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VOL. 10 NO. 6

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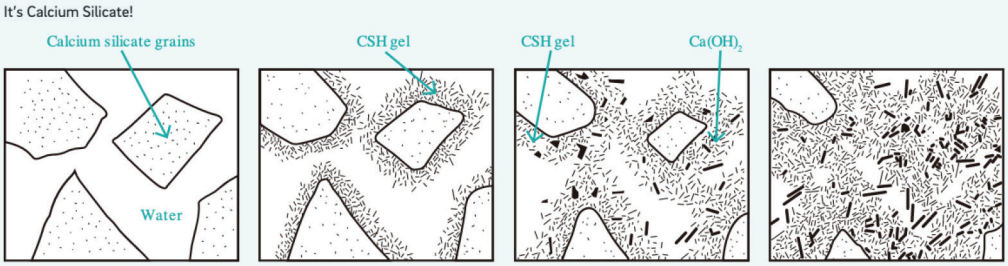

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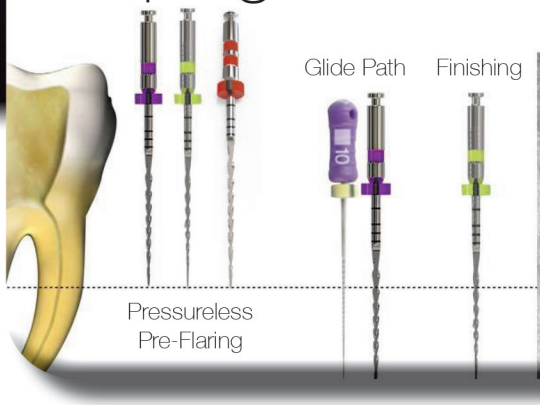

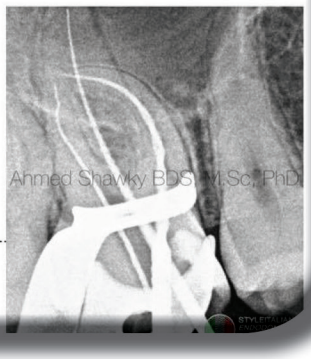

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From the Publisher

Ursula Jenkins

We have finished our last issue of the year and I look back on 2020, a true *annus horribilis* for the whole world. A year that began full of hope and plans, unravelled very quickly into disbelief, fear, despondency and uncertainty for the future.

As the Publisher of International Dentistry - African Edition for the past 21 years, I was faced with two options: close the journal or publish and distribute solely on a digital platform. Encouragement by Associate Editor, **Prof Andre van Zyl**, as well as support from members of the dental industry, gave the reassurance that the journal was still relevant to the profession and should not, under any circumstances, discontinue.

Our first digital issue was published in May and I am proud that we have managed to present all 6 issues this year. While response from the readers has been mixed, with most preferring the printed copy (the Publisher included), they have adjusted and the journal continues to be well-read.

We go into 2021with optimism. The printers are on standby to print hard copies once again, starting with the February/March 2021 issue and we are determined to return to some form of normality - albeit a 'new normal'.

I am indebted to **Andre van Zyl**, whose inspiration and wisdom gave me confidence and kept me motivated, not to mention the articles both he and **Dr Johan Hartshorne** submitted in abundance. Their input also paved the way for us to launch our Ethics 2020 supplement.

My sincere thanks also go to the members of the dental industry who continued to advertise during the dark days: **Wright Millners, Planmeca, Inter-Africa Dental, GSK, Voco, KZN Dental Suppliers, Dentalworld, Henry Schein The Dental Warehouse, Aidite, Smile Club, Roland, Straumann, Tasosol** and **Progressive Orthodontics.**

May you, our valued readers and advertisers, enjoy the peaceful holiday we all deserve. I hope 2021 brings us health, above all, and the resilience to recover and grow from the challenges of this past year.

Best regards

URSULA JENKINS
Publisher
MODERN DENTISTRY MEDIA

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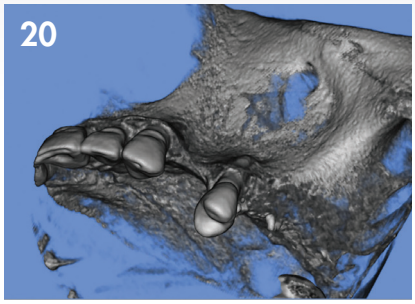

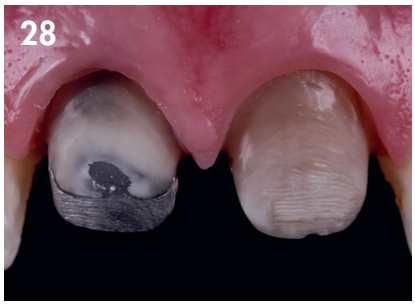

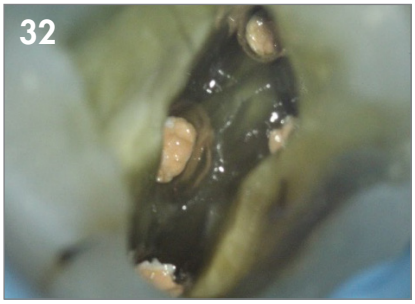

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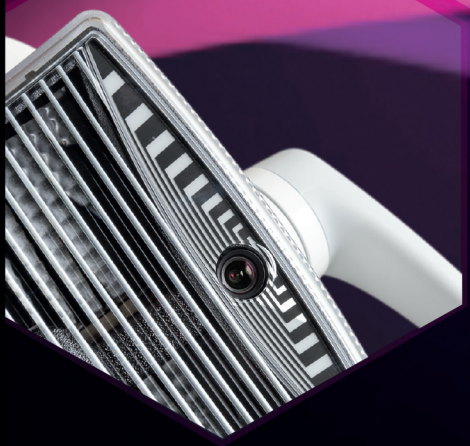

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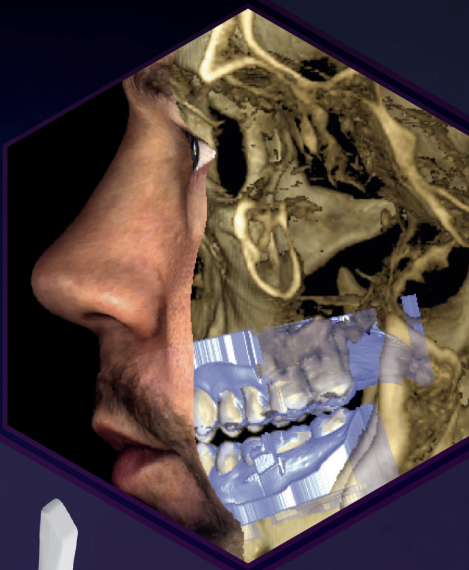

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A non-invasive treatment approach with direct composite veneers

Andrés Silva[1]

A 28-year-old female patient and 4th year dental student came to the dental clinic of the Master's degree in aesthetic restorative dentistry and endodontics in the King Juan Carlos University in Madrid. She was unhappy with the looks of her central incisors, which were restored after a trauma that she suffered years ago and now the old restorations looked aged and unaesthetically.

The original restorations had a shape in accordance to the size and shape of her teeth, but were darkened and too translucent, exposing the fracture line (Figure 1). Even after orthodontic treatment and two orthognathic surgeries, the patient still had severe midline deviation to the right side and mandibular asymmetry. There were diastemas present were the maxillary segmentation had been done (between teeth 1.2–1.3 and 2.2–2.3) (Figure 2 and 3).

The patient was looking for the most conservative option, so we offered composite veneers as a minimally invasive choice in which no healthy tooth structure has to be removed.

Resin composites can achieve excellent aesthetics[1] and with an overall survival rate higher than 88% up to 10 years, they are an optimum choice.[2]

On a close-up picture the shape of her teeth looks round and acceptable, but in the facial analysis, the smile line is inverted, and the central incisors don't stand out much. We wanted to create more harmonious teeth proportions that would also fill her smile. To plan this, we made a direct restorative trial adding composite to her teeth without bonding to see live what bigger teeth would look like and if the patient liked it. As everyone liked the plan, we took impressions with the trial still in place and poured type IV stone to make the study models.

Using digital photography and analysis, a 2D digital smile design (DSD) was done (Figure 4). This information was then transferred to the dental cast to make a 3D plan. On the next appointment, a silicon key was made to copy the wax-up and then transfer into the patient's mouth with a bis-acrylic resin for temporary teeth (Figure 5).[3]

[1] Andrés Silva
Private Practice, Valencia, Spain

Figure 1.

Figure 2.

Figure 3.

The patient was thrilled with the new look of her smile, so we proceeded to plan the appointment for the restorations. We made the shade selection using the button technique. The chosen composite was Essentia (GC) and the masses were Light Enamel (LE) and Light Dentin (LD) for the incisors and Universal Shade (U) for the right canine (Figure 6 and 7).

On the day of the restorations, local anaesthetic articaine 40 mg/ml+0.005mg/ml (Ultracaín, Normon) was placed. Complete isolation was achieved with rubber dam using the floss tie technique to adapt the dam to the cervical area of each tooth (Figure 8).

Rubber dam isolation helps achieve optimal gingival retraction that is superior to that obtained by using the cord retraction technique, obtaining field and moisture control and better access to create proper contact.

Once the isolation is placed, it is important to check the fit of the silicon key and make any necessary cut backs with a scalpel blade to ensure it is possible to fit it into place on top of the rubber dam (Figure 9).

To remove the old restorations without damaging the teeth, the old composites were outlined using a round, steel bur on a low-speed handpiece to delimit the margin between teeth and resin (Figures 10 and 11). The restorations could then be safely removed using a combination of high-speed, low speed and a number 12 scalpel blade for the remnants (Figure 12).

We started with the central incisors as these teeth had the same fracture pattern and thus the restorations would be similarly made, and it is easier to manage just two teeth at a time rather than five. Adhesion was achieved by a selective etching of enamel using 37% orthophosphoric acid for 20 seconds, then rinsed and air dried. Two layers of G-Premio BOND (GC) universal adhesive were placed, and the solvent was evaporated with air before light curing (Figure 13).

Using the silicon key, the palatal shell was made with Essentia LE. The two palatal shells were secured with a small amount of Light Dentin to prevent their breakage (Figure 14). Then, equal amounts of dentin mass were applied and the mamelons were shaped (Figure 15). At this point, we could see that there was an area of darkened tooth dentine that was not completely disguised with the dentine mass, so a small amount of Masking Liner (ML) was applied to cover it.

A layer of Opalescent Modifier was placed in between the mamelons and in the space between the mamelons and the incisal edge to recreate the opalescent halo. This is a great composite to recreate the natural opalescent effect

Figure 4.

Figure 5.

Figure 6.

Figure 7.

of anterior teeth. It has similar opalescent characteristics as enamel, so depending on the incidence of the light and the background behind the teeth, it may give either a bluish or orangish opalescent halo. This is much better than using stains that will give just one colour to the restoration.[4]

A last layer of enamel composite was added and moulded with a brush (Gradia Brush nº 1 flat, GC). A good tip is to impregnate the bristles with a modelling liquid (Modelling Liquid, GC) and then remove the excess with a cotton gauze, to prevent the composite from sticking to the

Figure 8.

Figure 9.

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Figure 10.

Figure 11.

instrument and make handling easier. A quick contouring was done with Sof-Lex discs (3M Oral Care) before moving on with the laterals and canine.

The same adhesive technique was performed on the lateral and canine teeth. Stratification was done on the laterals using Light Dentin and Light Enamel with Opalescent Modifier for the opalescent halo. A single mass of Universal Shade was used on mesial of the canine (Figure 16).

In order to close the interdental spaces and contour the emergence profile, a Mylar strip was placed interproximally and then a top layer of enamel placed. The strip was then pulled in a palatal direction while at the same time adapting the strip to the cervical area of the teeth. This was done in order to transfer the original anatomy of the teeth to the restoration and make more personalized teeth instead of using a preformed posterior matrix in a vertical direction, which would give a standardised profile to all cases.

Guidelines were drawn to mark the place for the transition lines, contouring was performed with Sof-Lex discs (3M Oral Care), and mamelons were shaped using a round stainless

Figure 12.

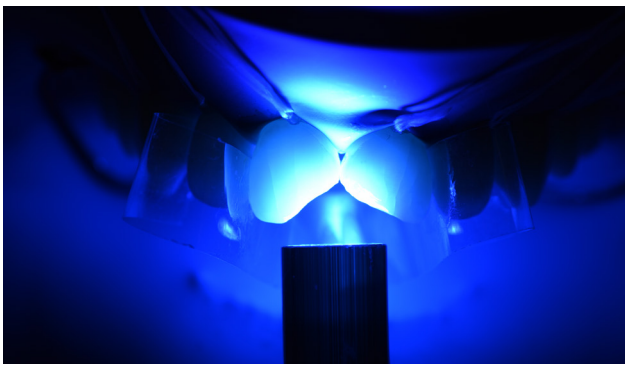

Figure 13.

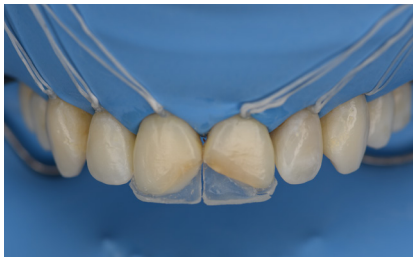

Figure 14.

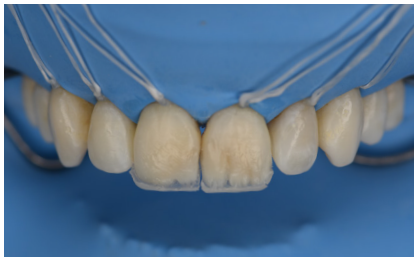

Figure 15.

Figure 16.

Figure 17.

Figure 18.

Figure 19.

Figure 20.

steel bur on a low-speed handpiece (Figure 17). Polishing was done by completing the Sof-Lex sequence and finishing with polishing paste on a felt buff wheel (Figure 18 and 19).

A one-week control was done to check the colour and integration of the restorations after rehydration had occurred (Figure 20). It was also a good time to check for absence of inflammation of the gums. If there were any, it would have been a good chance to review hygiene instructions or if caused by excess of material, to re-polish margins were needed.

The three months control confirmed the colour stability of the composite, the short time survival without any incidences and the gloss retention (Figure 21 and 22). We were very satisfied with the result.

In conclusion, direct composite veneers are a great, conservative and versatile treatment that can achieve great aesthetics and bring satisfaction to our patients. Essentia by GC follows a simple shade matching protocol to simplify the technique and the amount of shades needed to obtain excellent aesthetics.

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Figure 21.

Figure 22.

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Minimally invasive treatment of white spot lesions

Victoria Sampson[1]

White spot lesions on teeth are defined as enamel surface and/or subsurface demineralisation without cavitation.

Unfortunately, dentistry has seen a rise – not only in the prevalence but also the severity of these defects, with the US Oral Health Surveys recording a marked jump from 1.2% to 30.4% between 1986 and 2012 (Neurath, 2019). White spot lesions can be caused by numerous reasons, thus affecting prognosis and the treatment options available to remove them.

In response to the rise in white spot lesions, the dental industry has been pushed to adapt and create less invasive alternatives for removal of these white spots. When once the only alternative to white spots was drilling the defects away, we now understand the science and causes better, allowing us to create minimally invasive, preventive alternatives.

White spot defects have numerous causes that can affect the enamel substructure, and the treatment options available must reflect this. It is vital that the cause, size and depth of the white spots are ascertained before providing treatment options to a patient, as treatment results will vary depending on the enamel substructure available. The main causes of white spot lesions are outlined in Table 1.

Main complaint

Both patients presented with white spot lesions on their anterior teeth. The lesions had been present from the eruption of the permanent teeth. Both patients were mainly concerned with the appearance of the white spots, requesting for the spots to be removed.

Presenting symptoms

Following examination, neither lesion was carious. There were no signs of trauma or periapical infection and both teeth tested positive with Endo-Frost.

Cause	Presentation
Fluorosis	Symmetrical, white lines, snow capping, snow flaking on enamel
Trauma	Asymmetrical punctiform lesion on incisal third of tooth
Demineralisation	Faint white lesions around orthodontic brackets
Molar incisal hypomineralisation	Hypomineralised permanent first molars +/- incisors. Yellowing, mottling, post eruptive breakdown of molars
White spot lesion (natural)	Isolated white spots with diameter less than 0.5mm in incisors. Naturally occurring.

Table 1: Main causes of white spot lesions

[1] Dr Victoria Sampson BDS MFDS RCS Ed
Private Practice, London, UK

Figures 1a and 1b: Patient A (left) and patient B (right). Note the punctiform shape of the lesion and its location on the incisal third of the lateral incisor and central incisor respectively

Medical history

Both patients were fit and well with no known allergies. Neither patient had experienced illness or complications perinatally or postnatally, with their births being unremarkable. Their mothers had also experienced no difficulties during pregnancy and had not had antibiotics.

Previous dental history

The patients maintained excellent oral hygiene, brushing twice a day with fluoridated toothpaste.

Clinical diagnosis

Both lesions were indicative of traumatic hypomineralisation. Although many clinical diagnoses are possible, the punctiform lesions were asymmetrical, appearing only on one tooth on the incisal coronal third. Furthermore, neither patient had poor oral hygiene or a history of fixed braces, confirming that the hypomineralisation had not been caused by accumulation of plaque.

Treatment options discussed

Several treatment options were discussed for removal of the white spot on the labial surfaces of the teeth in question (Greenwall, 2013):

1. Tooth whitening (16% carbamide peroxide, two-four weeks)
2. Application of amorphous calcium phosphate (Abreu, 2011)

Figures 2a and 2b: Patient A (left) and patient B (right) displaying their white spot lesions on the upper right lateral incisor and upper right central incisor respectively before any treatment

Figures 3a and 3b: Patient A (left) and patient B (right) after two weeks of whitening with 16% carbamide peroxide. Note the exacerbation of the white spot lesions

3. Microabrasion using 6.6% Opalustre (Greenwall, 2006)
4. Resin infiltration (Icon, DMG)
5. Composite bonding
6. Direct resin veneer
7. Indirect veneer
8. Crown.

The advantages, disadvantages, prognosis and cost of each treatment option available were covered. As both lesions were small, relatively shallow white lesions, it was recommended to treat the lesions as atraumatically and non-invasively as possible. Both patients decided to start with whitening and have Icon Resin Infiltration treatment if whitening was not successful in full removal of the white spot. Both patients were aware of the risk of the white lesion being exacerbated with whitening (Walsh, 2004).

Treatment carried out

1) Both patients underwent two weeks of nightly at-home whitening with 16% carbamide peroxide delivered via a custom-fitting mouth tray
2) After the whitening, three weeks was allowed to wait for remineralisation and rehydration of the teeth (Titley, 1993). At this point, both lesions had been exacerbated by the whitening as expected
3) Icon resin infiltration was performed on the white lesions in question with the following technique:

- Isolation with Optragate isolation retractor and cotton wool rolls
- Surface of lesion was cleaned with pumice
- 15% hydrochloric acid was applied directly onto the lesion and left for two minutes
- Water rinse
- Ethanol was applied with a syringe directly onto the white lesion
- TEGMA resin (Icon resin) was applied on the white lesion and left for three minutes
- Light cure for 40 seconds
- Further Icon resin was applied to the tooth for another minute and cured for another 40 seconds
- The process was repeated until the white spot was removed. For patient A, the cycle was repeated 12 times until the white spot was removed. For patient B, the spot was removed within six cycles
- Polishing with Sof-Lex disc to remove any surface roughness (Neurath, 2019).

Review of treatment and comments

White lesions present with an intact layer of enamel followed by a subsurface porous area, called 'the body of the lesion'.

The pore volume of these areas of demineralisation increases, thus altering the refractive index of these lesions compared to adjacent sound tooth structure.

The more porous the lesion is, the more water and air lies within it, altering the refractive index (RI) compared to sound enamel (Cazzolla, 2018). The alteration in refractive indices between the porous enamel (RI=1-1.33) and the non-affected enamel (RI= 1.65) (Denis, 2013) produces the optical illusion of a white spot lesion.

During the procedure of Icon resin infiltration, hydrochloric acid is first applied to the lesion to promote erosion of the surface layer and allow penetration of resin infiltration into the lesion body (Torres, 2010).

The ethanol drying agent (Icon-Dry) is then applied to allow for complete drying of the lesion. The agent creates a dry field that encourages resin to be drawn into the lesion

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Figures 4a and 4b: Patient A (left) and patient B (right) after whitening and Icon resin infiltration

through capillary action. The resin infiltrant then is in an optimal position to occlude the microporosities, preventing any further demineralisation and altering the refractive index to become more similar to that of unaffected enamel (RI of resin = 1.475).

In both cases, Icon resin infiltration was effective and successful at treating the white spot lesions. Both patients were extremely satisfied with the physical outcome of the procedure and the painless and non-invasive nature of the treatment.

Summary

Icon resin infiltration is an effective treatment option for patients exhibiting traumatic hypomineralisation in certain cases. As the depth and morphology of the lesion cannot be distinguished clinically, treatment with resin infiltration should be done with caution and the patient warned of unsuccessful or incomplete resolution (Denis, 2013).

Nevertheless, in both cases mentioned, the white spots were removed atraumatically with Icon resin infiltration, proving that the procedure should be attempted before moving on to more invasive treatment options such as direct or indirect restorations. At six-month follow up, the resolution of the lesion remained stable.

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Hard tissue augmentation using an allogenic bone block: a clinical case report

Laurent Marchand[1], Irena Sailer[2] and Stefan Paul Hicklin[3]

The high clinical survival rates has led to the fact that dental implants are often the treatment of choice for the treatment of single tooth gaps in the posterior region, where more minimally invasive and adhesive restorations are not indicated[1]. Unfortunately, severely atrophied alveolar crests are frequently observed after traumatic extraction of teeth, resulting in a lack of bone which may complicate the implant placement[2]. In such situations, an autologous bone block grafting procedure may be considered the golden standard of care, with high survival rates of both the bone block as well as the implants placed into it[3].

Allogenic bone blocks offer similar osteoconductive properties compared to autologous bone due to the preserved microstructure of human bone [4]. The main advantage of allogenic products is, that there is no need of a donor site and therefore significantly less patient morbidity [5]. Recent studies focusing on allogenic bone grafting show overall excellent survival rates of these block grafts of 96.7% [4]. Furthermore, the implants placed into allogenic blocks also show a high survival rate of 97.36% [6]. At the same time, however, they may exhibit some drawbacks. It has been shown that allogenic graft sites show histologically less revascularization and bone gain when compared to autologous bone grafting [7]. Additionally, a sensitization to human leucocyte antigen (HLA) and thus a higher immunological response to allogenic grafts is reported [8 9]. In spite of these drawbacks, the shorter surgical intervention, reduced patient morbidity and predictable bone quality are highly advantageous aspects for both dentists and patients.

The present case demonstrates a primary bone augmentation using allogenic bone grafting material with subsequent implant placement and reconstruction with a screw-retained monolithic single crown on a titanium bonding base.

Initial Situation

A 41-year old patient presented at the University clinics of dental medicine of Geneva (Division of Fixed Prosthodontics and Biomaterials) with the primary wish to replace the missing tooth 24 which was extracted more than a decade ago. The patient was healthy, she took no medication and was a non-smoker. The visible single tooth gap at site 24 impaired the patient's smile and was, therefore, of aesthetical concern. The intraoral examination revealed a severe hard and soft tissue defect at site 24 (Fig. 1 & 2). The tissue conditions however looked favorable, with ample keratinized tissue and a rather thick biotype. An amalgam staining in the keratinized mucosa at site 26 can also be observed.

Treatment Planning

To better assess the bony situation at site 24, a CBCT radiograph was performed. It revealed a very thin bone crest with a width of approximately 3mm and a height of

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Figure 1.

Figure 2.

16mm (Fig. 3). Several treatment options were discussed:

An adhesively cemented resin-bonded bridge, while being the least invasive treatment method, shows little evidence of success in the posterior region and was, thus, discarded as a treatment option [10]. A conventional three-unit fixed dental prosthesis is a very well documented treatment modality with high survival rates [11]. On the other hand, it would have involved significant preparation of healthy tooth substance of the neighboring teeth and was thus kept as a second choice. An implant supported single crown presented itself as a valid reconstruction of a single tooth gap. However, implant placement with simultaneous guided bone regeneration (GBR) could not be performed, as the radiographic examination showed that the apex of the implant was very likely to be exposed, impairing thus the primary stability of the implant. Therefore, a staged approach with a primary bone augmentation was necessary. Due to the volume of the augmentation, stability of the graft was important. Such stability can be achieved using a reinforced membrane or a block graft. In discussion with the patient it was decided to use an allogenic bone block for the primary bone augmentation. This offers less patient morbidity in comparison to the autologous block graft [12].

After bone augmentation using the allogenic block graft and a healing period of 9 months, implant placement of a regular diameter bone level type implant (Straumann Bone level implant, diam. 4.1mm Regular Crossfit RC, length 10mm; Straumann, Basel, Switzerland) at site 24 was planned. Following successful osseointegration, it was planned to use a provisional implant crown for conditioning the peri-implant mucosa to achieve an optimal emergence profile for the final crown. As final reconstruction, a monolithic ceramic screw-retained single-crown cemented onto a titanium bonding base was planned.

Surgical Procedure

For the first surgical intervention (primary bone augmentation), the patient was pre-medicated with 2000mg of Amoxicillin and 600mg Ibuprofen 1 hour before surgery. After local anesthesia, sulcular incisions at teeth 23 and 25 along with a slightly palatal-offset crestal incision were performed. A beveled vertical releasing incision mesial of tooth 23 was

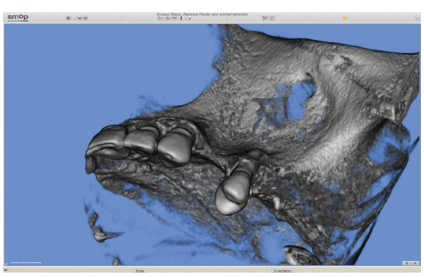


Figure 3.

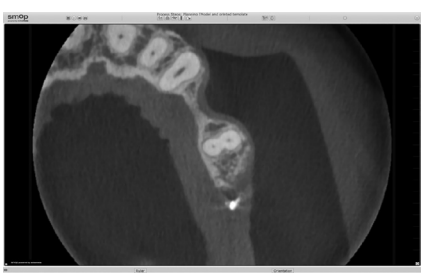
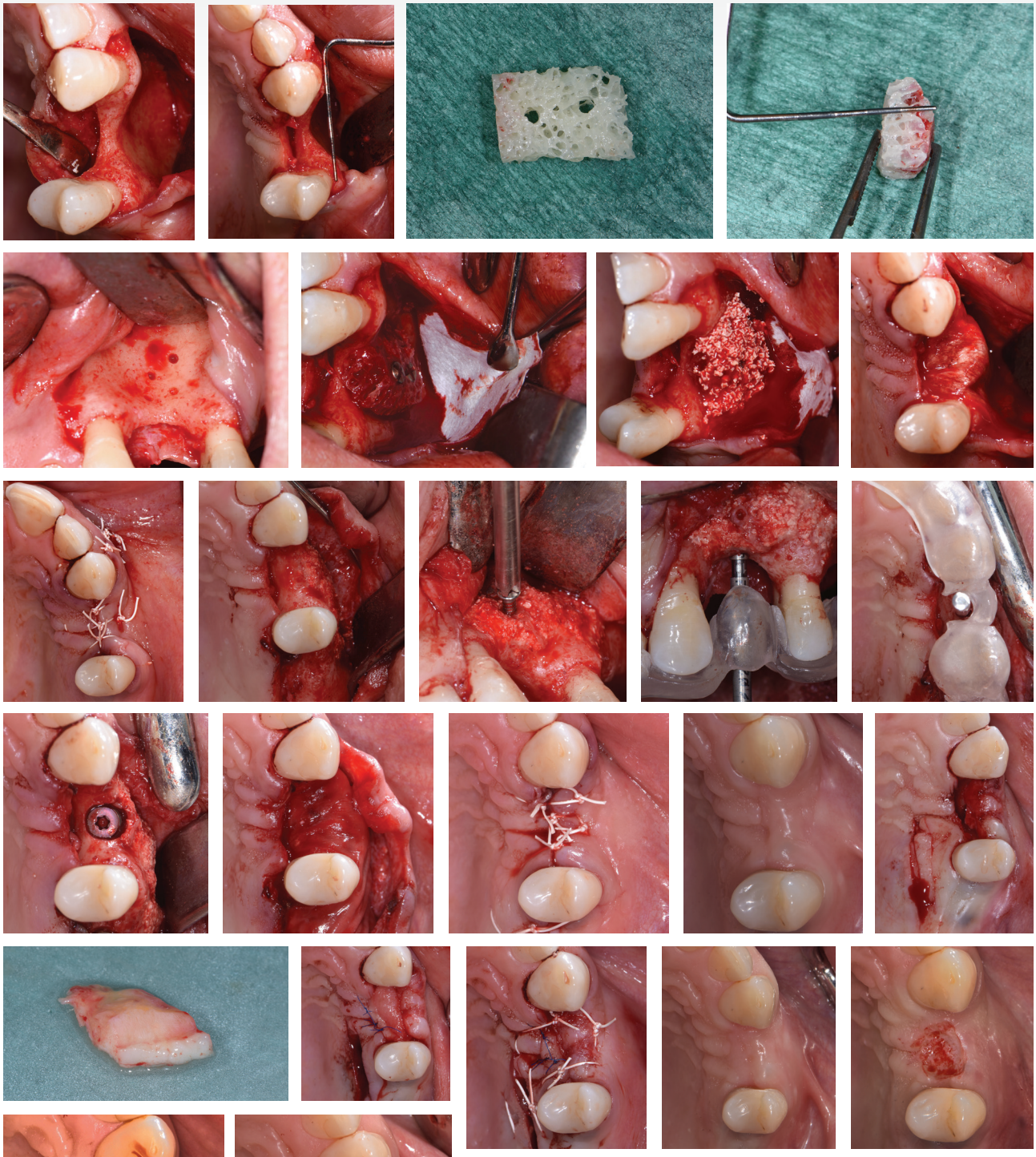


Figure 4.

Figure 5.



Figures 4 - 28.

made and a full-thickness muco-periosteal flap was elevated (Fig.4). The extent of the bony defect was analysed and the dimensions in bucco-oral and mesio-distal directions were measured (Fig. 5). An allogenic bone block (Maxgraft® Block 10x10x10mm, Botiss Biomaterials, Zossen, Germany) was prepared extraoral accordingly and 2 screw holes were drilled into the bone block (Fig. 6 & Fig.7). To facilitate osteoconductivity and osteogenesis, several perforations were drilled into the vestibular corticalis at site 24 using a surgical round bur [13 14] (Fig. 8). The bone block was fixated by means of 2 osteosynthesis screws (Pro-Fix Bone Fixation screws, 8mm length, Osteogenics Biomedical, Lubbock USA) and the edges were rounded (Fig. 9). The block graft was then covered with a bovine bone substitute (Cerabone®, Botiss Biomaterials, Zossen, Germany, Fig. 10) and a collagen membrane (Jason® Membrane, Botiss Biomaterials, Zossen, Germany, Fig. 11). After a periosteal incision, the flap could be repositioned tensionless and was closed with 5.0 ePTFE non-absorbable monofilament sutures (Fig. 12). Antibiotics (500mg Amoxicillin & 125mg clavulanic acid, taken three times daily for 7 days), pain killers (600mg Ibuprofen, taken when needed) and 0.2% chlorhexidine mouth wash (rinsing twice daily for 1 minute) were prescribed. The sutures were removed 10 days after surgery.

After an uneventful healing period of 9 months, implant placement at position 24 was performed. After a premedication with 2000mg of Amoxicillin and 600mg of Ibuprofen, a full thickness mucoperiosteal flap was raised under local anesthesia. A good bone healing and favorable crest width was present (Fig. 13). Both osteosynthesis screws were removed (Fig. 14) and the implant bed was prepared using a conventional surgical stent as reference for ideal 3D-position of the implant (Fig. 15 & Fig. 16). The drilling sequence was performed according to the manufacturer's recommendations and the implant (Straumann Bone Level implant, diameter 4.1mm Regular Crossfit RC, length 10mm) could be placed achieving good primary stability (Fig. 17). To prevent the resorption and to compensate for the naturally occurring remodeling of the bone block, another bone augmentation procedure was performed using a xenograft bone substitute (Cerabone®, Botiss Biomaterials, Zossen, Germany) and a collagen membrane (Jason® Membrane, Botiss Biomaterials, Zossen, Germany, Fig. 18). The flap could be repositioned without a periosteal releasing incision and was closed with a 5.0 ePTFE non-absorbable monofilament suture (Fig. 19). The same post-operative protocol was used as for the first intervention.

After an uneventful healing period of 8 weeks, the implant showed good secondary stability, but insufficient soft tissue

Figure 29.

Figure 30.

Figure 31.

Figure 32.

Figure 33.

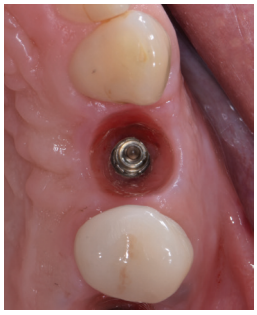


Figure 34.

Figure 35.

Figure 36.

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Figure 38.

Figure 39.

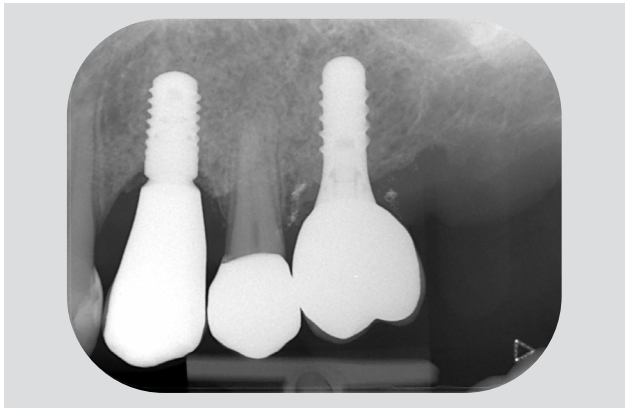

Figure 40.

volume at site 24 could be observed (Fig. 20). Because of the rather large augmentation procedures, some vestibulum height and height of keratinized mucosa was lost. To improve this situation, a connective tissue graft combined with a keratinized mucosal part was planned. A mid-crestal incision and sulcular incisions were made at the recipient site and a split flap pouch was created (Fig. 21). At the donor site palatal of tooth 25 with a 3mm safety distance to the gingival margin, a single-incision technique was used to harvest the graft (Fig. 22). The combined keratinized and connective tissue graft was cleaned extra-orally and then fixed with monofilament polyamide 6/0 sutures (Fig. 23). Both donor and recipient sites were then closed with a 5.0 ePTFE non-absorbable monofilament suture (Fig. 24).

After a healing period of additional 6 weeks, the re-opening was performed using the mini-roll-flap technique [15]. Intraorally, an excellent hard and soft tissue situation could be observed (Fig. 25). To optimize the esthetic outcome, the re-opening procedure was chosen to augment the volume in bucco-oral direction. After de-epithelialization with a round diamond bur (Fig. 26), a semi-lunar incision on the palatal aspect of the implant site was performed and the cover screw of the implant was removed (Fig. 27). The small flap was folded inwards under the vestibular mucosa and a healing screw was placed onto the implant (Fig. 28).

This technique often does not require any sutures as the tissues are held stably in place by the healing abutment (Fig. 28). After a healing period of 2 weeks, the implant was ready for the prosthetic phase.

Prosthetic Procedure

After an uneventful healing phase of 2 weeks, the peri-implant mucosa was healthy and stable. The healing abutment was removed and a corresponding scan body (Straumann Mono Scanbody RC 025.4915, Straumann, Basel, Switzerland) was screwed onto the implant. Following an optical impression with an intraoral scanning (IOS) device (Trios 3, 3Shape, Copenhagen, Denmark), a temporary crown was fabricated using CAD/CAM technology. The crown was milled from an PMMA acrylic resin block, polished and pre-treated on the luting surface with an acrylic coupling agent.

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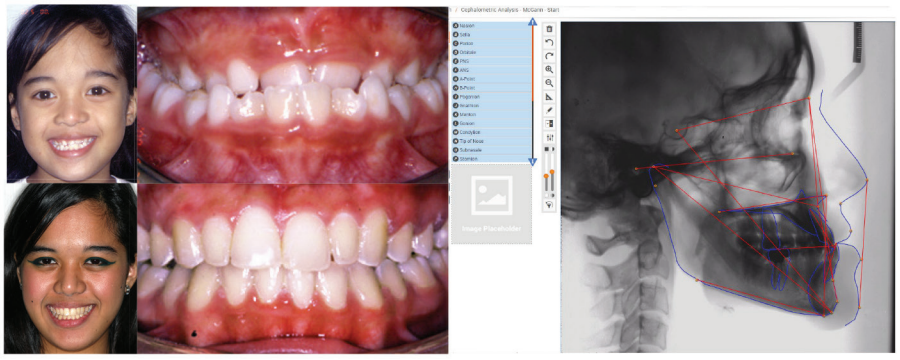

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The corresponding titanium bonding base (RC Variobase for crown 022.0107, Straumann, Basel, Switzerland) was sandblasted with 28µm silica-coated aluminiumoxide particles and pretreated with a silane containing coupling agent. The temporary crown was cemented onto the bonding base using a self-curing composite cement and high-gloss polished (Fig. 29). The provisional crown was screw-retained onto the implant with a torque of 15Ncm (Fig. 30 & Fig. 31).

After 2 weeks, the temporary crown was removed and modified to improve the emergence profile for the final reconstruction (Fig. 32 & Fig. 33). The cervical portion of the temporary crown was modified using a composite resin material. After another 3 weeks, the emergence profile was ideal and the peri-implant tissues were healthy and stable (Fig. 34).

A final optical impression was taken using the same protocol as before. The screw-retained final reconstruction was made out of monolithic glass-ceramic (Fig. 35). It was designed (3Shape Dental Design software, 3Shape, Copenhagen, Denmark) and milled out of a lithium-disilicate block using CAD/CAM technology. During an intraoral try-in, the approximal and occlusal contact points were evaluated and only minor modifications had to be made. The lab technician added esthetic staining (Fig. 36) and a final try-in was performed (Fig. 37). After approval of the patient, the bonding surface of the final reconstruction was acid-etched using hydrofluoric acid and pretreated with a coupling agent. The titanium bonding base (RC Variobase for crown 022.0107, Straumann, Basel, Switzerland) was sandblasted, cleaned and silanised using the same protocol as described above. The crown was cemented onto the titanium base abutment using a self-curing composite cement and gloss polished in the laboratory. The finalized reconstruction was screw-retained onto the implant using a torque of 35Ncm. The screw access hole was closed with Teflon tape and a temporary filling material. After a settling period of 2 weeks, the screw was re-tightened again with 35Ncm and the access channel closed with a PTFE tape and resin composite.

Final Result

A detailed hygiene protocol was explained to the patient and maintenance appointments were scheduled every 6 months. The patient was very satisfied with both the esthetic and the functional result (Fig. 38 – Fig. 40). During the control visit 1 year after crown insertion, neither biological nor technical complications were observed.

Conclusion

The treatment approach shown in the present case report lead to an esthetically and functionally favorable result. A bone augmentation using an allogenic bone block graft seems to be a valid alternative to autologous grafting. The allogenic material showed a high biocompatibility and yielded a bone healing similar to what can be expected of an autologous graft. The use of an allogenic biomaterial leads to significantly less patient morbidity, as no donor site for the grafting procedure has to be created. As a negative point the higher cost of biomaterials in comparison to autologous bone grafting must be considered.

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Esthetic results on discoloured substructures

Tony Rotondo[1] and Szabolcs Hant[2]

It is quite common for the prosthetic restorative team to be faced with discoloured preps, which, if located in the visible esthetic zone, require a well-considered approach. The question at the core is: How can we integrate the discoloured tooth structure into our layering work in a way that a balance between an effective "coverage" and a vibrant interplay of shades is achieved (Figs 1 and 2)? The approach outlined below is based on a clearly defined treatment itinerary consisting of the following stages:

1. Space requirement for masking with all-ceramic restorations
2. Material selection
3. Masking with framework
4. Masking with staining material (IPS Ivocolor®)
5. Layering with ceramic materials (IPS e.max® Ceram)

Figure 1: These images highlight the inherent structure of natural teeth. It is the job of the dental technician to replicate these characteristics.

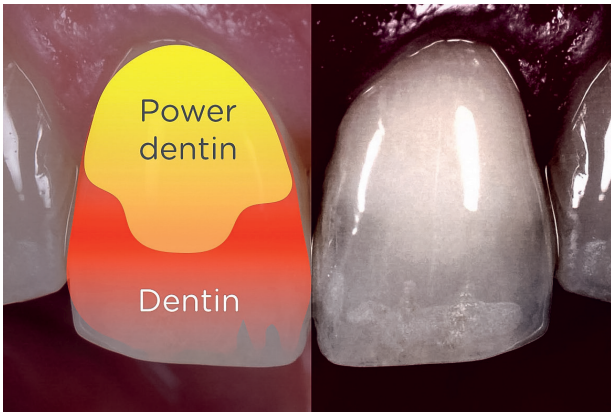

Figure 2: To replicate the dentition in this case, Power Dentin is used for the opaque area and Dentin for the more translucent part.

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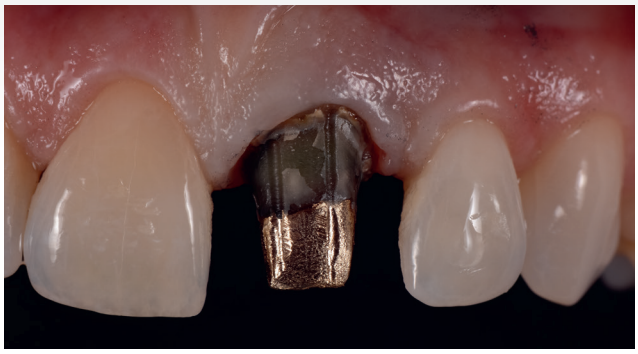

Figure 3. The metal core build-up is to be restored with a crown.

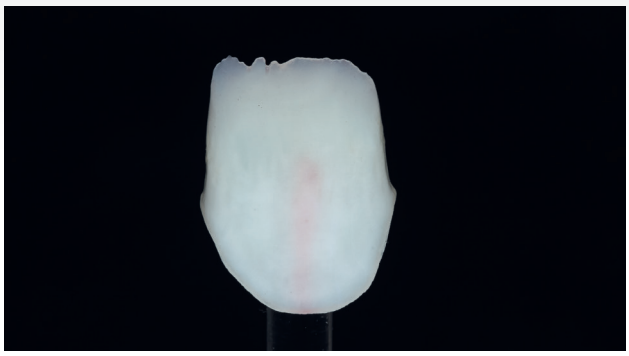

Figure 4. The coping is first masked with one layer, in total with three layers, of IPS Ivocolor Essence White. Available space: 1.1 mm

Figure 5. The metal post is effectively masked. The brightness and value of the crown blends in with the natural dentition optimally

Space requirements for masking discoloured substrates with all-ceramic restorations

Sufficient space is essential to place all-ceramic restorations on discoloured preps if we want to mask the discolouration and attain a natural shade effect and the desired brightness (Figs 3 to 5). We can calculate the space required for the all-ceramic restoration with a formula proposed by Aki Yoshida and Galip Gürel as follows: We take the minimum thickness of an all-ceramic framework and add 0.15 mm by every shade we want to increase the brightness.

For example:

- Discoloured prep: shade A4
- Goal for the final crown: A1
- Minimum thickness of IPS e.max Press: 0.4 mm
- Space required for the restoration: 4 x 0.15 + 0.4 = 1 mm

Another method is to use the SNA app (IPS e.max Shade Navigation App). This app establishes the translucency and shade based on the starting situation.

Selecting the framework material

Our material of choice has been IPS e.max Press for the past twelve years and we have had excellent experiences with it. We usually use the MO 0, LT and MT press ingots. If we happen to use the LT ingot, we always select an ingot that is one shade brighter for the framework, for example a BL4 for a final A1 shade. This is discussed in more detail in the section on "Layering" below. Under normal circumstances, these ingots are ideal. However, if the prep is severely discol-oured, the situation is more complicated. In these cases, the discoloured tooth structure must be disguised.

We differentiate between two methods for masking:

- Masking with the framework
- Masking with staining material (IPS Ivocolor)

Masking with framework

If the framework is used to mask the discoloured tooth structure, the options are limited. The masking capabilities will depend on the thickness of the framework and not only on the material chosen. MO ingots can easily block out discolour ed substrates if they are used in an adequate thickness of 0.5 to 0.7 mm. In many cases, however, there is not enough space or the shade of the prep is too dark. Another method is to use HO ingots or zirconia frameworks for masking. However, these materials are extremely opaque, making it hard to create a natural illusion of depth and translucency in the incisal area.

Masking with staining material (IPS Ivocolor)

The Ivocolor range of stains and glazes includes some amazing materials. Given their unique properties, the Enamel and Effect materials are suitable for both metal-ceramic and all-ceramic restorations. Another advantage we like is the low firing temperature. The low-fusing Glaze and Essence materials helped us many times to adjust a contact point

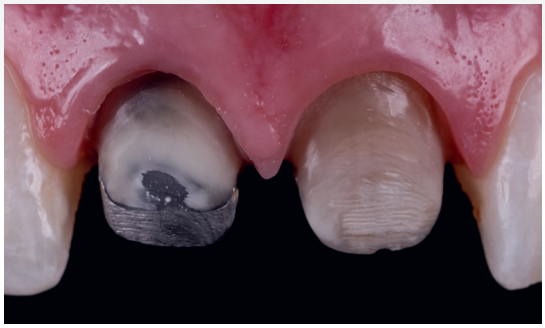

Figure 6 : This case also involves a severely discoloured prep.

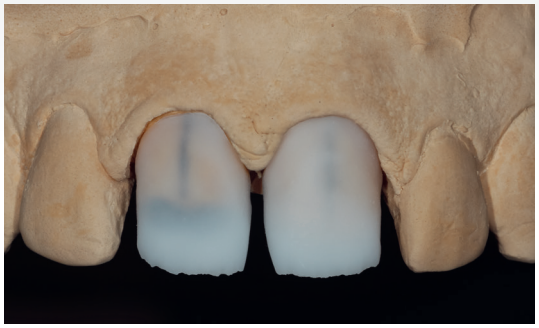

Figure 7: LT framework masked with IPS Ivocolor Essence White

Figure 8: A photograph (polarizing filter) is taken at the try-in to verify the brightness.

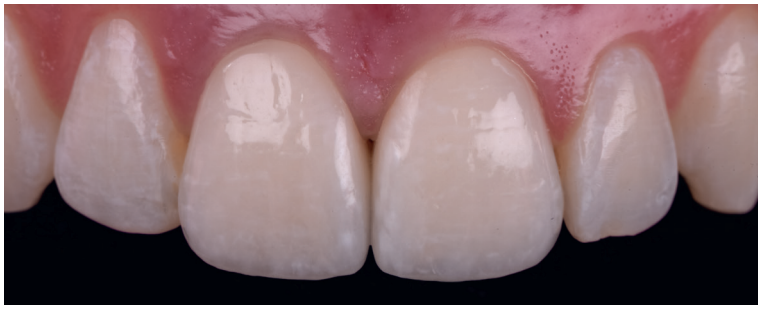

Figure 9. Both crowns in situ

or to add more chroma and effects at the correction firing, without compromising the shape or texture.

We need a framework to use this technique. Any framework material will do in conjunction with the IPS Ivocolor range. Ini tially, we always used the MO 0 ingots. Then we realized that the LT and MT ingots generate similar masking effects, whilst providing superb full-contour lingual surfaces. IPS Ivocolor Essence White can be easily used as a basic white stain (Figs 6 to 9). We fire three separate layers because one thick layer can shrink too much during the firing process, causing uneven surfaces and cracks from the shrinking. With three layers of IPS Ivocolor Essence White, even severely discoloured areas can be masked without reducing the space required for the layering. These three layers of staining material are usually only between 0.1 and 0.15 mm thick. Other Essences can be added to the basic white stain to achieve an even closer match to the final shade. In so doing, however, you should bear in mind that the more translucent materials you mix in, the less effective the masking effect is. For example, IPS Ivocolor Essence Cream contains translucent particles that reduce the opacity of the mixture. If you are not sure about the level of opacity you are getting, you can dilute the mixture with stain liquid or benzyl alcohol and then check with a magnifying glass (10 to 20-times magnification). We normally use IPS Ivocolor Essence Sunset to add chroma to the white stain. Alternatively, you can also just use pure white at this stage and increase the chroma at the next stains firing. Stains are fired at a firing temperature of 750°C using the dentin firing program.

Masking with framework

Layering is also an important factor to cover discoloured preps and to achieve a high level of brightness and chroma. Originally, the IPS e.max layering ceramic was developed for opaque, high value framework materials, such as the HO and MO ingots and the first generation of zirconia materials. On these high-value frameworks, IPS e.max Ceram worked beautifully. Problems started to arise when the LT and HT ingots were introduced. How could you combine the translucent IPS e.max Ceram layering ceramic with the trans-lucent LT and HT framework materials? All of a sudden, the usual layering technique did not work any longer, leaving dental technicians confused and frustrated – and so were we. Then we discovered the key element for successful restorations: brightness-value-opacity. We learned a great deal by experimenting with different combinations

Figure 10. In this case, the discoloured prep is to be restored with a crown and the adjacent tooth with a veneer.

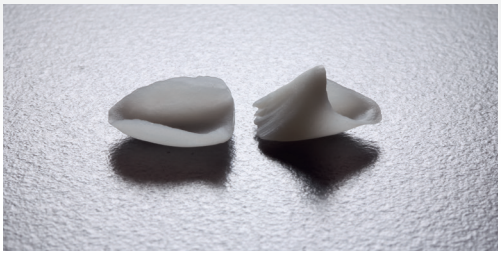

Figure 11. The frameworks have been pressed from a MT ingot and masked with IPS Ivocolor Essence White.

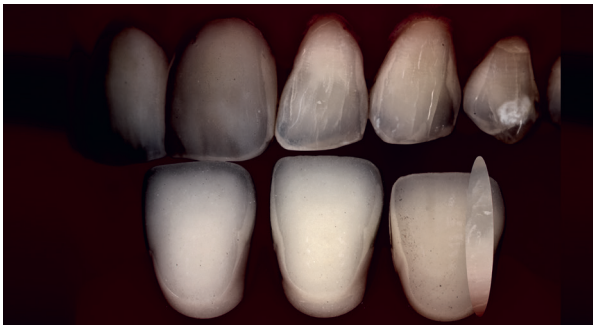

Figure 12a and 12b. Dental photographs assist in analysing the initial situation.

of materials. For some time, our principle has always been to use Mamelon Light Impulse – a material that features a high level of opacity and fluorescence and goes a long way towards achieving a lifelike result. In the meantime, the IPS e.max Ceram system has been extended to include the new Power Dentin and Power Incisal range of materials. These materials allow users to achieve a natural opacity without mixing different materials. If the framework is white and/or opaque, the first generation of Deep Dentin/Dentin/Incisal materials can still be used. If the frameworks are made of LT, MT or other translucent material, the new Power materials are used best (Figs 10 to 14).

Conclusion

The correct brightness is essential for successful esthetic re-sults. The framework material should be selected carefully, especially for all-ceramic restorations. With the IPS e.max system, this is relatively easy, even in difficult cases. It is ad-visable to first determine the shade of the preparation and the space available for the restoration and then select the framework material. The IPS e.max Shade Navigation app (SNA app) is a useful tool for dentists and dental technicians in doing this. With the above presented approach, we can restore most cases of severely discoloured tooth structure with ceramic restorations that harmoniously and smoothly blend in with the natural dentition.

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Figure 13. Try-in after the first firing

Figure 14. Both ceramic restorations in situ

Management of the MB2

Kreena Patel[1]

The MB2 or 'fourth' canal has a quite the reputation for being challenging to locate and negotiate. Kreena Patel discusses facts about the MB2 and clinical tips for successfully managing it.

Importance

Just how important is this little canal? This question is often debated among clinicians as some feel root canal treatment can be carried out successfully without treating MB2.

Successful endodontic treatment relies on locating, disinfecting and obturating all the canals. Studies have shown the incidence of MB2 canals is roughly 90% in maxillary first molars and 60% in maxillary second molars. Therefore, the majority of maxillary molars contain four canals and we should start root canal treatment of these teeth with this in mind.

There are often multiple ports of communication between MB1 and MB2. The MB2 can join MB1 along its path or terminate via a separate apical foramen (Figure 1 and Figure 2). Rarely, there can be an MB3 canal present (Figure 3).

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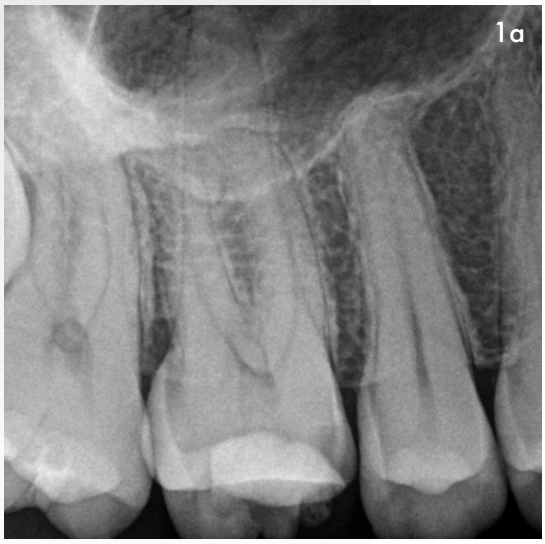
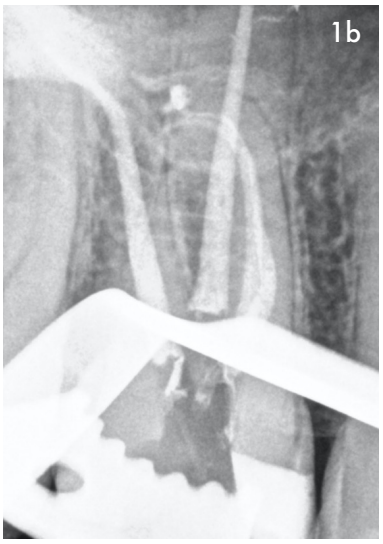
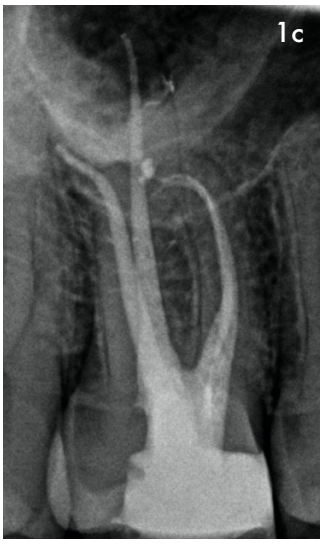
Private Practice, Surrey and Berkshire, UK.
@kreenaspecialistendodontics.







Figures 1a, 1b and 1c: MB1 and MB2 are two separate canals

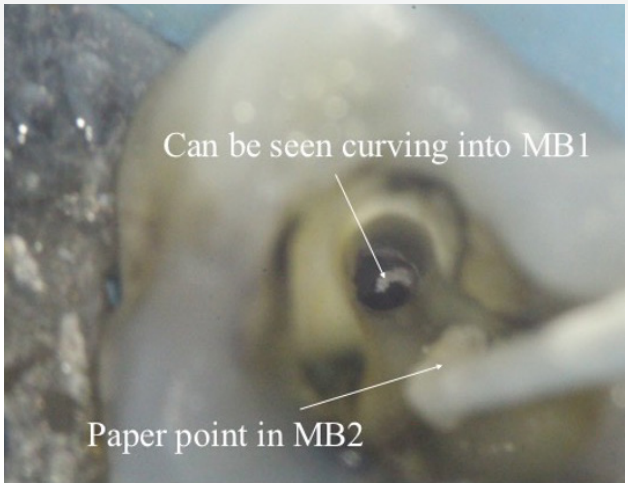


Figure 2: A paper point has been placed in the MB2, and can be seen appearing in MB1 where the canals join

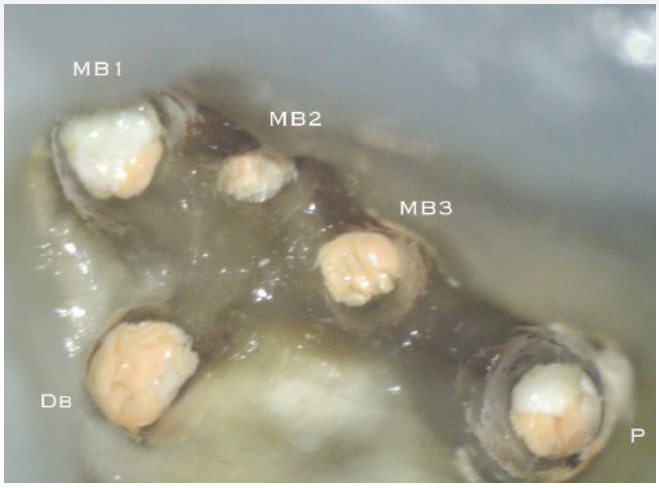


Figure 3: Upper second maxillary molar with MB1, MB2 and MB3

A missed MB2 canal is one of the main causes of endodontic failure in maxillary molars. In cases of irreversible pulpitis, it may be responsible for ongoing temperature sensitivity, and in necrotic cases, residual bacteria will increase the risk of infection (Figure 4).

CBCT

Cone beam CT has become a very useful tool in endodontics because it allows us to see root canal morphology is three dimensions. It is important to note there are large differences in scan quality obtained by various CBCT machines; a high-resolution small volume scan is necessary to visualise the fine details required for endodontics. CBCT has been shown to be a reliable tool for detecting MB2 canals and assessing their path up the root (Figure 5). However, studies have shown MB2 canals are still sometimes located clinically even when they are not seen on the scan (Blattner et al, 2010; Parker et al, 2017).

Location

Magnification and lighting make all the difference when trying to locate MB2. Studies have shown that the frequency of MB2 canal detection for microscope, dental loupes and no magnification were 71.1%, 62.5% and 17.2% respectively (Buhrley et al, 2002). The experience of the operator and time spent searching for the canal have also been shown to be important factors.

Figures 4a, 4b and 4c: Patient was referred for the root canal retreatment of UR6. The tooth had been treated privately with her general dentist three years ago; the root canal treatment had been carried out to a good standard (under rubber dam isolation, three canals cleaned, shaped, disinfected using sodium hypochlorite and obturated to length). The patient did not have significant pain but the tooth did not 'feel right' and was affecting her function. Root canal retreatment was carried out and an additional MB2 canal was located. The patient's symptoms settled immediately following treatment and she was advised to proceed with a cuspal coverage restoration

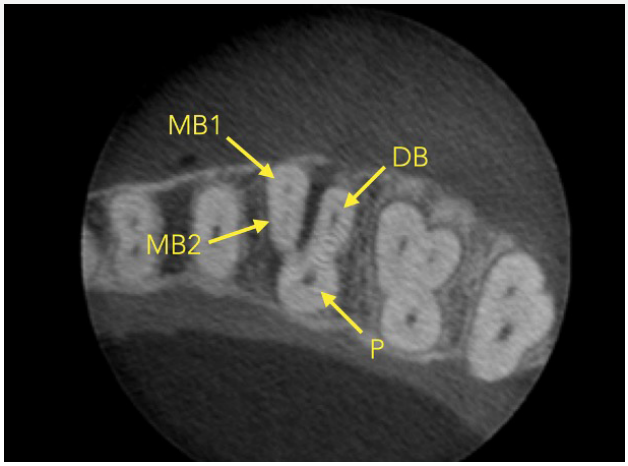
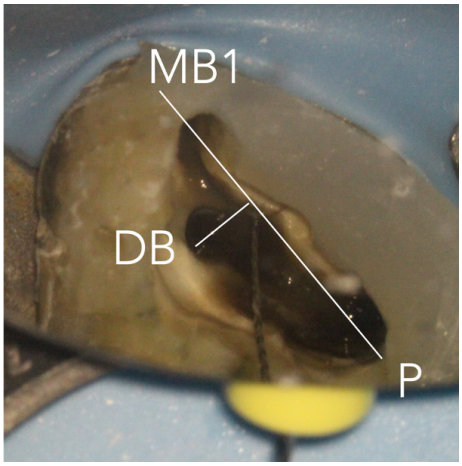


Figure 5: CBCT image (axial view) of a maxillary molar highlighting the presence of two canals in the MB root. Sometimes the MB2 canal is more calcified and cannot be seen clearly. If the MB root form is oval and the MB1 is asymmetrically positioned then there will still likely be an MB2 canal present

The pulp floor has developmental root fusion lines which are darker; these can provide a road map for locating canals because of where the orifices lie (Krasner and Rankow, 2004). The MB2 canal is commonly located within the developmental groove between MB1 and palatal orifices. Envisage a line joining the MB1 and palatal canal, and draw another line from DB to this line – in the majority of cases MB2 is located at this juncture, and a few millimetres away from the MB1 orifice (Figure 6). A sharp DG16 probe is essential for exploring the area and locating the orifice. Less frequently, the MB2 orifice can lie closer to the palatal orifice (Figure 7) or within the MB1 orifice itself (Figure 8).

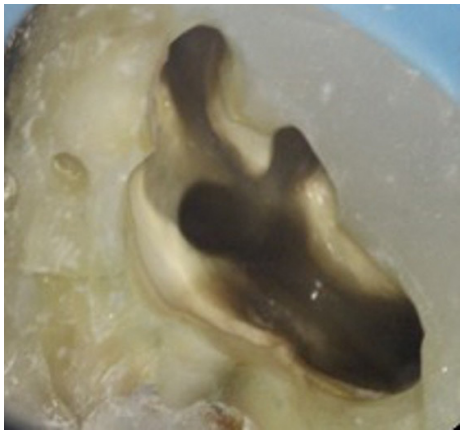
The orifice lies at the junction of the pulp floor and mesial wall, and is frequently covered by a mesial lip or 'shelf'



6a: The MB2 orifice normally lies at the juncture of these two lines

6b: MB2 located with a hand file

6c: Orifice enlargement and coronal flaring



6d: After cleaning and shaping

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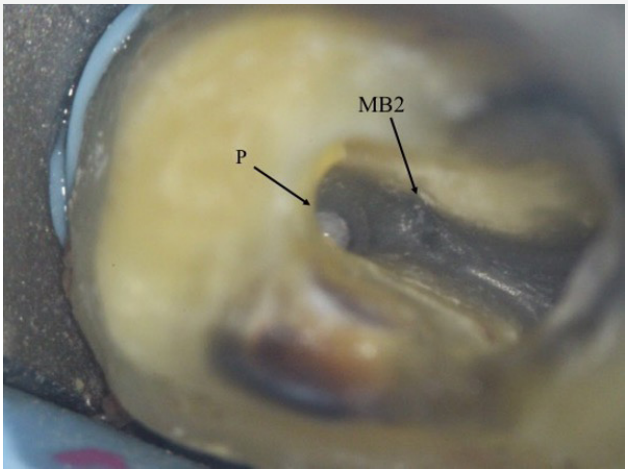
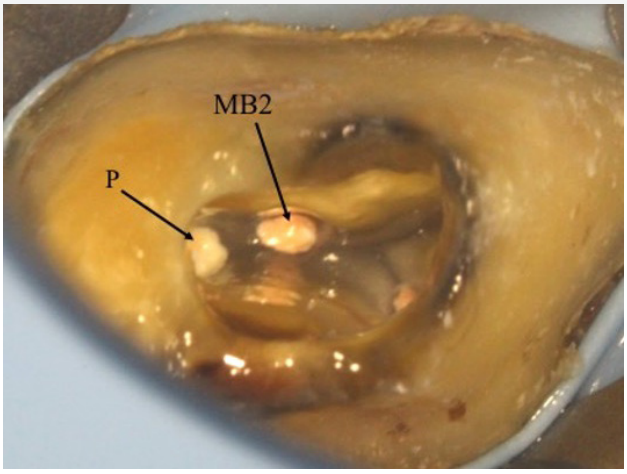


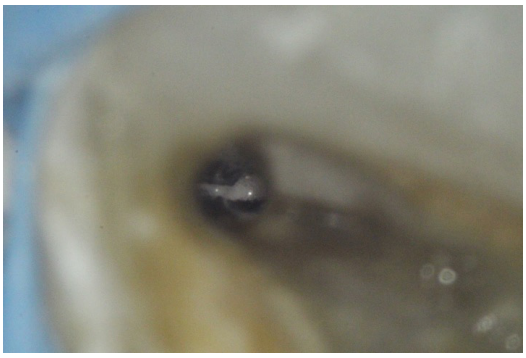
7a: MB2 orifice detected close to the palatal canal



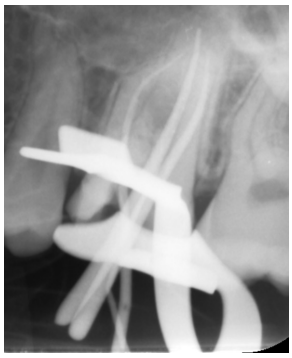
7b: After obturation

of dentine, particularly in older patients. Therefore, the access cavity will need to be extended to remove this. In calcified cases, the MB2 may be slightly deeper apically. Piezo-electric ultrasonic tips or long-neck burs used in a slow handpiece are very useful removing the dentine shelf and searching for MB2. They allow good vision during

8a: Preoperative radiograph. The tooth had previously been accessed by the referral dentist.

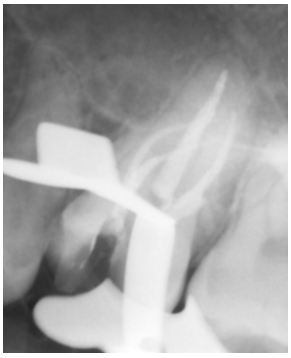


8b: MB2 was located within the MB1 orifice (mesial wall). The microscope photograph was taken after the MB1 and MB2 have been fully prepared

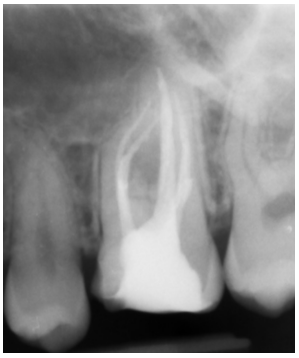


8c: Master cone radiographs taken with a GP cone in MB1

8d: Master cone radiograph taken with cone in MB2 d) Mid-fill radiograph shows MB1 and MB2 are separate canals



8e: Postoperative radiograph



8f: Post-obturation photograph showing one MB orifice. A trough line can be seen where MB2 was searched for in its 'typical' location

9a: Access regained: the GP point was removed to reveal the perforation on the pulp floor

9b: The true MB2 canal was located using a small hand file

9c: Canals prepared and obturated

9d: Perforation repaired using Biodentine

preparation because the head of the handpiece does not obstruct your view. They also remove dentine and calcifications in a controlled manner so the preparation is more conservative. It is essential to preserve as much dentine as possible because it is quite easy to perforate the mesial wall or pulp floor when searching for MB2 (Figure 9).

10a: Master cone shows MB2 joining MB1

10b: MB2 joins MB1 at an acute curvature (white arrow)

Instrumentation

I strongly advise fully preparing the MB1 canal prior to locating and instrumenting MB2. The MB2 often joins MB1 at a sharp angle, and it makes negotiation much easier if the MB1 is already enlarged (Figure 10).

Instrumentation of MB2 can often be difficult. The canal often has an abrupt mesial curvature in the coronal 1-3mm making it challenging to negotiate initially. I find that spending time initially gaining correct access and coronal flaring to gain straight line access can prevent ledges, which once formed are very difficult to bypass. Rotary orifice openers such as XA (Dentsply Sirona) used in a brushing motion away from the furcation are very useful for this.

Small hand files (size 8-10) can then be taken further into the canal and a glide path formed prior to using rotary instruments. If at any point the hand file meets resistance the canal can be flared up to this point prior to taking pre-curved hand files back into the canal. The MB2 can be calcified in extensively restored teeth and older patients. Stiffer hand files and 17% EDTA solution can be very useful for these situations but care needs to be taken as it is also easy to ledge the canal using these.

The MB root is a small root and a more conservative preparation of the MB2 is necessary to prevent unnecessary weakening and fracture long-term. I would recommend using a slightly less tapered (6%) rotary file for the final preparation. Some clinicians advise preparing MB2 to the level it joins MB1 to conserve dentine. However, in my experience I find the MB2 frequently joins MB1 but then separates into its own canal apically

(2-1-2 morphology) (Figure 11). Therefore, I would recommend always preparing the MB2 to full length. Obturation of these complicated systems presents its own challenge and can only be done effectively using a warm technique.

Summary

Successful root canal treatment involves treating all the canals present. The MB2 has been shown to be present in most maxillary molars and the clinician should approach treatment of these teeth with this in mind. The MB2 is notoriously challenging to locate and negotiate, but with the correct magnification, light, equipment, knowledge and experience it can be treated predictably.

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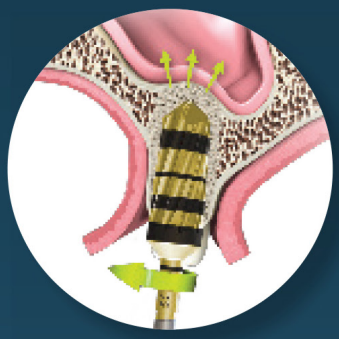

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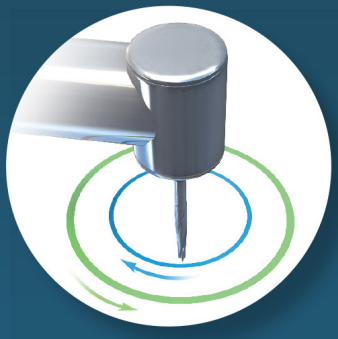

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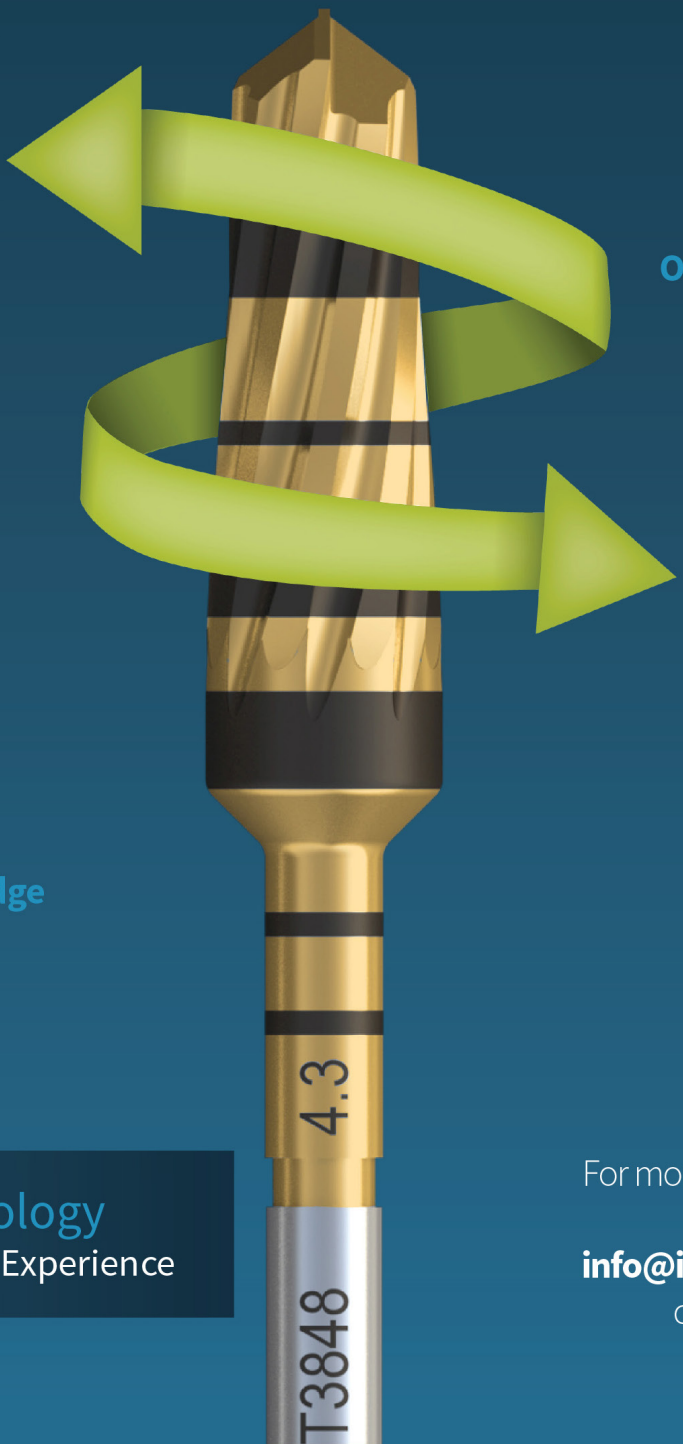

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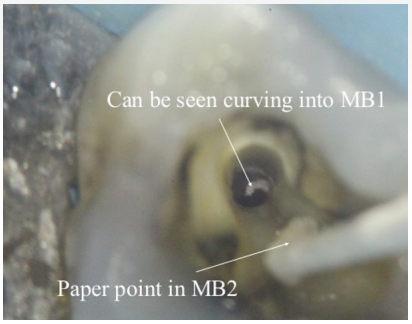
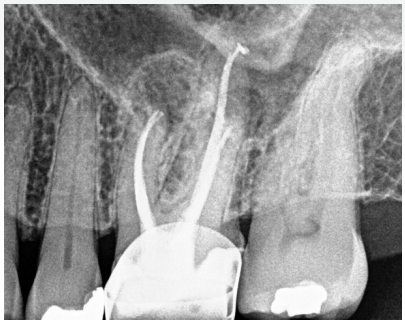
11a: Preoperative radiograph

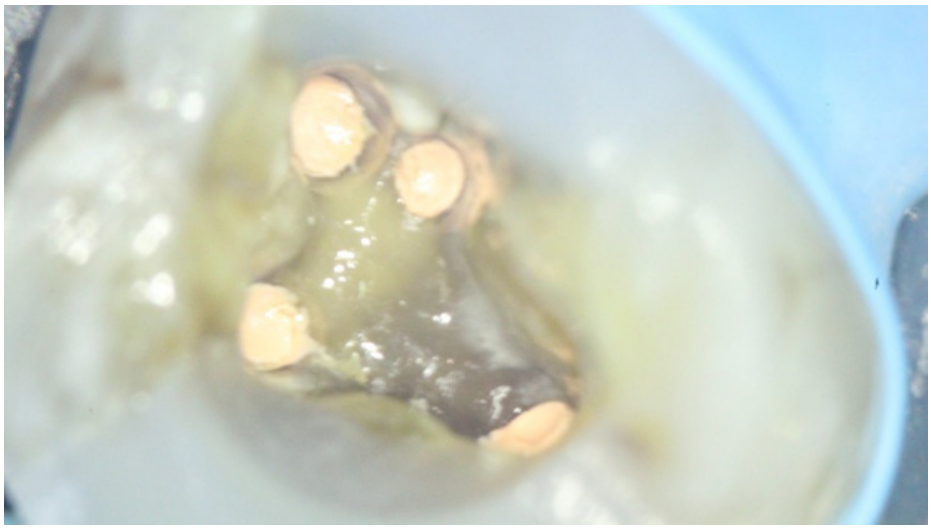


11b: A paper point has been placed in MB2, and can be seen appearing in MB1 where the canals join



11c: Mid-fill radiograph showing the MB2 has a separate apical foramen from MB1. The MB1 &MB2 have a 2-1-2 morphology (2 orifices-merging into 1 canal – separating into 2 canals). The MB2 should always be fully instrumented because this anatomy is difficult to predict

11d: Postoperative radiograph



11e: Microscope photograph

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- Diastema closure
- Repair of porcelain/composite

Simplified layering technique for superior-quality posterior restorations

Gianfranco Politano[1] and Marleen Peumans[2]

Today, there is a strong trend towards streamlining den-tal materials and procedures. We would like to show that simplification and good quality are not a contradiction in terms when posterior teeth are restored with proven direct materials. Furthermore, we have developed a method to heighten our efficiency which involves a simplified layering protocol and a composite material that is easy to adapt to the remaining tooth structure.

In this article, we present a simplified layering protocol for the placement of direct composite restorations in posterior teeth. In the two cases described, we used Tetric EvoFlow Bulk Fill as the dentin replacement and a medium-translucency nanohybrid composite A2/A3 (IPS Empress® Direct and Tetric® EvoCeram) as the enamel replacement. Clinical experience has shown that the combination of these two material used with a bilaminar histo-anatomical layering method results in restorations that blend in seamlessly with the surrounding tooth structure. In the two cases, a simplified layering protocol was used to place superior-quality restorations in posterior teeth in only 30 minutes.

One of the benefits of streamlined products and procedures is that clinical protocols are easier to standardize, thereby reducing the risk of error. If we look at the different steps of the clinical procedure, we see quite clearly that cavity prepa-ration cannot be simplified. To ensure the longevity of the restoration, the cavity must be properly prepared according to the biomechanical analysis.

However, with regard to the adhesive protocol, it can defi-nitely be streamlined by making use of a contemporary uni-versal adhesive (e.g. Adhese® Universal). It can be applied in several modes: etch-and-rinse, self-etch or self-etch with prior selective etching of the enamel with phosphoric acid. The restoration is then efficiently placed by following a simplified layering protocol, taking three important aspects into account:

1. Application of the histo-anatomical bilaminar layering technique

The objective is to copy the natural tooth. Therefore, the histo-anatomical build-up of the natural tooth has to be reproduced: The natural occlusal dentin is concave, while the enamel is convex. This biological fact (Bazos et al., 2011) has to be taken into consideration during the composite layering process. As a result, the dentin com-posite will be layered in a concave way and the enamel composite in a convex way (Fig. 1). Layering according to this "bilaminar" technique is simple. In the prepared occlusal cavity, the enamel and dentin can be clearly distinguished so that the dentin and enamel composite can be efficiently applied in the correct spatial order. An additional advantage of the bilaminar histo-anatomical technique is that there is minimal risk of making visual mistakes when grinding in the occlusion.

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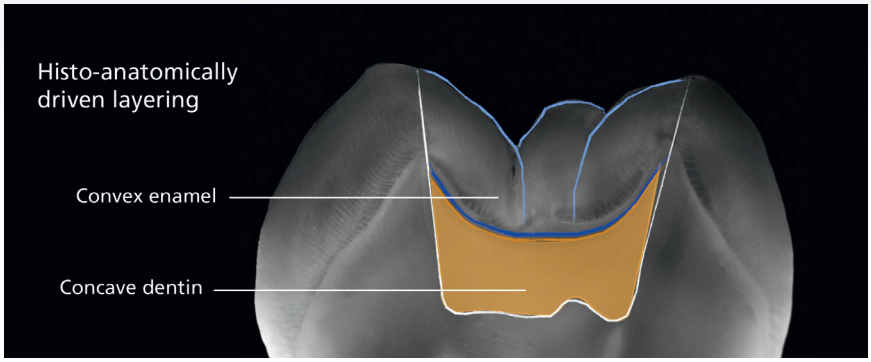

Figure 1: The natural occlusal dentin layer has a concave shape, while the enamel layer is convex.

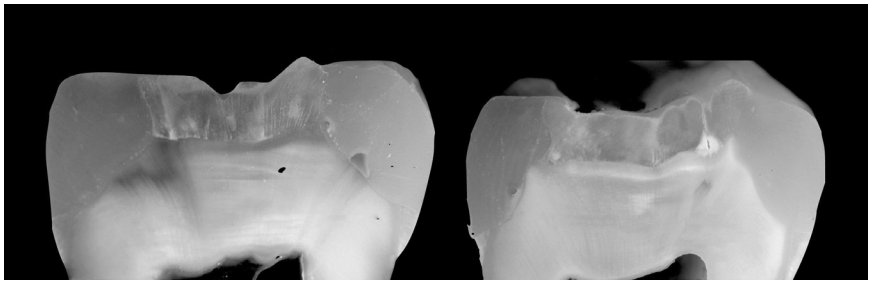

Figure 2: Treatment of two molars with Class II cavities: flowable composite (1) and conventional composite (2). The flowable composite shows better adaptation.

2. Selection of the composite materials for dentin and enamel replacement

A highly filled flowable composite resin should be selected as the dentin replacement. This type of ma-terial readily adapts to the cavity margins, the cavity floor and the overlaying conventional composite layer (Fig. 2). In addition, flowable composites show low shrinkage stress because of the elastic bonding effect. A flowable composite is easy to apply as a dentin re-placement, since it automatically assumes the concave shape of the dentin. Very deep cavities are quickly filled with a product such as Tetric EvoFlow Bulk Fill, for example. This flowable composite resin has a high filler content of 52 vol %. The patented light initiator Ivocerin in combination with the Aessencio Technology enables you to apply this flowable composite in 4-mm thick layers, which nevertheless can be reliably cured. During the polymerization process the translucency of the flowable composite drops from 28 % to a low < 10 %which is very similar to that of natural dentin. Further-more, the material has convenient self-levelling properties, and it optimally adapts to cavity walls. Finally, Tetric EvoFlow Bulk Fill shows low shrinkage stress, as the material contains an elastic resinous filler known as a shrinkage stress reliever, in addition to the standard fillers. The dental enamel is replaced using a medium-trans-lucency material (A2/A3) that imitates the optical properties of natural dental enamel. The esthetic IPS Empress Direct materials and the clin-ically proven Tetric EvoCeram composite are suitable for this purpose. As described, the enamel material must be applied in a convex way, according to the successive cusp build-up technique: that is, the cusps are built up in individual steps. An enhanced esthetic effect can be attained by characterizing the occlusal fissures with a brown stain (IPS Empress Direct Color Brown). This results in the optical separation of the cusps. In addition, the stain seals the fissures, thereby decreasing the possibility of plaque accumulation and simplifying the polishing of the occlusal surface.

3. Layering protocol for Class II restorations

When the proximal box of a Class II cavity is filled, the layering pro-cess starts with the placement of a highly filled flowable composite in the cervical part of the cavity. This layer should be at least 2 mm in thickness (Fig. 3). The aim is to improve the marginal adaptation in the cervical area of the preparation. The proximal enamel wall is built up with conventional nanohybrid enamel composite in order

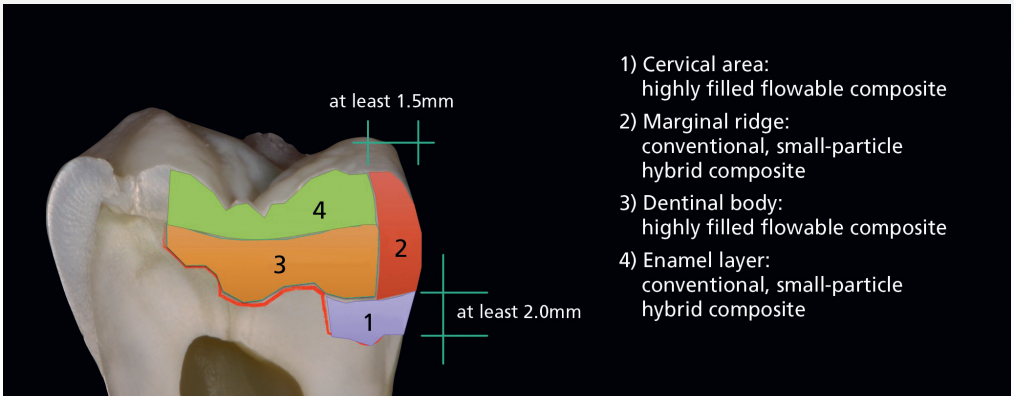

Figure 3: Layering scheme for a Class II restoration. The flowable Tetric EvoFlow Bulk Fill can be applied in one step (layer 1 and 3) with a maximum increment thickness of 4 mm.

to obtain the best possible physico-mechanical properties within the marginal ridge area. Once the Class II cavity has been transformed into a Class I cavity further layering can take place as described above. The layering proce-dure is further simplified and accelerated by using Tetric EvoFlow Bulk Fill as the dentin replacement, since this material is applied in one step (in the box and the occlusal part). Nevertheless, the maximum thickness of this layer must not exceed 4 mm.

In the last step of this clinical procedure the functional requirements are checked and the restoration is finished and polished. These steps can be simplified by ensuring the following points:

- A precise evaluation of the occlusion and articulation of the initial situation will prevent any over-contouring of the occlusal surface.
- In the treatment of Class II cavities, the correct selection and positioning of the matrix band will avoid the use of exces-sive amounts of composite material.
- When the cusps are modelled according to the successive cusp build-up tech-nique, attention must be paid to giving the cusps the correct inclination and to leaving enough space for the antagonist cusp. This will significantly reduce the time needed for adjusting the occlusion as well as finishing and polishing.

The restorations are easy to finish and polish to a high surface gloss with the three silicone polishers of the Astropol set. The polishers must be used in the correct order: that is, in decreasing grit size. The grey polishers are suitable for finishing the occlusal surfaces and the margins. They are operated at a speed of 10,000 rpm with water-cooling. These polish-ers remove the scratches that were created by the diamond bur when the occlusion was ground in. Subsequently, the green and then the pink polishers are used to polish the res-toration to a high gloss shine.

Case 1

A 35-year-old patient requested us to replace the amalgam restorations in her first and second lower molars. She complained of pain in the last molar when she chewed. The clinical pictures showed unacceptable restorations in both of the teeth (Fig. 4). After having applied the universal adhesive system Adhese Universal, we replaced the dentin with Tetric EvoFlow Bulk Fill (Fig. 5). This flowable composite resin has very good self-levelling properties and automatically assumes a concave shape. In the second molar, the flowable bulk-fill material was applied in one increment in the occlusal part and in the proximal area of the preparation and subsequently polymerized with the Bluephase light curing device (light output 1200 mW/cm2) for 20 seconds.

The manufacturer recommends light curing of 10 seconds. The layer did not exceed 4 mm in thickness. Due to the Aessencio Technology, the opacity of the flowable material increased significantly during the light curing process (Fig. 5). Next, we replaced the enamel with the medium-translucency Tetric EvoCeram A3 material using the successive cusp build-up technique. We stained the fissures with IPS Empress Direct Color Brown (Fig. 6). Once we had removed the rubber dam, we checked the occlusion. As the cusps had been built up in the correct way, only minimal adjustments were required. We finished and polished the composite restorations using the three polishers from the Astropol composite polishing kit. The surfaces of the completed restorations were attractive in their simplicity and blended in seamlessly with the surrounding tooth structure (Fig. 7).

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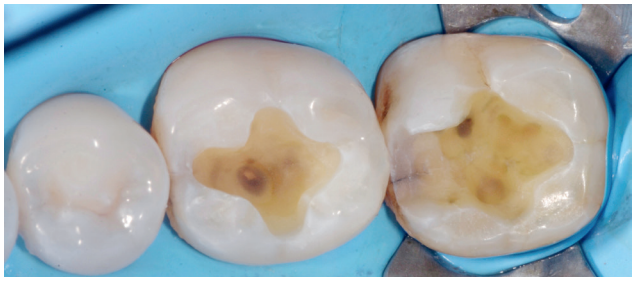
Figure 4: Case 1: Defective restorations in two lower molars



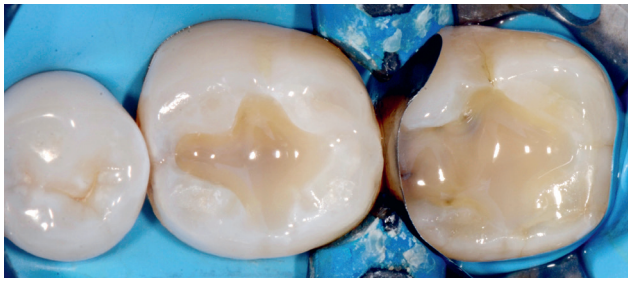


Figure 5a and 5b: Replacement of the dentin layer using Tetric EvoFlow Bulk Fill. Due to the Aessencio Technology, the opacity of the composite increases during the polymerization process.

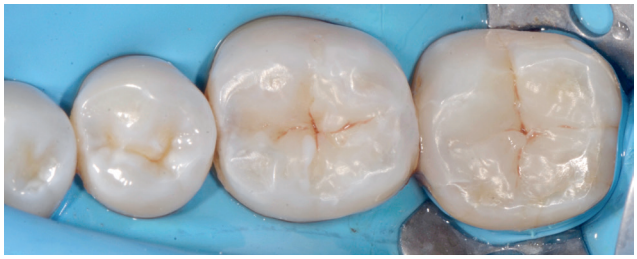


Figure 6: Replacement of the enamel with a medium-translucency composite (Tetric EvoCeram A3) using the successive cusp build-up technique. The fissures were characterized with IPS Empress Direct Color Brown.

Case 2

A thirty-year-old patient presented with defective restorations in two lower molars (Fig. 8). We placed a rubber dam and removed the old restorations. In the process, we found numerous carious lesions (Fig. 9). We removed the infected dentinal tissue with a round tungsten carbide bur at a low speed. Next, we cleaned the prepared cavities by air-abrading them with aluminium oxide particles (30 µm). We did not reduce the slightly under-mined buccal cusp of the first molar, as it was not exposed to heavy loading during occlusion and articulation (Fig. 10).

Figure 7: Result after finishing and polishing

ETHICS 2020 SUPPLEMENT

In response to our readers' requests, International Dentistry - African Edition is pleased to annouce the publication of our Ethics 2020 Supplement.

Co-edited by Prof Andre van Zyl and Dr Johan Hartshorne, the supplement has six excellent articles dealing with Ethics in dentistry, authored by Dr Johan Hartshorne, Dr Elizabeth Meyer and Prof Andre van Zyl.

Our sincere thanks go to the Editors and Authors and to our sponsors, **GSK** and **PPS,** who made this Supplement possible.

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Figure 8: Case 2: The two molars required direct composite restorations.

Figure 9: When the old restorations were removed, numerous caries lesions were revealed.

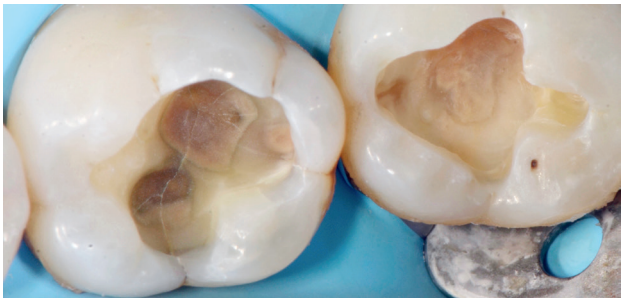

Figure 10: Prepared cavity after air-abrasion with aluminium oxide

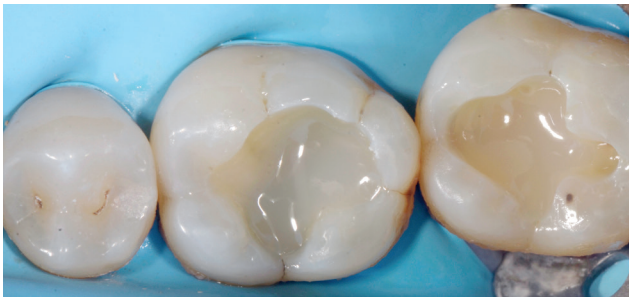

Figure 11: Reconstruction of the dentin layer with Tetric EvoFlow Bulk Fill (after curing)

Figure 12: Result after finishing and polishing. The enamel layer was rebuilt one cusp at a time with IPS Empress Direct Enamel (A2).

After the polymerization step, the composite showed a significant increase in opacity, and the material effectively masked the discoloured bottom of the cavities (Fig. 11). We used IPS Empress Direct Enamel in shade A2 to replace the enamel. Subtle staining of the fissures with IPS Empress Direct Color Brown created an optical separation of the cusps. The finished and polished restorations looked very attractive and could not be distinguished from the natural tooth structure (Fig. 12).

Conclusion

Superior-quality composite restorations can be placed in posterior teeth in a normal time frame. The bilaminar histo-anatomical layer-ing protocol significantly simplifies the treat-ment process. A highly filled flowable bulk-fill composite showing a dentin-like opacity and an enamel composite resin exhibiting medium translucency are key elements of this protocol.

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COVID-19 risk management in dental practice Part 1: Seven Pandemics and 100 years later – What lessons have we learnt?

Johan Hartshorne[1] and Andre van Zyl[2]

Keywords: COVID-19, consequences, coronavirus, epidemiology, influenza, mitigation, pandemic, SARS, MERS, Spanish flu, Asian Flu, Hong Kong flu, Swine flu, seasonal flu, risk management

Executive Summary

Rationale

- COVID-19 is a global public health emergency of international concern and declared a pandemic on March 11, 2020 by the World Health Organization.
- No country, government, institution, health care system or individual saw, anticipated or was prepared for what was coming at them.
- The rapid advance of COVID-19 around the world has laid bare the unpreparedness of health care systems, availability of resources, and the limits of our knowledge.
- The purpose of this Part 1 of this review is to provide a historical overview of pandemics over the past 100 years, an epidemiological snapshot of COVID-19 globally, South Africa and other geographic regions, and South Africa, and a brief understanding of risk mitigation and its socio-economic consequences within the wider context of communities and populations.

Key points

- COVID-19 is the most contagious of all the respiratory viral pandemics
- COVID-19 is spreading fast in more than 215 countries with 42,548,025 confirmed cases, 1,150,140 deaths, and 31,454,342 recoveries globally to date.(24 October, 2020)
- Mitigation strategies are all based on hand hygiene, wearing masks, screening, isolation and quarantine, social distancing and avoiding crowded places and gatherings.
- Non-pharmaceutical interventions alone are unlikely to prevent or contain a pandemic – it only delays or flattens the pandemic peak to allow health authorities to prepare for the pandemic and reduce the strain on health care systems.
- History has every time repeated itself in showing global unpreparedness of public health care systems and inadequate availability of resources.
- It is impossible to predict why, how and when cycles and waves will occur in different countries.
- COVID-19 infection outbreaks are fuelled by superspreading events (high risk individuals, facilities and opportunistic situations.

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- To reach herd immunity for COVID-19, 70% or more of the population would need to be immune. • Studies suggest that at this point in time no more that 2-4% of any countries population has been infected with SARS-CoV-2.
- The primary focus of the initial mitigation and lockdown efforts has been on limiting the spread of SARS-CoV-2 s infection and COVID-19 disease (so called 'flattening the curve') to relieve potential strain on health care systems because of unavailability or inadequacy of resources (personal protection equipment), facilities (hospital beds and intensive care units) and to prepare health care professionals to be able to manage the impact of COVID-19.
- COVID-19 around the world has laid bare the un-preparedness of health care systems, availability of resources, and the limits of our knowledge
- Fundamental questions about how SARS-CoV-2 spreads in a population and who is at risk of both infection and severe complications is still unanswered.
- Co-morbidities and immunocompromised conditions tend to increase severity of illness and fatalities.

Practical implications

- The unintended consequences of 'lockdown', mitigation policies and restriction has resulted in a devastating impact on social, economic and health care systems.
- Governments world-wide are now faced with the complicated challenge on how to deal with all the unintended consequences created by the 'lockdown' intervention and restore the devastating effects of COVID-19.
- SARS-CoV-2 is a novel respiratory virus, there is no vaccine, no antiviral drugs and no scientific evidence-based data to underpin / back any mitigation or infection control protocol.
- A novel virus is always going to be a problem because the population has no immunity and there is no vaccine.
- Each pandemic is different and no one can predict when and how it will end .

Introduction

A highly contagious pneumonia outbreak caused by a novel coronavirus emerged in Wuhan, China in December of 2019. Subsequently, the World Health Organization (WHO) declared a public health emergency of international concern over this global pneumonia outbreak on January 30, 2020. On February 11, 2020, WHO named the novel viral pneumonia officially as Corona virus disease or COVID-19. The International Committee on Taxonomy of viruses (ICTV) named the virus: severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)[1] The World Health Organization (WHO) officially declared COVID-19 as a pandemic on March 11, 2020.[2]

Covid-19 is spreading fast with an increasing number of infected patients world-wide.[3] The Johns Hopkins University of Medicine dataset on July 27, 2020 showed there were 16,526,414 confirmed cases of COVID-19 globally, 649,662 deaths whilst 10,115,994 individuals infected with SARS-CoV-2 globally have recovered. Cases of COVID-19 at this stage have been reported in more than 188 countries.[4,5] The rapidly increasing number of cases and evidence of human-to-human transmission suggested that the virus was more contagious than SARS-CoV and MERS-CoV.[6,7,8] In addition, thousands of health care workers have been infected, and outbreaks have occurred in hospitals, aged care facilities and prisons.[9] Thus COVID-19 has not only become a global public health emergency, but mitigation policies such as 'lockdowns' implemented world-wide has also placed a tremendous amount of strain on health care systems (including dental practices) and global economies.

No country, government, institution, health care system or individual saw, anticipated or was prepared for what was coming at them. In addition to the loss of lives, COVID-19 has placed unprecedented physical, financial and emotional strain on health care systems, businesses, food security, individuals and global economies at large. Dentistry world-wide was, and are still in many countries, under severe strain since the outbreak of COVID-19. As a result dentists and their staff have to endure work-, health-, social- and economic-related implications and anxieties resulting from the COVID-19 pandemic.

SARS-CoV-2 is a novel respiratory virus and at the time of this writing there is no vaccine and no anti-viral drugs against SARS-CoV-2. Furthermore, there is at this moment in time no scientific evidence-based data to back any mitigation or infection control protocol specifically against COVID-19 and SARS-CoV-2.

Literature search methodology

Emerging literature on COVID-19 is scattered over various sources, characterized by lack of, or incomplete or uncontested evidence-based data and by a plurality of voices within the health care, academic, and environmental research community. The pandemic and its implications is rapidly evolving making it difficult to clearly and rapidly

synthesize and articulate scientific evidence.[10] There is need for timely evidence to inform and update dentists on their infection prevention and control practices on emerging infectious respiratory diseases. Because there are no specific evidence-based data for COVID-19, the only source of data we have is retrospective data on previous respiratory viral pandemics. A retrospective review of available evidence will allow extrapolation of results from indirect evidence and rapid dissemination of results widely to assist dentists to adjust their infection control and prevention protocols.

A comprehensive literature search of multiple bibliographic databases was conducted, including Medline, Embase and the Cochrane Collaboration. COVID-19 repositories with lists of grey literature sources (e.g., LitCOVID, COVID-END and WHO-COVID-19) and pre-print servers or repositories for biological and medical sciences (e.g., medRxiv, bioRxiv) were also included in the search strategy. Preprints are preliminary reports of research word that have not been certified by peer review. Information derived from preprints thus have to be interpreted with caution. Studies and reviews in all languages were considered for inclusion. Search keywords used in this review include, COVID-19, consequences, coronavirus, epidemiology, influenza, mitigation, pandemic, SARS, MERS, Spanish flu, Asian Flu, Hong Kong flu, Swine flu, seasonal flu, risk management. Electronic databases were searched to July 31, 2020.

Purpose

The purpose of this 4-part series is to enhance dental practitioners understanding of the what, why, and how underpinning the risk-management of the virus (SARS-CoV-2) and the disease (COVID-19) within both the broader community and the dental practice setting.

Part 1 provides a historical overview of pandemics over the past 100 years, an epidemiological snapshot of COVID-19 (October,24, 2020), and a brief understanding of risk mitigation and its socio-economic consequences in the wider context of communities and populations.

Part 2 will focus on the key parameters of the infection chain that impact directly on risk management in the dental practice setting namely: (i) the pathogen SARS-CoV-2, (ii) reservoir or source of infection, (iii) portal of exit, (iv) mode of transmission, (v) portal of entry and virus replication, and (vi) a susceptible host and the corona virus disease (COVID-19) In addition, Part 2 will also summarize the current state of knowledge regarding the aerobiology and flow physics implicated in the generation, expulsion, evolution and transmission of virus-laden droplets and aerosols generated from the respiratory tract during expiratory activities such as breathing, talking, coughing and sneezing and during aerosol generating procedures.

Part 3 of this review investigates the current available in formation on: (i) the global burden of COVID-19 on health care workers and in particular dental health care workers, (ii) why the dental practice setting is regarded as a 'high occupational risk' setting, and (iii) are dental health care workers and their families at increased risk of COVID-19 compared to the general population?

Part 4 of this review provides an update and summarizes the current knowledge on infection control and prevention measures in the dental practice setting.

These reviews will enhance dental practitioners knowledge, awareness and appreciation of pandemics, respiratory viruses and their consequences, current epidemiology data, and what precautionary and preventive measures to take that will minimize, mitigate or eliminate the risk of exposure and transmission of coronavirus in the dental practice workplace, to protect the health and safety of dental health care workers (DHCW) and patients and public visiting their premises during the COVID-19 pandemic.

Placing Covid-19 in perspective – 7 pandemics and 100 years later

Between 1918 and 2020 the world has experienced three major wars, massive growth in population and human associated microbiomes, antibiotic resistance, trade and international travel, all contributing in their own unique way to the emergence and spread of pandemic diseases. During this period the world has experienced seven respiratory virus pandemics, four related to influenza virus, (Spanish Flu 1918, Asian Flu 1957-1958, Hongkong Flu 1968-1970, Swine Flu 2009-2010, and three to coronavirus (SARS 2002, MERS 2012, and COVID-19). (Table 1) [11-28]

These pandemics have several common features, namely: (i) they are caused by a novel virus, originating from a primary animal host (i.e, Influenza – birds and swine, and coronavirus – bats and camels), (ii) transmission is by respiratory droplets, contact with contaminated surfaces and airborne transmission, (iii) symptoms are similar to flu, (iv) there is no immunity and no vaccination is available, (v) secondary bacterial pneumonia is a common feature, and (vi) they tend to occur in waves.

Co-morbidities and immunocompromised conditions tend to increase severity of illness and fatalities. Mitigation strategies are all based on hand hygiene, wearing masks, screening, isolation and quarantine, social distancing and avoiding crowded places and gatherings. Non-pharmaceutical

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Table 1 : A comparison of epidemiological characteristics of respiratory virus pandemics and seasonal flu over the past century (1918 -2020)

	Spanish Flu 1918	Asian Flu 1957-1958	Hongkong Flu 1968-1970	Swine Flu 2009-2010	Seasonal Flu (Annually)	SARS * 2002	MERS** 2012	COVID-19*** 2019
Detected: Date	March 1918	February: 1957	July 1968	April: 2009	Seasonal	November: 2002	June: 2012	December: 2019
Origin	China	Yunan, China	Hongkong, China	Mexico	South-East Asia	Guangdong, China	Jeddah, Saudi Arabia	Wuhan, China
Pathogen	Influenza A/ H1N1	Influenza A/ H2N2	Influenza A/ H3/N2	Novel A/H1N1 H1N1 pdm09	A/H3N2 or A/H1N1p-dm09	SARS-CoV βcoronavirus	MERS-CoV βcoronavirus	SARS-CoV-2 βcoronavirus
Receptor	Sialic acid	Sialic acid	Sialic acid	Sialic acid	Sialic acid	ACE2	DPP4 (CD26)	ACE 2
Incubation period	1-2 days	1-2 days	1-2 days	1 – 4 days	2-4 days	2-14 days (mean: 5 days)	2-14 days	2-14 days (mean: 6 days)
Ro: (Contagiousness)	≈1.8	≈1.7	≈1.8	≈1.5	≈1.3	≈ 1.7-1.9	≈ 0.4-0.7	≈ 3.54 (highly diffusible)
Spread (countries)	Unknown	39	74	122	Unknown (not notifiable)	26 countries	27 countries	213 countries
Number cases	500 million (50% of global population)	9 million in UK	Unknown	60.8 (43.3 -89.3) million	1 Billion annually	8096 (21% health-care workers)	2521	41 million
Number deaths	≈ 50 million (over 4 month period)	1-2 million	1-4million	≈ 284,000 151,700-575,400	≈ 400,000 290,000 – 646,000 annually	774	866	600,532
Mortality rate	1-3%	0.67%	0.03	0.02%	0.1%	≈ 9.2% (9.5%)	≈34.4% (34.4%)	≈ 1,38-3.4% (2.3%)
At risk group	13-34 years of age	Younger age groups 5-39 yrs old	Younger populations	Younger people pregnant women	Children 5-19 yrs Elderly & immune compromised,	Elderly & individuals with Co-morbidities	Medical co-morbidities, Men >60 yrs	Individuals with co-morbidities, >65Yrs,
Vaccine	None	Available when pandemic hit USA	November 1968	Effective vaccine available after epidemic	Effective vaccine	No vaccine available	No vaccine available	No vaccine available - 3 in development stage
Disease profile	Highly contagious Deadliest Most died of pneumonia	Mild pandemic Pneumonia 50% Low death rate	Highly transmissable Low disease severity	Mild but costly Predictors of death: lung disease, other co-morbidities	Mild and self-restricting Many people have residual immunity 3-5 million cases of severe illness	Acute and often fatal illness	Acute and often fatal illness. Most patients who die are immunocompromised or have medical co-morbidities	Very contagious and high mortality. More people have mild-to- moderate symptoms/ less severe clinical picture, asymptomatic spread
Duration	6 months (abated quickly	1 -2 years	2-3 yrs	1 year	Seasonal (annually)	SARS has reappeared four times	Still active	Ongoing
Waves	3	2	2	1	Annually	4	Still active	Still active
End of Pandemic	April 1919	1 March 1958	1970 still in circulation as part of seasonal flu	August 2010	Seasonally	July 2003	Still active	Still active
References	11,12,13,15	12, 13, 14, 15, 16	12,13,15	13, 15, 17, 18	15, 24	13, 15, 19, 20, 22, 23, 28	13, 15, 19, 20, 21, 22, 23, 25,26	13, 15, 19, 20, 21, 22, 23,27, 28

*SARS : Severe acute respiratory syndrome / **MERS: The Middle East Respiratory Syndrome
***COVID-19 epidemiological data as on 12 June 2020

Table 2: Comparative epidemiological perspective of COVID-19 data stratified by geographical regions (Up to 24 October 2020)

Geographical area	South Africa	Africa	Europe	North America	Asia	South America	Oceana	Global
Countries		57	48	39	49	14	8	215
Population	59,540,916	1,360,378, 201	747,207,105	590,547,609	4,620,145,977	4,318,674,627	41,762,627	11,668,715,952
Tests	4,657,116 (7.72%) †	16,000,528 (1.18%) †	203,297,225 (27.2%) †	146,704,230 (24.8%) †	355,921,749 (7.7%) †	41,345,749 (0.95%) †	9,646,979 (23,1%) †	772,916,460 (6.62%) †
Cases	712,412 (1.20%) †	1,708,640 (0.12%) †	8,050,726 (1.08%) †	10,483,822 (1.77%) †	12,994,159 (0.28%) †	9,274,079 (0.21%) †	35,878 (0,08%) †	42,548,025 (0.36%) †
Cases/Million	7110	2100	11945	7815	7309	14703	2794	5459
Deaths	18891 (0.03%) †	41020 (0.003%) †	248,240 (0.03%) †	341,954 (0.06%) †	231,881 (0.005%) †	286,071 (0.007) †	959 (0.002%) †	1,150,140 (0.01%) †
Deaths/Million	317	33	276	202	79	459	22	147,6
Recovered cases	643,523 (90.3%) ‡	1,398,172 (81.8%) ‡	3,407,407 (42.3%) ‡	6,985,006 (66.6%) ‡	11,401,113 (87.7%) ‡	8,221,740 (88.6%) ‡	31,245 (87.1%) ‡	31,454,342 (73.9%) ‡
Active cases	49,998 (7.02%) ‡	269,448 (15.8%) ‡	4,395,079 (54.6%) ‡	3,156,862 (30.1%) ‡	1,352,165 (10.4%) ‡	766,268 (8.26%) ‡	3674 (10.24%) ‡	9,943,543 (23.3%) ‡
Serious/critical cases	546 (0.08%) ‡	2069 (0.12%) ‡	15,578 (0.19%) ‡	20,006 (0.19%) ‡	21,087 (0.16%) ‡	17,856 (0.19%) ‡	17 (0.05%) ‡	76,617 (0.18%) ‡

(† = % of Population) / (‡ = % of Cases)
Adapted from Worldometer, 2020 30 and Coronatracker, 202031

interventions alone are unlikely to prevent or contain a pandemic – it only delays or flattens the pandemic peak to allow health authorities to prepare for the pandemic and reduce the strain on health care systems.

Differences between pandemics mostly occurred in the level of contagiousness, mortality rate, age groups most likely to be affected and the number of people affected and died.

Common variables that are most likely associated with the occurrence and cyclic nature of pandemics are emergence of novel viruses due to genetic mutations, antibiotic resistance, increasing population growth, increased crowding and gathering in public spaces, shopping, public transport and sporting events, and increased international travel. Global connectedness and international travel has brought about greater and faster spread of infectious disease, larger disease impacts, and improved international cooperation and surveillance to mitigate spread of infectious disease. However, history has every time repeated itself in showing global unpreparedness of public health care systems and inadequate availability of resources.

History has also shown that pandemics occur in unpredictable cycles and occur in waves, however it is impossible to predict why, how and when cycles and waves will occur in different countries. In addition pandemics are inherently uncertain, nobody knows how it will end and when it will end.

Furthermore, pandemics are always associated with societal disruption, economic burden and strain on public health systems, hospitals and human resources during pandemic peaks. Pandemics, distinguished on the basis of their geographical spread, have caused significant disease burden, social and economic disruption for centuries. In recent decades, however, globalization and increased travel mobility have altered the emergence and accelerated global disease spread.

The experience in countries, especially poorer countries, with differences in demographic and social structures, poor quality and unavailability of health care, have emphasized

the intense pressure that COVID-19 pandemic places on national health systems, with demand for testing kits, PPE, intensive care beds and ventilators, rapidly outstripping their availability. This has potentially profound consequences on the impact and outcome of measures that can help reduce the spread of the virus, and associated morbidity and mortality.[29]

Epidemiology: Prevalence, morbidity and mortality statistics

Initial studies indicate a high prevalence of COVID-19 with a rapid spread from a single city (Wuhan) to the entire country in just 30 days.[3] The COVID-19 outbreak, which originated in Wuhan, China, has now spread to 215 countries infecting more than 42 million individuals of all ages as of 24 October, 2020. (Table 2) [30,31]

By mid-February 2020, a large number of infections in medical staff had already been reported.32 Survey data show that resident physicians in anaesthesiology, frontline emergency medicine, and ophthalmology were at greatest risk of contracting COVID-19. Another review suggested that dental practitioners are at a particular risk to infection due to close contact with patients and potential exposure to contaminated droplets and aerosols generated during dental procedures and saliva contaminated surfaces that could lead to potential cross-infection.[33]

Although most dental practices are only providing emergency services, the dental practice setting is considered a high risk environment for both dental health care workers as well as patients and staff due to airborne, aerosol, contact and contaminated surface transmission routes of SARS-CoV-2.[34]

A comparative demographic and epidemiological analysis of current COVID-19 data (up to 23 October, 2020) is summarized in Table 2.[30,31]

The global COVID-19 testing rate to date was 6.62%. More testing was done in Europe (27.2%), North America (24.8%) compared to Africa (1.18%). The testing rate in South Africa was 7.72%. The global prevalence rate for COVID-19 to date is 0.36%. The highest prevalence rate was in North America (1.77%) followed by South Africa (1.20%). Europe and South America showed the number of COVID-19 cases per million people. (Table 2). The global COVID-19 related mortality rate per population to date was 0.01%. South Africa and Europe had the highest mortality rate to date (0.03%). To date, the average global recovery rate is 73.9%

South Africa showed the highest recovery rate (90.3%) while the lowest recovery rate to date is in Europe (42.3%). The percentage of cases that are serious/critical are more or less the same over geographical regions with a global average of 0,18%. (Table 2) The lowest average percentage of individuals presenting serious/critical was found in Oceana (0.05%) and South Africa (0.08%).

Variations amongst regions have not been analysed but can be possibly be ascribed to testing trend (high or low testing protocols), accuracy of testing, asymptomatic cases and geographic heterogeneity (summer and winter during COVID-19 outbreak).

What is our current understanding of contagiousness?

Spreading of a virus contagiousness is measured in general by the basic reproductive number (R0)

This is a measure of the average number of secondary infections from an index case. With R0=2 for instance, each index case transmits to two new cases, which then each transmits to two new cases, and so on, increasing the number of new cases exponentially. For an outbreak to persist the R0 must be greater than 1; If R0 is less than 1, the number of new infections over time will decrease.

The reproduction number, or R0, is a mathematical term that defines contagiousness, namely the number of people that one sick host can infect. Estimates of the R0 of SARS-CoV-2 have ranged from 2.24 to as high as 3.58[35] although the WHO estimates it is between 1.4 and 2.5.[36] Current evidence suggests that it takes 3-7 days for the epidemic to double in size. The estimated median range reproduction number (R0) is between 2.0 and 3.0.

What is the current understanding of population heterogeneity, super-spreading events and transmission dynamics of SARS-CoV-2?

There are many heterogeneities in human societies, including different age cohorts, society activity levels and health status, that will influence virus transmission in a population.[37] However, it is suggested that viruses have significant transmission heterogeneity resulting in a small proportion of viruses infecting the vast majority of secondary cases.[38] Factors most likely contributing to superspreading are not completely understood but include (i) biological factors (e.g., individuals with higher viral load), (ii) behavioural and social factors (e.g., individuals with high contact rates), (iii) high risk facilities and places (e.g., closed spaces with poor ventilation such as prisons, long-term care and facilities, health care facilities), and (iv) opportunistic situations (e.g., where large number of individuals temporarily cluster such as in fish and meat factories, cruise ships, crowded public

transportation, family gatherings, parties and night clubs). In these situations, the probability of transmission per contact temporarily increases in an unusual way, such as singing or frequent loud speaking.38 While super-spreading events fuel outbreaks, they allow an opportunity to risk-stratify populations and locations for public health interventions and to interrupt super-spreading events.

What do we know about COVID-19 treatments, vaccines, herd immunity and mitigation measures?

Currently, there are no tested and approved antiviral drugs against COVID-19. Drug treatments currently used for COVID-19 mainly comprise four ways i.e., antiviral Western medicine, Chinese medicine, immunoenhancement therapy, and viral specific plasma globulin.3 There is also no vaccine available at this in time, although three different vaccines are in their development stage.

To reach herd immunity for COVID-19, likely 70% or more of the population would need to be immune.[39] Infectious disease epidemiologists state clearly that herd immunity against COVID-19 will not be achieved at a population level in 2020. Although more than 16 million confirmed cases of COVID-19 have been reported worldwide, studies suggest that no more that 2-4% of any countries population has been infected with SARS-CoV-2.

To date the primary focus of the initial mitigation and lockdown efforts has been on limiting the spread of SARS-CoV-2 s infection and COVID-19 disease (so called 'flattening the curve') to relieve potential strain on health care systems because of unavailability or inadequacy of resources (personal protection equipment), facilities (hospital beds and intensive care units) and to prepare health care professionals to be able to manage the impact of COVID-19. The objective of limiting spread of infection and stalling COVID-19 was to assist government and health care authorities to buy the necessary time to allow them to prepare for COVID-19. The primary intervention to this end was 'lock down' with accompanying restrictive regulations to minimize the spread of infection.

A key issue for epidemiologists is helping policy makers decided on the main objectives of mitigation (lock down) - e.g. minimizing morbidity and associated mortality, avoiding an epidemic peak that overwhelms the health care services, keeping the effects of the economy within manageable levels, and flattening the epidemic curve to wait for vaccine development and manufacture on scale and antiviral drug therapies.[40] Such mitigation objectives are difficult to achieve by the same interventions, so choices must be made about priorities.[41] For COVID-19, the potential social and economic impact of voluntary self-isolation or mandated quarantine (lock down) could be substantial and with disastrous implications.[41]

As the COVID-19 pandemic continues to expand, with uncertainties surrounding re-emergence and unavailability of a vaccine, hospital settings and dental practices are scrambling to implement and intensify infection control measures to protect themselves and patients from exposure to the coronavirus. It has also been suggested that SARS-CoV-2 surveillance should be maintained because a resurgence in contagion could be possible as late as 2024.[42] SARS-CoV-2 transmission from asymptomatic and pre-symptomatic hosts makes it more critical than ever that we develop methods of mass-analysis that provide better and faster prediction of COVID-19 infection. One of our greatest challenges globally is prophylactic prevention and control of transmission of SARS-CoV-2 from asymptomatic patients.

Unintended consequences and socio-economic burden of COVID-19

The COVID-19 pandemic will be written in the annals of history as the largest global social engineering experiment, with unprecedented interventions ever undertaken, exposing the vulnerabilities of Governments, economies, livelihoods and lives, including dental health care workers and their practices, worldwide. Similarly, the United Nations has declared the COVID-19 pandemic to be the greatest test the world has faced since World War 2.[43]

Furthermore, the pandemic vividly demonstrates the health, social and economic burden that that the infectious coronavirus and COVID-19 has imposed in an intimately connected world.[44] Pandemic misinformation, anxiety and fear, fuelled by social and mainstream media, is crowding out urgently needed public health guidance and scientific facts. Unprecedented containment and mitigation policies including lockdown, travel restrictions, isolation and quarantine, school closures and limiting dental and health care services to emergency care only, have been implemented in an effort to limit the spread of COVID-19 and to relieve the potential strain on health care systems. The resulting unintended consequences of these measures has potentially resulted in a wide spread devastating impact on social and economic systems with accompanying wide scale job losses, loss of income, compromised food security, and emotional stress. A further and more complicated challenge to Government now, is how to prepare and

deal with all the unintended consequences created by the 'lockdown' intervention and restore the devastating effects of COVID-19. To quote: "Is economic meltdown a price worth paying to halt delay what is already amongst us?"[45]

The healthcare information and resources burden resulting from COVID-19

The rapid advance of COVID-19 around the world has laid bare the unpreparedness of health care systems, availability of resources, and the limits of our knowledge.

During 'lock down' restrictive measures were implemented allowing only emergency health and dental care. The restrictive measures imposed on oral health care, poses many potential implications for individuals and oral health care providers such as: fear and anxiety, social stigma, disruption and discontinuity of care, neglect, inappropriate use of medication, misdiagnosis, non-diagnosis, malpractice, misconduct under the protection of restrictive legislation. In addition the dental health care workers are facing financial and emotional hardship, due to closure of their practices. Opening their practices now have brought about new challenges including the cost and administrative implications as a result of required personal protection equipment (PPE) and the Government regulations imposed on practices to ensure safe practice. Infection control and prevention globally seems to be a point of considerable confusion within the dental profession.[46] At the fore, inadequate availability of appropriate PPE, lack of knowledge and appropriate training on how to manage infection control and prevention within this new environment, and general fear and anxiety of being exposed to the coronavirus and associated COVID-19 disease.

In addition, the wave of reviews and descriptive studies being produced are just as large as the pandemic itself and characterized by inadequate testing and reporting of epidemiological data, as well as rapid and biased reporting of observations that have not been tested by the peer-review system. Despite the exponential increase in the number of publications and epidemiological data on the number of COVID-19 cases and deaths around the world, fundamental questions about how SARS-CoV-2 spreads in a population and who is at risk of both infection and severe complications is still unanswered.

Conclusion

The COVID-19 pandemic has brought upon us a 'forced sabbatical leave' and a multitude of global challenges that transcends political, cultural, socio-economic, medical, and engineering boundaries, that no individual, healthcare system, Government nor Country can afford. Each pandemic is different and no one can predict when and how it will end. That question that needs to be answered is: why after 7 global pandemics, an ongoing annual flu epidemic, and 100 years later do health care systems and Governments world-wide still have to prepare for viral respiratory outbreaks?

Preparedness and research forms the basis and must continue to evolve to keep pace with the heightened risk associated with pandemics. Since the start of the outbreak, research and rapid reporting has gone through various stages: (i) spreading and testing, (ii) clinical manifestation and management of those serious and critical ill, (iii) the reasons for and mapping of asymptomatic versus serious cases, (iv) vaccine development, and (v) rapid, effective and affordable testing. Researchers in the physical (engineering), medical, biological, behavioural and environmental sciences should collaborate to study these challenges related to the transmission and spread of infectious respiratory disease and reducing diseases severity, to define new research problems, develop new hypothesis, help solve user-centered and community-based problems, to educate and change behaviours, and to provide critical information to assist decisionmakers to mitigate risks associated with infectious respiratory viral diseases.

A novel virus is always going to be a problem because the population has no immunity and there is no vaccine. Development of vaccines is currently in progress. Neutralizing antibodies and vaccines could play significant roles in controlling the COVID-19 outbreak. However, longitudinal serological studies are urgently needed to determine the extent and duration of immunity to SARS-CoV-2.

Lockdowns are socio-economically not sustainable, and the stakes for the world is enormous. The infectious and aerosol sciences community needs to step up and tackle the current challenges presented by COVID-19, to provided evidence-based recommendations that will better prepare us for future inevitable pandemics.

For current numbers in COVID-19 please visit
https://www.worldometers.info/coronavirus/

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Article: Hard tissue augmentation using an allogenic bone block: a clinical case report. Marchand et al, page 20

1. *In a lack of bone which may complicate the implant placement, what grafting procedure is the gold standard according to the authors?*
a Autogenous bone blocks
b Autologous bone blocks
c Allogenic bone blocks

2. *In the case described, amalgam staining in the keratinized mucosa at which site was observed:*
a Site 24
b Site 25
c Site 26

3. *In the case described, implant placement with simultaneous guided bone regeneration (GBR) could not be performed. True or false?*
a True
b False

4. *Implant placement at position 24 was performed after a healing period of:*
a 2 weeks
b 8 weeks
c 9 months

5. *Which statements are correct: During the prosthetic procedure:*
a The provisional crown was screw-retained onto the implant
b The provisional crown was cement-retained onto the implant
c The temporary crown was cemented onto the bonding base using a self-curing composite cement
d b and c
e. a and c

Article: Management of the MB2. Patel, page 32

6. *By what other term is the MB2 known as?*
a Second canal
b Third canal
c Fourth canal
d Mesio-lingual canal

7. *Which statement is correct: Studies have shown the incidence of MB2 canals is roughly:*
a 60% in maxillary first molars and 60% in maxillary second molars
b 90% in maxillary first molars and 60% in maxillary second molars
c 60% in maxillary first molars and 90% in maxillary second molars

8. *A missed MB2 canal can be the cause of:*
a Ongoing temperature sensitivity
b Residual bacteria
c Neither of the above
d Both of the above

9. *Which statement is correct: Studies have shown that the frequency of MB2 canal detection for dental loupes is:*
a 71.1%
b 62.5%
c 17.2%

10. *For the final preparation of the MB2 canal, what instrument does the author recommend`?*
a Small hand files (size 8-10)
b A slightly less tapered (6%) rotary file
c Neither of the above

Article: COVID-19 risk management in dental practice Part 1: Seven Pandemics and 100 years later – What lessons have we learnt? Hartshorne, van Zyl, page 48

11. Which of the following is not a pandemic?
a Spanish flu
b Asian Flu
c Annual seasonal flu
d Swine flu
e Hong Kong flu

12. Which of the following statements regarding common features of pandemics is TRUE?
a They are all caused by coronavirus
b Transmission is by respiratory droplets
c Symptoms are not similar to seasonal flu
d They do not occur in waves
e Secondary bacterial pneumonia is not a common feature

13. Coronavirus mortality is measured by the basic reproductive number R_0 (TRUE or FALSE?)
a *True*
b *False*

14. Which of the following statements regarding factors most likely contributing to superspreading events is TRUE
a Individuals with low viral load
b Places with good ventilation
c Places where large number of people cluster together
d Individuals with low contact rates

15. To reach heard immunity for COVID-19, likely 70% or more of the population would need to be immune. (TRUE or FALSE?)
a True
b False

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16. COVID-19 originated in:
a Mexico
b Hong Kong
c Wuhan
d Jeddah
e Yunan

17. The incubation period for COVID-19 is:
a 1-2 days
b 2-4 days
c 21 days
d 2-14 days

18. COVID-19 related deaths globally as at 12 June 2020 were approximately:
a 866
b 284,000
c 400,000.
d 1,130,000
e. 4,000,000

19. Which of the following statements fits the COVID-19 disease profile:
a Very contagious
b SLow mortality rate
c More people have severe symptoms
d No asymptomatic spread.

20. Which of the following statements regarding COVID-19 is TRUE:
a Younger age groups are at greater risk
b Highest death rate is amongst 13-34 age
c COVID-19 has the highest mortality rate of all pandemics
d Individuals with medical co-morbidities are at greater risk
e COVID-19 has spread 74 countries

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