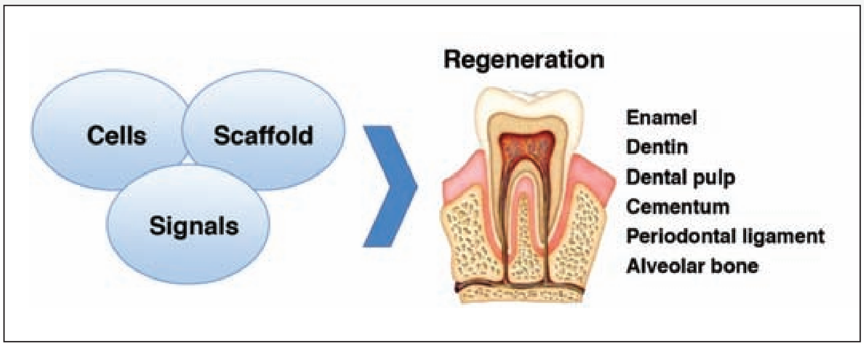


Figure 2: The three key elements of dental tissue engineering are stem cells, scaffolds and signals.

Materials used for furcation perforation repair

In an attempt to repair a furcation perforation, several materials such as amalgam, tricalcium phosphate (TCP), hydroxyapatite, gutta percha, calcium hydroxide, zinc oxide-eugenol-based cement (IRM and Super-EBA), glass ionomer cement, composite resins, resin-glass ionomer hybrids, demineralised freeze-dried bone and MTA have been used over the years (Arens, Torabinejad, 1996; Balla et al, 1995; Bryan, Woollard, Mitchell, 1999, Yildirim et al, 2005; Salman et al, 1999). However, none fulfil all requisite qualifications for an ideal biomaterial.

Balla et al (1991) reported that no hard tissue was formed at the furcation perforation defect site when treated with either tri-calcium phosphate, hydroxyapatite, amalgam or calcium hydroxide (Life); instead, the defect site was occupied by epithelium and acute inflammatory cells (Balla et al, 1991). MTA is water-based cement that is derived from Portland cement (type I). It was introduced as a root-end filling material in the early 1990s (Torabinejad, Watson, Pitt Ford, 1993; Torabinejad, Chivian, 1999). It was subsequently determined that it was a suitable material for various clinical applications such as pulp capping, repair of furcal perforations as well as root-end closure (Sinai et al, 1989; Torabinejad et al, 1995). MTA promotes periradicular tissue regeneration (Pitt Ford et al, 1995; Yildirim et al, 2005; Holland et al, 2001; Zhu, Xia, Xia, 2003; Noetzel et al, 2006) and it differs from other materials by its ability to promote cementum regeneration, thus facilitating the regeneration of the periodontal apparatus (Pitt Ford et al, 1995; Arens, Torabinejad, 1996). Its biocompatibility nature is suggested by its ability to form hydroxyapatite when exposed to simulated body tissue fluid (Sarkar et al, 2005).

Two commercial forms of MTA are available; Proroot MTA (Dentsply Tulsa Dental), which is available in both gray or white form, of which the latter contains a lower amount of iron, and MTA-Angelus (Angelus) (Asgary et al, 2005). MTA-Angelus was introduced to address the long setting time from two hours for Proroot MTA to 10 minutes for MTA-Angelus. MTA-Angelus contains 80% Portland cement and 20% bismuth oxide, with no addition of calcium sulfate, while Proroot MTA is composed of 75% Portland cement, 20% bismuth oxide, and 5% calcium sulfate dehydrate (Hashem et al, 2008). The constituents of the Portland cement are minerals, amongst which the most important are dicalcium silicate, tricalcium silicate, tricalcium aluminate, tetracalcium ironaluminate and dehydrated calcium sulfate (Oliveira et al, 2007; Asgary et al, 2009a). The only significant difference between the dominant compounds of white and gray MTAs and associated Portland cements is bismuth oxide, which is present in MTAs (Asgary et al, 2009a; Asgary et al, 2004).

It has been reported that the sealing ability of MTA (Loma Linda University, Loma Linda, CA) was significantly better compared to amalgam in preventing leakage of Fusobacterium nucleatum through furcal perforations (Nakata, Bae, Baumgartner, 1998). When used to seal a large furcation perforation, Proroot MTA with/without internal matrix and MTA-Angelus with internal matrix showed the lowest dye absorbance compared to zinc oxide-eugenol cement (IRM) with/without internal matrix and MTA-Angelus without internal matrix. Additionally, the authors reported that IRM without internal matrix had the highest dye absorbance (Hashem, Hassanien, 2008). However, white and gray MTA (Dentsply Tulsa Dental) showed no significant differences in microleakage when used for furcal perforation repair (Ferris, Baumgartner, 2004; Hamad, Tordik, McClanahan, 2006). Furcal perforations have been repaired with Proroot gray MTA (Dentsply) and Geristore (Denmat). Geristore has been used as a root end filling material and in the restoration of subgingival surface defects such as root surface caries and iatrogenic perforations, surgical repair of root perforations


Recommended for
IPS e.max®
Multilink® Speed
Variolink® Esthetic DC
THE RIGHT CEMENT FOR
EVERY CLINICAL SITUATION
The duo for all your cementation needs
The easy way of cementing highly esthetic restorations.
IPS Empress® CAD/ Esthetic
Veneers
Inlays / Onlays / Partial Crowns
Crowns
IPS e.max® CAD/Press
Veneers / Occlusal Veneers
Inlays / Onlays / Partial Crowns
Crowns / Bridges
Tetric® CAD
Veneers
Inlays / Onlays
Crowns
IPS e.max® ZirCAD
Crowns / Bridges
Endodontic Posts
Fibre Posts
Metal Posts
Metal / metal-based
Inlays / Onlays / Partial Crowns
Crowns / Bridges
The efficient way of cementing zirconia restorations.
ivoclar vivadent
passion vision innovation
0860 456 123
orders@ivodent.co.za
www.ivodentonline.co.za | www.ivohealth.co.za | www.facebook.com/IvodentSA
ivodent
Adding value

and as an adjunct in guided-tissue regeneration (GTR) (Mehrvarzfar et al, 2010). It also leaked significantly less than amalgam (Mehrvarzfar et al, 2010). In the aforementioned study, the authors reported that the sealing ability of MTA and Geristore was reduced when bioglass was used as a matrix underneath.

Sluyk, Moon and Hartwell (1998) assessed the effect of time and moisture on setting, retention and adaptability of MTA when used for furcal perforation repair. Findings showed that MTA adaptation to perforation walls increased in the presence of moisture. They further suggested that a moistened matrix can be used under MTA to prevent under- or overfilling of the material. Furthermore, Main et al (2004) indicated that MTA provided an effective seal for root perforations.

Yildirim et al (2005) investigated the histologic response to MTA and Super EBA (Bosworth Company) when used in furcation perforation repair in dogs. In their study, less inflammation and new cementum formation was observed with MTA compared to Super EBA, which demonstrated connective tissue repair without inflammation. Similar abilities to seal furcal perforations were observed for both Portland cement and MTA (De-Deus et al, 2006; Noetzel et al, 2006) evaluated histologically the inflammatory reactions and tissue responses to experimental tricalciun phosphate (TCP) and MTA when used as repair materials in furcation perforations in dogs. Results showed no significant differences between MTA and TCP in terms of bone reorganisation or deposition of fibrous connective tissue.

Thus, MTA is considered the gold standard and material of choice for perforation repair and has demonstrated good potential for clinical success. However, it has some disadvantages, including the inability to degrade to allow for replacement with natural tissues, low resistance to compression over the long-term, extended setting time, poor handling, and difficult insertion into cavities because of its granular consistency, while additional moisture is required to activate the cement setting, and lastly, the high cost, despite its widespread use (Torabinejad et al, 1995; Chng et al, 2005; Kogan et al, 2006; Coomaraswamy, Lumley, Hofmann, 2007; Parirokh, Torabinejad, 2010). Many dental materials have been demonstrated in the literature to exhibit cytotoxic effects during setting. Low cell numbers were demonstrated in vivo with freshly mixed MTA (pH=10.2) compared to preset MTA (pH=12.5) (Tronstad, Wennberg, 1980). However, histologically, no difference in bone and cementum regeneration was observed after periradicular surgery in dogs between fresh and preset Proroot MTA (Apaydin, Shabahang, Torabinejad, 2004).

In 2006, Asgary and colleagues introduced a new endodontic cement, a calcium-enriched mixture (CEM) cement. Major components of CEM cement powder are 51.75 wt.% calcium oxide, 9.53 wt.% sulfur trioxide, 8.49 wt.% phosphorous pentoxide, and 6.32 wt.% silicon dioxide; whereas the minor essential constituents are aluminium oxide > sodium oxide > magnesium oxide > chlorine. CEM cement has a similar pH but an increased flow compared to MTA. However, working time, film thickness and price are considerably less (Asgary et al, 2008a). Unlike MTA, mixed CEM cement releases calcium and phosphate ions and forms hydroxyapatite not only in simulated body tissue fluid but also in normal saline solution (Asgary et al, 2009a; Amini et al, 2009).

Although the chemical composition of CEM cement and MTA are different, they have similar clinical applications (Asgary et al, 2008b; Asgary et al, 2008c; Asgary et al, 2009b; Asgary, Ehsani, 2009c). Similar to MTA, CEM cement had low cytotoxic effects on different cell lines (Asgary et al, 2009d). However, it showed a better antibacterial effect comparable to calcium hydroxide (Asgary et al, 2008d). Similar sealing ability was demonstrated by both Proroot MTA and CEM when used to repair furcal perforation of primary molar teeth (Haghgoo et al, 2014).

Non-surgical approach

When a perforation repair is indicated, it is recommended to first attempt an intracoronal approach (non-surgical) to preserve the periodontium thus increasing the chances of success (Regan, Witherspoon, Foyle, 2005). Generally, perforations coronal to the crestal bone fall into the category of a non-surgical approach. The use of a surgical microscope operated at high magnification and with ample illumination allows for better management of perforation repairs (Kratchman, 2004; Daoudi, Saunders, 2002).

A surgical approach may complicate the treatment and lead to loss of periodontal attachment, chronic inflammation and furcal pocket formation (Arens, Torabinejad 1996). Experience has shown that buccally located perforations are easier to repair than lingual or proximal lesions. Lingual located perforations, especially in the mandible, should be treated non-surgically or orthodontically. If they are not responding to treatment, the tooth should be extracted (Regan et al, 2005). If a tooth can be extruded orthodontically to a point where the perforation reaches a supragingival level, repair of the defect will be greatly facilitated (Smidt, Lachish-Tandlich, Venezia, 2005). Whether clinically practical or not, one case of intentional reimplantation was reported after repair of the perforation was performed on

the extracted tooth (Poi et al, 1999).

In cases of large perforations, bleeding should be controlled first using sterile saline. Alternatively, calcium hydroxide, calcium sulphate, or collagen has been used (Clauder, Shin 2009). For bleeding control, non-specific intravascular clotting agents should be avoided as they may lead to alveolar bone damage and delay in healing (Lemon, Steele, Jeansonne, 1993). In cases of perforations that are infected or perforation sites that need further enlargement and cleaning, burs or ultrasonic tips may be used. However, ultrasonic tips are preferable as they are gentler to the adjacent periodontium tissues (Pitt Ford et al, 1995; Arens, Torabinejad, 1996; Clauder, Shin, 2009). For cleaning of infected perforations, 2.5% sodium hypochlorite has been used (Arens, Torabinejad, 1996), however, sterile saline is indicated in large perforations (Clauder, Shin, 2009). To avoid blockage of the canals with repair material, gutta percha points, paper points, cotton pellets or an easily removable material (such as Cavit) should be placed over the canal orifices (Clauder, Shin, 2009).

A resin-bonded material such as Geristore (Denmat) is recommended to restore subgingival defects (Clauder, Shin, 2009), which also serves as an adjunct to GTR (Abitbol et al, 1996; Behnia, Strassler, Campbell, 2000). It is less sensitive to moisture than conventional glass ionomer cement while a drier environment improved the results (Cho, Kopel, White, 1995). Adhesive materials can be used in supracrestal perforations, whereas MTA is preferable in subcrestal perforations (Clauder, Shin, 2009). If a perforation defect involves bone destruction (intraosseus defect), a barrier is needed to facilitate controlled placement of the repair material. This is not necessaary if the defect does not include an intraosseus defect (Clauder, Shin, 2009). If MTA is used a moist cotton pellet should cover the material to allow setting of the material. After perforation repair the final restoration can be placed either after one day or one week. Once repair has been achieved the root canal(s) can be cleaned, shaped and filled (Pitt Ford et al, 1995; Arens, Torabinejad, 1996).

If a perforation is present in the middle third of the root, the canal(s) should be prepared first before closing the defect to avoid blocking the canal. With the aid of an operating microscope, obturation of the canal apical to the defect should be done first, followed by filling the remainder of the canal and the perforation site with MTA (Clauder, Shin, 2009). Alternatively, the root space beyond the perforation can be maintained by means of a file or gutta percha cone. In case a file is used, it should be loosened after finishing the repair procedure to allow easy removal before the MTA is fully set (Clauder, Shin, 2009). The other option is to use a gutta percha point and soften it with heat to the dentinal wall opposing the perforation. MTA is then placed at the defect site (Clauder, Shin, 2009). Perforations at the apical one-third are quite challenging and difficult to manage. Successful treatment cannot always be achieved for all cases necessitating apical surgery or extraction of the tooth to remedy the problem (Clauder, Shin, 2009).

Surgical approach

Surgical intervention (external approach) is indicated in areas that are not accessible by non-surgical means alone, cases that have not responded to non-surgical treatment or in repairing a perforating resorption (Regan et al, 2005). The surgical approach is performed by reflecting a flap at the perforation site followed by cleaning and preparing the perforated area and finally packing the repair material (Alhadainy, 1994).

During the surgical repair procedures, cortical bone damage is involved, which may result in reduced success of the corrective surgical procedure. Thus, a GTR technique has been recommended for successful treatment outcomes by using either non-resorbable or resorbable membranes as a barrier (Duggins et al, 1994; Barkhordar, Javid 2000; Rankow, Krasner, 1996; Dean et al, 1997; Leder et al, 1997). This barrier guides selected cells to populate at the perforation defect, ie, placing the barrier between the gingival tissue and the perforation defect will facilitate the repopulation of the defect by periodontal ligament cells and other osteogenic cells and prevents the colonisation by gingival cells (Linde et al, 1993; Sandberg, Dahlin, Linde, 1993). A resorbable membrane is generally preferable, as it does not need a second surgical procedure to remove it. However, in some cases, titanium-tented membrane or a supporting graft material is needed to prevent collapsing the membrane into the defect (Abitbol et al, 1996).

Cementum regeneration and role in the periodontium reconstruction

Cementum formation is very essential in the furcation perforation repair process (Pitt Ford et al, 1995; Clauder, Shin, 2009; Samiee et al, 2010; Zairi et al, 2012). Pitt Ford and colleagues (1995) evaluated the histologic response to experimentally induced furcation perforations in dog mandibular premolars repaired by either MTA or amalgam and found that most of the MTA samples showed no inflammation and cementum deposition, whereas with the use of amalgam, moderate to severe inflammation with no cementum deposition was present.

Healing after intentional perforations in dogs' teeth was evaluated after repair with either MTA or Sealapex (Kerr) (Holland et al, 2001). Most samples sealed with MTA showed new cementum deposition and an absence of inflammation. In 2010, Samiee and colleagues reported that cementum-like hard tissue was formed using either MTA or CEM cement in the furcation perforation in dogs in the presence of a mild inflammatory response. The authors concluded that both materials showed a similar favourable biological response in furcation perforation repair.

Zairi et al (2012) compared the inflammatory reactions and tissue response of furcal perforations in dogs' teeth to growth factors, TGFβ1, basic fibroblast growth factor (bFGF), osteogenic protein-1 (OP-1) and IGF-I, with MTA or IRM as controls. The authors reported that a clear stimulatory effect on cementum formation and inhibition of collagen capsule formation was exerted by the growth factors. However, MTA exhibited better results than the growth factors. Based on that, the authors suggested a further study comparing the effects of application of growth factor mixture with MTA and MTA alone on tissue healing and regeneration.

In a case report, Bains et al (2012) used tissue engineering principles for the furcation perforation repair of the pulpal floor of the right mandibular first molar of 39-year-old male patient using MTA and platelet-rich fibrin (PRF). The authors reported that this combination was able to repair the perforation defect and regenerate the lost periodontium in the furcation area effectively. A case report (Eghbal, Fazlyab, Asgary, 2014) was published describing the nonsurgical endodontic management of an extensive perforation of the floor of the pulp chamber in a first mandibular molar of a 28-year-old Caucasian female using CEM cement. The authors reported that CEM was able to induce hard tissue formation, ie bone and cementum.

Cellular tissue engineering approach for cementum regeneration

A proposed therapeutic approach was reported by the removal of autologous cells from the patient's periodontal ligament (PDL), culturing of the cells in vitro, which were then placed back onto the exposed root coated with chemo attracting factors, subsequently covering the area with an artificial basement membrane (Terranova, 1990). However, it is unknown whether this method produced the desired effect. Lekic and colleagues (2005) reported that rat periodontal and bone marrow cells were able to differentiate into periodontal ligament fibroblasts, osteoblasts and cementoblasts when transplanted into periodontal wounds in rats, thus contributing to periodontal regeneration.

Regeneration of cementum, PDL and alveolar bone have been observed using auto-transplantation of bone marrow derived mesenchymal stem cells (BMMSCs) (Kawaguchi et al, 2004) or periodontal ligament cell sheet (Akizuki et al, 2005) into periodontal osseous defects in dogs. However, the principle disadvantage of cell sheets is their delicate structure and difficult handling during surgery (Li, Jin, 2015). Furthermore, the harvest of bone marrow (BM) is a highly invasive and a painful procedure for the donor. Moreover, it has been reported that the number, proliferation and differentiation potential of BMMSCs decline with increasing age (Kern et al, 2006).

It has been reported that cementoblast-biodegradable poly(lactic-co-glycolic acid) (PLGA) polymer sponge-treated defects showed complete bone bridging and PDL formation, whereas minimal evidence of osteogenesis was exhibited by follicle cell-treated defects along the root surface of athymic rats (Zhao et al, 2004). Periodontal ligament stem cells (PDLSCs) have the ability to differentiate into cementoblast and osteoblast (Isaka et al, 2001; Seo et al, 2004) and have shown potential therapeutic applications in periodontium regeneration. However, the very low number of these cells residing in the PDL is indicative of the difficulty acquiring a sufficient number for regenerative treatment remains and is an issue that remains unresolved (Maeda et al, 2011). Primary cultures of PDLSCs yielded small cell numbers, therefore before application, PDLSCs must proliferate at least 12 population doublings (Zhu, Liang, 2015). Additionally, it has been found that the proliferation and migration ability and differentiation potential of PDLSCs decreased with increasing age (Zhu, Liang, 2015).

Apical tooth germ cells conditioned medium were able to provide the cementogenic microenvironment and induced the cementoblastic differentiation of PDLSCs (Yang et al, 2009). Hertwig's epithelial root sheath (HERS) cells, or their secreted products, were able to induce PDL cells differentiation along the cementoblastic lineage in vitro (Zeichner-David et al, 2003). Several in vivo studies have also shown the potential capability of PDLSCs to form cementum and PDL-like tissues (Yang et al, 2009; Liu et al, 2008; Feng et al, 2010; Park, Jeon, Choung, 2011).

Regenerative therapy

Tissue engineering is an interdisciplinary field that applies the principles of engineering and life sciences toward the development of biological substitutes that restore, maintain, or improve tissue function or a whole organ (Langer, Vacanti, 1993). Tissue engineering aims to stimulate the body either to regenerate tissue on its own or to grow tissue outside the body, which can then be implanted as natural tissue (Nadig, 2009).

Triad components

Regenerative endodontics can be defined as biologically based procedures designed to replace damaged structures, including dentine and root structures, as well as cells of the pulp-dentine complex (Murray, Garcia-Godoy, Hargreaves, 2007). This approach consists of the following interactive triad: 1) an appropriate cell source; 2) a supportive matrix (scaffold); and 3) inductive biological factors or signals (Figure 1). To create regenerative therapies, these disciplines are often combined rather than used individually (Murray, Garcia-Godoy, Hargreaves, 2007).

Future perspectives for the perforation repair

Reconstruction of the lost attachment via regeneration of the periodontium components, such as cementum, PDL and bone, is essential in the repair of perforated areas. Replacement of the lost cementum (cementogenesis) is very critical and enhances the reattachment of the fibres of the periodontal ligament. Several studies have been published that demonstrate the ability of different materials to repair furcation perforations, albeit with variable success rates.

However, during recent years, there has been a paradigm shift from conventional to regenerative endodontic therapy and repair of the periodontium is not an exception. To date, to the best of our knowledge, no studies have been published in the literature reporting on the effect of the triad application (stem cells, scaffold and growth factor) for furcal perforation repair and the response of surrounding tissues (cementum, PDL and alveolar bone). We propose a stem cell-based tissue engineering approach for furcation perforation repair through enhancing of stem cell differentiation along the cementoblastic lineage in association with scaffold and growth factor. The suggested biomimetic approach is illustrated in Figure 2. This will have the potential to open a new era and strategy in endodontic and periodontal tissue engineering therapies.

Conclusions

Perforation of the pulp chamber floor of multi-rooted teeth constitutes a perplexing and frustrating problem. It is a major cause of endodontic treatment failure. A furcation perforation has to be regarded as an endodontic and periodontal problem. The inflammatory response in the periodontium, leading to irreversible loss of periodontal attachment in the area, can result in loss of the tooth if the perforation is not successfully repaired. To re-establish the periodontal tissue in the perforation site, surgical and non-surgical techniques have been utilised.

For furcation perforation repair, several materials have been used with varying results. However, the stem cell-based tissue engineering approach is very promising and is suitable for furcation perforation repair. This approach has the potential to revolutionise the practice of regenerative endodontics in the future and may therefore save many teeth that would otherwise have to be extracted due to a poor to hopeless prognosis.

Moreover, it will help and assist in designing regenerative therapies based on sound biological principles, which can be applied in both endodontic and periodontal specialties.

Acknowledgements

This study was financially supported by the Universiti Sains Malaysia Research University Grant 1001/PPSP/813058, PRGS (1001/PPSG/8146005) and short-term grants (304/PPSG/ 61312012 and 304/PPSG/61312018) from the School of Dental Sciences, Universiti Sains Malaysia.

References

A full list of references is available from the Publisher

Reprinted with permission by Endodontic Practice August 2017

Minimally invasive reconstruction of anterior teeth - A combination of 3D printing, press technique and adhesive bonding

Mauricio Umeno Watanabe[1]

Introduction

Ceramic veneers present a popular minimally invasive treatment option to restore a person's smile. Dental materials and techniques are being enhanced all the !ime. As a result, the fabrication processes are also changing. The successful adhesive bonding technique is consistently being optimized, for example, in terms of its handling.

A growing number of patients are consulting their dentists with the request for an even-looking smile and the realignment of their teeth. In addition to this cosmetic wish, they usually ask that as little as possible of the healthy tooth structure be removed. As a result, the teeth should be prepared according to tooth-preserving principles, without having to make any compromises in terms of the esthetic properties. This balancing act can be achieved with the help of modern ceramic materials - in conjunction with the adhesive bonding technique. Therefore, it is important for the dental team to choose a material that optimally fulfils their functional and esthetic planning requirements. The teeth have to be prepared very carefully. The restorations are adjusted to the smile with artistic flair, while taking into account the principles of proportion. Finally the restorations are seated in accordance with the guidelines of the adhesive bonding technique. The challenge is to find a way of fabricating ultra-thin ceramic veneers that demonstrate adequate strength and stability. Furthermore, it is important to establish a sound bond between the restorations and the tooth structure by means of the sensitive adhesive bonding technique. In order to ensure long-lasting, successful outcomes, it is recommendable to use products that are optimally coordinated.

The materials

The optical properties of a modern ceramic material (e.g. IPS e.max® Press) are very similar to those of natural dental enamel. Therefore, veneer restorations are capable of imitating the translucent properties of natural teeth and ensuring optimum light transmission. Furthermore, very thin restorations with a minimum thickness of 0.3 mm can be produced due to the excellent mechanical properties of IPS e.max Press. As a result, the demand for minimally invasive treatments can be met, since only very little of the healthy tooth structure needs to be removed. Veneers obtain their final strength from the strong bond with the tooth structure (adhesive cementation). The decisive factor at this stage is the procedure used for seating the veneers (luting protocol). The products of the silicate ceramic materials portfolio within the IPS e.max system are coordinated with the Variolink® Esthetic luting composite. The single component ceramic primer Monobond® Etch & Prime, which is contained in the system, etches and silanates glass-ceramic surfaces in one easy step. Moreover, the etchant is much gentler than hydrofluoric acid.

[1]Mauricio Umeno Watanabe
Rua Sao Jose, 648
16200-103 Birigui/Sao Paulo Brazil
mauriciowatanabe@yahoo.com.br

Figure 1: Preoperative view. The patient wanted more attractive upper anterior teeth.

Figures 2 and 3: Slight preparation of the cervical margin with Arkansas stones.

Figure 4: The teeth prepared for the veneers.

Case study

The female patient wished to have more attractive upper anterior teeth (Fig. 1). She had a well-groomed appearance and healthy teeth. However, the young woman was dissatisfied with the shape of her teeth. She felt that they were too narrow. She requested strong-looking, bold tooth shapes that would give her a harmonious smile. After one consultation, she chose the veneer option. This case presented quite a challenge. On the one hand, the healthy teeth would have to be ground as little as possible. On the other hand, the patient's wishes had to be fulfilled, without making the teeth look too bulky. As a result, we decided to use ultra-thin ceramic veneers.

Clinical preparation

First, an esthetic and functional plan was established with the help of a wax-up of the vestibular region of the ULS to the URS. Then the esthetic treatment phase started. The main aim of the preparation was to achieve an even thickness of the ceramic veneers in relation to the envisaged result. Since the teeth had to be slightly enlarged in the present case, only minimal removal of tooth structure in the vestibular region was necessary. In order to prevent over-contouring of the margins and the risk of gingival inflammation, a shoulder was carefully created at the cervical margin using Arkansas stones (Figs 2 to 4).

Fabrication of the veneers in the laboratory

IPS e.max Press is an excellent material for fabricating veneers. In the first fabrication phase, digital technologies were used. The master cast was digitalized . Then, the ultra-thin veneers were designed using CAD software. They were produced with a synthetic resin that fires without leaving any residue (3D printing). The printed veneers demonstrating a

Figure 5: Printed veneers made of synthetic resin.

Figures 6 and 7: Manual adjustment of the printed veneers with wax.

Figure 8: Att achment of the sprues.

Figure 9: Spruing of the restorations for the press procedure.

Figure 10: Finishing of the ceramic veneers on the model.

minimal thickness of 0.3mm offered an ideal basis for manually shaping the actual veneers (Fig. 5). Only very little wax had to be applied to achieve the ideal proportions. The shape of the teeth was adjusted with wax in the incisal and proximal areas in particular. The aim was to create an even appearance of the vestibular surfaces from the UL5 to the URS (Figs 6 and 7).

In the course of the preparation of the restorations for the press procedure, the advantages of printed veneers became evident: They are comparatively stable, which greatly facilitates the spruing process. The restorations were invested, pressed (IPS e.max Press) and divested in the conventional way (Figs 8 and 9). Finishing of the delicate veneers was reduced to only a few steps. The veneers were polished and then sent to the dental office (Fig.10) .

Adhesive cementation

In the dental practice, the restorations first had to be tried in and evaluated in terms of their shade and translucency. Water-soluble try-in pastes are recommended for this purpose. Their shade corresponds to that of the cured luting composite. As a result, they allow a reliable esthetic assessment to be made. Following the cleaning of the teeth and the veneers, the restorations were tried in - at first, each veneer was tried in separately and then all the veneers were tried in together.

The adhesive cementation of ceramic restorations is a technique-sensitive procedure. In order to achieve a long-lasting bond, it is of utmost importance to prepare this step carefully and to observe the cementation protocol. The single-component ceramic primer Monobond Etch & Prime was used to condition the ceramic restorations. The primer was scrubbed into the contact surface with a microbrush for 20 seconds in order to remove any saliva and silicone residue (Fig. 11) . During the 40-second reaction time, the etchant enlarged (roughened) the surface and produced an etching pattern. Next, the primer was rinsed off and the restoration was dried with a stream of air for 10 seconds. Then the reaction between the silane and the activated glass-ceramic

Figure 11: Application of Monobond Etch & Prime.

started. This resulted in the development of a thin layer of chemically bound silane, which ensures a strong and reliable bond to the teeth. An additional benefit offered by Monobond Etch & Prime is the fact that the product etches and silanates in one step. This simplifies the sensitive placement procedure and heightens its efficiency.

After the preparation of the tooth surfaces in accordance with the requirements of the adhesive technique, the veneers were cemented with a light-curing luting composite (Variolink Esthetic LC, shade: light) (Figs 2 and 13). The material offers a balanced combination of flowable and stable properties, which facilitates handling. Therefore, the veneers can be bonded with comparatively little effort. Next, all residues were removed and final light curing took place. The cement joint was covered with glycerine gel (Liquid Strip). In the last step of the seating procedure, the margins were finished.

Result

The planned goal was achieved with the ceramic veneers (Fig. 14). The upper anterior teeth look much bolder - as desired - and also some what lighter. They harmonize with the oral environment and the facial features of the young patient. Furthermore, the soft tissue adapted very well to the new situation. The wishes of the patient were fulfilled: Her new smile was achieved without any substantial loss of tooth structure (Fig. 15).

Conclusion

Modern ceramic materials such as IPS e.max Press allow teeth to be restored with minimally invasive techniques. Even ultra-thin veneers (minimum thickness of 0.3 mm) can be produced. The ceramic restorations are cemented with the matching Variolink Esthetic luting composite. The single-component glass-ceramic primer offers the possibility of etching and priming the glass-ceramic surfaces in one step. As a result, only one protocol is needed for the different types of ceramics. This significantly facilitates day-to-day procedures and heightens the efficiency of the dental office.

Figures 12 and 13: Placement of a veneer.

Reprinted with permission by Reflect 2/2018

Figure 14 : Situation following insertion . All the veneers have been cemented in the mouth.

Figure 15: The satisfied patient. Her wishes have been.fulfilled with minimally invasive restorations.

70 Jahre 1948 - 2018

Walser® Matrices

Handmade in Germany since 1948

KZN Dental Suppliers
sales@kzndental.co.za
031 312 8234

No more papillary bleedings – Adapt to the natural tooth shape

Multiply reusable and sterilizable

Savings of up to 4000 EUR per year compared to screw/spanner systems and **up to 9000 EUR per year** compared to sectional matrix systems!

Testimonial from Dr. Rob Wortzel from New Jersey/USA:

*"**These matrices are amazing**. I'm getting **great contacts**. They **offer retraction** and **hold cotton rolls in place**, I get **great contours** that require minimal adjustment. I'm getting them into areas that I haven't been able to get other matrices in.*
I recommend them highly to any dentist who has high standards and high expectations for inter-proximal Composite restorations."

Read much more advantages and testimonials on www.walser-dental.com


O-shape


X-shape


ON-shape

SET OF 25 R9,999

SET OF 10 R4,999

Order your Walser® Matrices today and benefit from the many advantages, like tens of thousands of enthusiastic dentists in 120 countries worldwide!

Bestseller worldwide – "Best of" 2018

You are looking for
- a matrix for most posterior and extra large molars, **without blood inside the cavity** and **without annoying regrinding**?
- a fast solution for **children**?
- a solution for **very deep subgingival caries**?

We have the solution for you!

The complete set of 25 Walser® matrices:

INDUSTRIE PREIS 2018
BEST OF


Placement of O-shape with the Walser® Matrix forceps

Awarded with **"Best of" Industry Award 2018** and our **Bestseller in 120 countries** worldwide!

MM MICRO MEGA

One Curve

Starter Pack
- 2x One Curve
- 2x #10 C files

R399

C·Wire Heat-treatment of Nickel-Titanium, a One Curve exclusivity
- Shape Memory
- Pre-bendable
- Conservation of curvature

100% + more flexible

2.4 X more resistant

R899
2x3ml

IN CASE OF ORAL INFLAMMATORY CONDITIONS

KLiRiCH® PRO

Periodontal oral gel

Soothes all types of oral inflammations

Patented gel, made in France with natural ingredients

ITENA® CLINICAL PRODUCTS

CPD QUESTIONNAIRE 9.1.1

Article: Clinical application of crosslinked gutta-percha core obturators. Van der Vyver, Vorster, page 6

1. *According to Gutmann (2012) the minimum preparation size and taper needed in order for GuttaCore material to flow into canal intricacies during obturation are:*
   - a ISO size 20 and 4% taper
   - b ISO size 20 and 6% taper
   - c ISO size 25 and 4% taper
   - d ISO size 25 and 6% taper

2. *Which of the following obturation techniques according to Li et al (2014) showed the least interfacial gaps and void formation after obturation?*
   - a Warm vertical
   - b Cold lateral
   - c Carrier-based
   - d A combination

3. *Which of the following should aid/assist the clinician in selecting the correct size GuttaCore obturator after canal shaping:*
   - a Fitting of GuttaCore obturators and confirming radiographically
   - b Using GuttaCore Verifiers
   - c Obtaining "tug-back" with GuttaCore on working length
   - d Using the tip size of the glide path preparation file in selecting the obturator

4. *Which of the following contributes to the success of root canal treatment?*
   - a Proper shaping on the canal
   - b Disinfection of the root canal system
   - c Three-dimensional obturation
   - d All of the above
   - e None of the above

5. *The authors of these case presentations recommend the use of the ProTaper SX file in which of the following motions?*
   - a "Pecking-motion" with apical pressure
   - b Brushing motion whilst applying apical pressure
   - c Backstroke brushing motion
   - d None of the above

Article: Using cross-polarised photography as a guide for selecting resin composite shade. Villavicencio-Espinoza et al, page 24

6. *What are some of the benefits of direct resin veneer composites?*
   - a Good mechanical properties
   - b Excellent aesthetics
   - c Colour stability
   - d All of the above
   - e None of the above

7. *What term is used to describe the use of polarising filters associated with digital photography?*
   - a Cross-digital photography
   - b Cross-polarised photography
   - c Cross-polarised dentistry
   - d Cross-digital imagery

8. *Identify the factor not associated with optimum shade selection for matching restorative materials to natural teeth*
   - a Reflection of light
   - b Light source
   - c Shade guide type
   - d Hydration of dentition
   - e Composition of restorative material

9. *Which images of the maxillary anterior teeth do the authors recommend be taken, to better understand their colour?*
   - a Against a black background
   - b Against a black background with shade guide
   - c Against black background and cured resin composites
   - d All of the above
   - e None of the above

10. *Which is correct: when taking digital photographs:*
    - a The reflection of the flash on the enamel of the adjacent teeth may increase the hue
    - b The reflection of the flash on the enamel of the adjacent teeth may increase the chroma
    - c The reflection of the flash on the enamel of the adjacent teeth may increase the value

Article: Furcation perforation: current approaches and future perspectives. Farea, Husein, Parmeijer, page 44

11. Perforation accounts for the second greatest cause of endodontic failure in how many cases?

a 8.6% b 9%
c 9.6% d 10%

12. According to the literature, what factors depend on the prognosis of the tooth?

a The sealing ability or cytotoxicity of the repair materials
b The location and size of perforations
c The location and size of perforations
d None of the above e All of the above

13. Although MTA is considered the gold standard and material of choice for perforation repair, what are some of its disadvantages:

a Poor sealing ability
b Low resistance to compression
c The inability to degrade
d All of the above e B and C

14. Appropriate material selection, plus the use of a matrix are two factors which should be considered in the repair of perforations. The selection of repair materials should be based on which criteria? :

a Biocompatibility (be nontoxic and noncarcinogenic)
b Ability to induce osteogenesis and cementogenesis
c Perforation site accessibility
d A and B e All of the above

15. What was recommended by Lemon (1992) as an internal matrix:

a Amalgam placed with plaster of Paris
b Hydroxyapatite under amalgam
c 65% non-resorbable hydroxyapatite and 35% plaster of Paris

Article: Furcation perforation: current approaches and future perspectives. Farea, Husein, Parmeijer, page 44

16. Taneja, Kumari (2011) found which materials did not improve the sealing ability of MTA when used as internal matrices for furcation perforation repair

a Calcium sulfate and hydroxyapatite
b Collagen
c Hydroxyapatite and plaster of Paris

17. When used to seal a large furcation perforation, what did the authors report as having the highest dye absorbance:

a MTA-Angelus with internal matrix
b IRM without internal matrix
c Proroot MTA with/without internal matrix

18. Which statement is correct:

a Buccally located perforations are easier to repair than lingual or proximal lesions
b Lingual located perforations are easier to repair than buccal or proximal lesions
c Proximal lesions are easier to repair than buccal or lingual located perforations

19. Which statement is correct.

a MTA is preferable in subcrestal perforations
b Adhesive materials can be used in subcrestal perforations
c MTA is preferable in supracrestal perforations

20. According to the authors, which is generally preferable during surgical repair procedures:

a Resorbable membranes
b Non-resorbable membranes
c Both of the above

Positions Available


Love is...
Dentsply Sirona
The Dental Solutions Company