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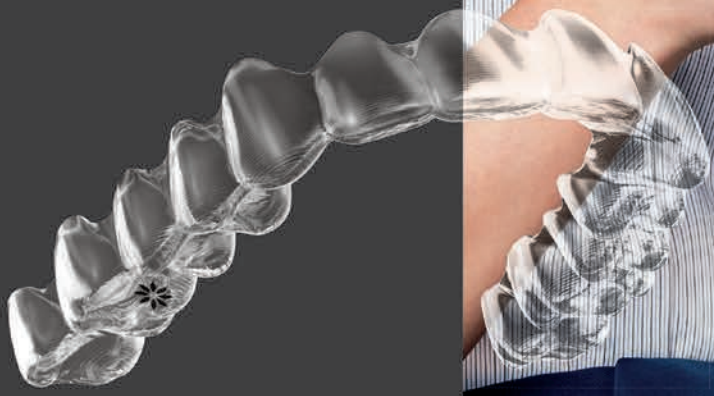

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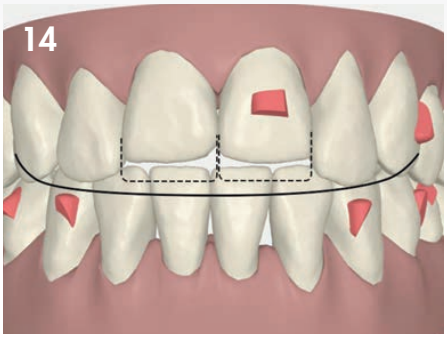

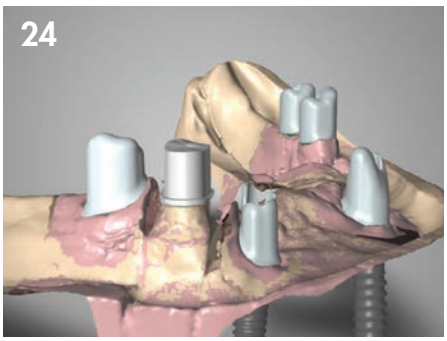

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Henry Schein's 'We Care Global Challenge' hits Australia

On 14th February 2019, the Henry Schein team from Australia and New Zealand for the first time took part in the 'We Care Global Challenge'. This initiative aims to bring colleagues together under the shared mission of benefiting children and communities in need. For the second year in a row, Team Schein Members (TSMs) participated in the We Care Global Challenge, a company-wide initiative in which TSMs at 15 Company locations in four countries assemble comfort kits for people fighting cancer around the world.

Built in partnership with global non-profit organisation, Heart to Heart International, the kits are sent to other non-profit organisations dedicated to the fight against cancer in each location's community. In 2018, more than 17,000 hygiene kits were assembled and sent to people living in international emergency areas.

The winning team each year gets to pick the theme for the year ahead. In 2019 all challenge participants are building comfort patient kits for people currently going through breast cancer treatment.

The local Australasian teams assembled 1500 kits for the McGrath Foundation, whose nurses will hand them out to patients during their home visits. The McGrath Foundation is a breast cancer support and education charity in Australia, which raises money to place McGrath Breast Care Nurses in communities across Australia and to increase breast health awareness.

The Challenge is not only an excellent way for TSM's to come together, it's a way in which they can truly give back to people within their communities.

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The no prep approach: when and how?

Stefan Koubi[1]

When and how

Indications for no-prep protocols are quite strict and may be summarised as follows:

- Post orthodontic treatment needing some small improvement
- Minor smile design corrections (embrasures, diastemas, and so on).

Nowadays, the no-prep concept is popular, but in order to plan correctly the practitioner should have a precise idea of dos and don'ts.

This article hopes to highlight the use of chips in aesthetic treatment.

Tips for this case:

- Basic way of producing the restoration in the lab: press and polish
- Bleaching was undertaken before starting the case to increase aesthetic integration of chips – bonding sequences start with chips first and laminate

Figure 1: Initial situation.

[1] Dr Stefan Koubi, Associate Professor, University of Marseille, France. Private Practice, Marseille, France

Figure 2: Intra-oral view: note the low value of the color, diastema between UR1 and UL1 and narrow shape of UR2.

Figure 3: Occlusal check: incisal edge must be reduced during preparation to allow sufficient thickness for incisal ceramic (1,5 mm).

Figure 4: Analysis of the shape.

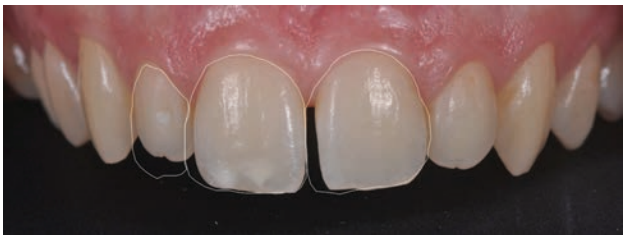

Figure 5: Intra-oral view of upper arch (with flexipalette). Decision process should focus on the design of the augmentation of white tissue.

Figure 6: A mock-up is created with chemical cure composite (Luxatemp Star DMG) to visualize the esthetic project. Of course the final choice must fulfill biological and functional criteria.

Figure 7: Laminate veneering is chosen to enhance tooth 1.2.

Figure 8: After bleaching with 5% carbamide peroxide (White Dental Beauty Optident) slight preparation is performed to follow prep less concept in order to visualize cervical margin. Increasing the color value is key to improving esthetic integration and mimicry of restorations.

Figure 9: A no prep approach was chosen for teeth 1.1 and 2.1.

Figure 10: No prep restorations are made with emaX press and then polished. No stain is required.

Figure 11: Here you can see the opalescence of the material.

Figure 12: Try-in of the 3 restorations with glycerine paste (Vitique veneer B1 DMG).

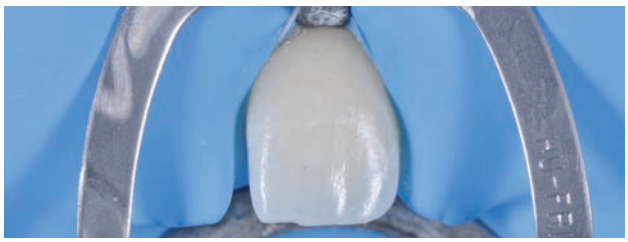

Figure 13: Individual dam (Nictone, 212 Hu-friedy).

Figure 14: Placement of the chip prior to laminate veneer. Margins are polished with silicone wheel on low speed handpiece.

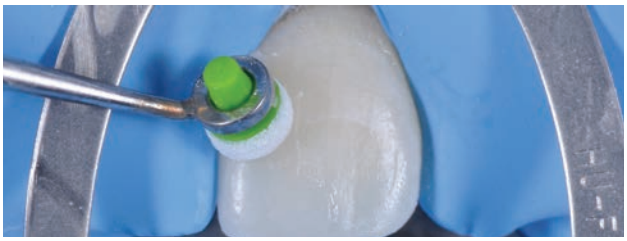

Figure 15: Use of Optrasculpt pad (Ivoclar Vivadent) with a soft pressure on the restoration.

Figure 16: Individual dam for bonding procedure of the laminate after the chip because it is less fragile.

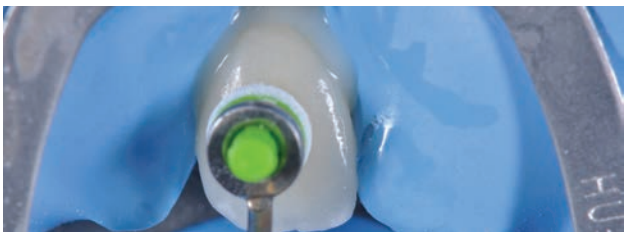

Figure 17: Same procedure for the placement of the laminate veneer on tooth 1.2.

Figure 18: Same procedure for the placement of the laminate veneer on tooth 1.2.

Figure 19: Close-up on the lateral.

Figure 20: Final (ceramist Gerald Ubassy).

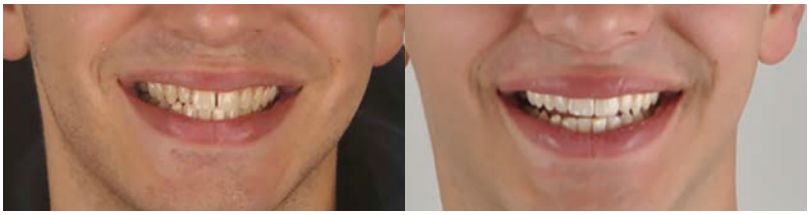

Figure 21: Before and after.

Conclusions

No-prep restorations can be very useful in contemporary treatment planning as they are able to solve some everyday cases. However, it is important to integrate this type of restoration into a basic workflow in which it is simple for both the technician and the dentist to achieve in a feasible and repeatable way.

The role of the dentist as a smile architect is fundamental in order to visualise the ideal pink/black/white ratio for top quality aesthetics and biological preservation.

Non-surgical endodontic retreatment of extensive periapical lesion

Fernando Muñoz Ayón,[1] Jorge Paredes Vieyra,[2] Victor Manuel de la Torre Martínez[3]

Fernando Muñoz Ayón, Jorge Paredes Vieyra and Victor Manuel Delatorre Martínez demonstrate a nonsurgical endodontic retreatment of extensive periapical lesion of endodontic origin with Vitapex

Apical periodontitis and its accompanying periapical bone resorption are an inflammatory disorder of periradicular tissues caused by persistent microbial infection within the root canal system of the affected tooth (Safavi and Nichols, 1993).

Incessant apical periodontitis after root canal treatment often portrays a more complex scenario than primary apical periodontitis (Nair, 2006).

The most common causes for failure in endodontics include: the inability to eradicate bacteria from the root canal system after treatment, reinfection of the root canal by coronal leakage (Haapasalo et al, 2007), extraradicular infection, foreign body reaction and true cysts (Cohen, Hargreaves and Berman, 2011). In such cases where primary endodontic therapy does not succeed, a non-surgical endodontic retreatment approach is the best option.

The main difference between treating primary endodontic disease versus post-treatment disease is the need to regain access to the apical third of the root canal previously treated. Once this is achieved, all of the principles of endodontic therapy apply to the completion of the retreatment case (Cohen, Hargreaves and Berman, 2011), including cleaning, shaping and interappointment dressings. The most widely used intracanal medication to date continues to be calcium hydroxide Ca(OH)2; its antimicrobial mechanism and high pH (12.5) provide an environment where few microorganisms are able to survive. Another drug used with high antibacterial activity is iodoform (CHI3), which has been used successfully as a medicament and filling paste for many years (Pallota et al, 2010). Vitapex is a commercial Ca(OH)2 paste used as root canal dressing in primary and permanent teeth; it also contains CHI3 and inhibits or kills the pathogen in the root canal; furthermore, it can promote bone repairment and regeneration, as shown by Xia and colleagues (2013).

Figure 1: Patient reported pain on mastication but no contact surfaces could be observed. Palatal groove housing bacteria (caries) could be seen with microscope

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[3] Dr Victor Manuel de la Torre Martínez is a professor at the School of Dentistry, Universidad Autónoma de Baja California, Campus Mexicali, Mexicali, Baja California, Mexico.

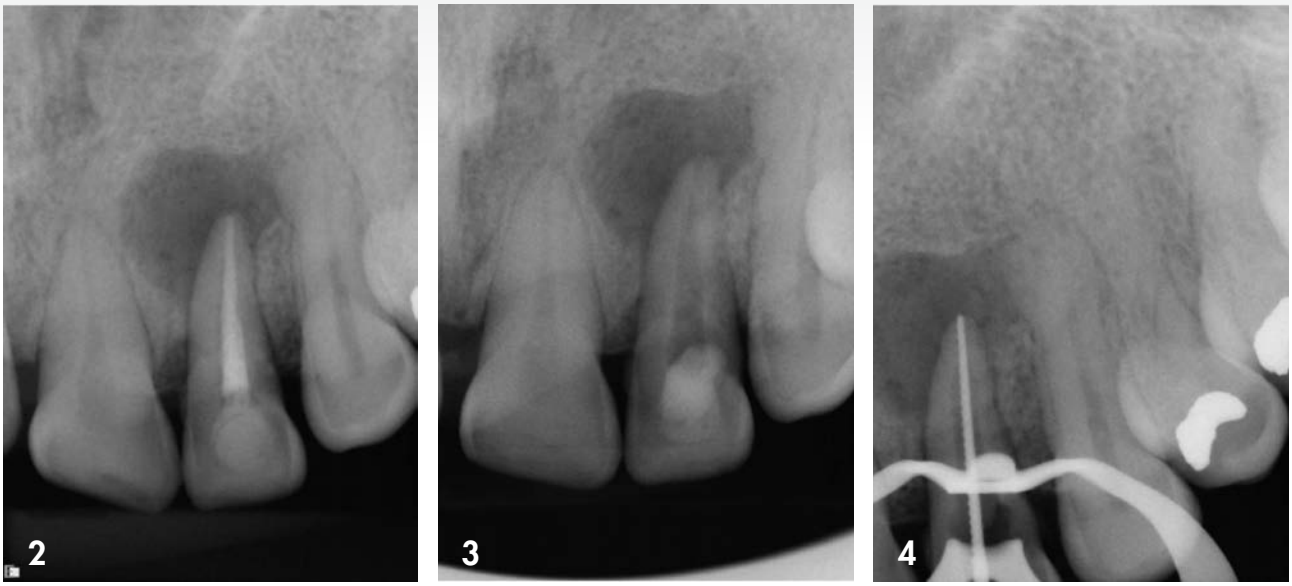

Figure 2: Previously acceptable root canal filling with a persistent large periapical lesion (approximately 10mm in diameter).
Figure 3: Gutta percha filling was removed and calcium hydroxide powder was placed inside the canal to control exudate. The tooth was re-evaluated 10 days later and was asymptomatic.
Figure 4: Working length with Root ZX apex locator.

Although very effective eliminating bacteria inside the canal, removal of these Ca(OH)2 pastes is often difficult. Passive ultrasonic irrigation (PUI) has proven to be effective in Ca(OH)2 removal (63.3%) from the root canal wall due to its cavitation and microstreaming effect on NaOCl compared with syringe delivery. However, whether PUI can effectively remove Ca(OH)2 from the root canal wall is not well known (van der Sluis, Wu and Wesselink, 2007).

During root canal treatment Ca(OH)2 pastes might sometimes unintentionally escape through the apex of the tooth. The deliberate placement of Ca(OH)2 beyond the confines of the root canal in the presence of large and chronic periapical lesions has been advocated. Some speculate that this favours periapical healing and encourages osseous repair. Such deliberate overextension is not, however, widely advocated (Orocoglu and Cobankara, 2008).

Case report

A 42-year-old female patient was referred to our office for treatment of maxillary left lateral incisor tooth. The reason for consultation was completion of root canal therapy, which had been left unfinished two to three years to date.

Upon questioning, the patient reported mild pain with the presence of a sinus three months previously. The patient also reported pain on mastication three days prior to this appointment and clinical examination confirmed the presence of purulent exudate on palpation at the gingival margin, as well as a palatal groove and composite filling on access cavity (Figure 1). The right lateral incisor was slightly sensitive to percussion and palpation. Radiographic evaluation (Schick CDR, Schick Technologies) demonstrated a very acceptable endodontic treatment accompanied with a radiolucent lesion approximately 10mm in diameter around the apex (Figure 2).

Non-surgical retreatment approach was planned and informed consent was given and signed by the patient. Treatment was performed without local anesthesia and with rubber dam in place. The access cavity was prepared with carbide bur #2 (Mani, Inc) and Endo-Z (Dentsply International). Removal of gutta percha was attempted via Protaper Universal Retreatment files. Once inside the canal, a calcium hydroxide paste was found, removed and 2.5% sodium hypochlorite irrigating solution was administered as final rinse. Canal was dried with sterile paper points (Coltène Whaledent Group, Hygienic) and calcium hydroxide powder (Sultan Healthcare Inc) was placed into the canal to control the exudate. The tooth was temporarily restored with intermediate restorative material (IRM Caulk; Dentsply).

Clinical evaluation was performed after 10 days (Figure 3). The tooth was asymptomatic and isolated in the same manner as that described in the previous appointment.

Figure 5: Vitapex was placed as intracanal medication and intentionally extruded past the apex.
Figure 6: After more than a year (17 months) the patient returned with mild pain and a cast post crown restoration on the tooth. Lesion was smaller, showing healing process but still present. Coronal leakage as well as poor sealing of crown was present.
Figure 7: Canal preparation, as well as Vitapex removal, was performed with F4 and F5 Protaper universal files.

Working length was then determined by an electronic apex locator (Root ZX, J Morita) with a #45 K-file (Mani, Inc) (Figure 4).

During this appointment 2.5% NaOCl was administered; the canal was then dried in the same manner as previous appointment and Vitapex (Neo Dental Inc) was placed as intracanal dressing and intentionally placed in the periradicular area through the apex (Figure 5). A cotton pellet was placed in the pulp chamber and the tooth was temporarily restored with intermediate restorative material (IRM Caulk; Dentsply).

The patient lost all contact with our practice and returned 17 months later with mild pain and a cast post and metal porcelain crown in the unfinished root canal treatment. After removal of cast post and crown the canal preparation was accomplished with F4 and F5 Protaper Universal files (Figures 6-7). Canals were obturated by means of the lateral condensation technique and Sealapex sealer. After one month (Figure 8) the patient was asymptomatic and mild healing of the perirapical lesion was observed, even though no permanent crown had been placed.

The patient lost contact once again but one year later returned, asymptomatic, and the tooth and periapical tissues appeared to be healing correctly with total repair and proper function of the tooth (Figure 9).

Discussion

From a microbial perspective, after pulp necrosis, infection of the root canal system occurs. Microorganisms then inhabit the oral cavity like bacteria and fungi invoke a protective inflammatory response in the periradicular tissues.

However, when host defense systems cannot enter the necrotic root canal and eliminate the invading microbes, the inflammatory process results in the formation of abscesses, granulomas and/or periapical cysts, as shown by Love and Firth (2009) and Soares and colleagues (2008).

Such lesions can only be detected radiographically when alveolar bone loss has been accompanied by cortical bone involvement during lesion development (Soares et al, 2008; Arslan et al, 2012). The mean diameter of apical lesions range from 5-8mm: lesions of 10mm or more are considered granulomas or apical cysts (Soares et al, 2008; Soares et al, 2006). Even though the incidence of radicular cysts is approximately 15% of all periapical lesions, healing of all apical periodontitis ranges from 80–95% after root canal treatment, which alone suggest that cysts may heal without surgery (Love and Firth, 2009; Soares et al, 2008; Arslan et al, 2012; Soares et al, 2006). Therefore, management of large periapical lesions by nonsurgical procedures should always be considered.

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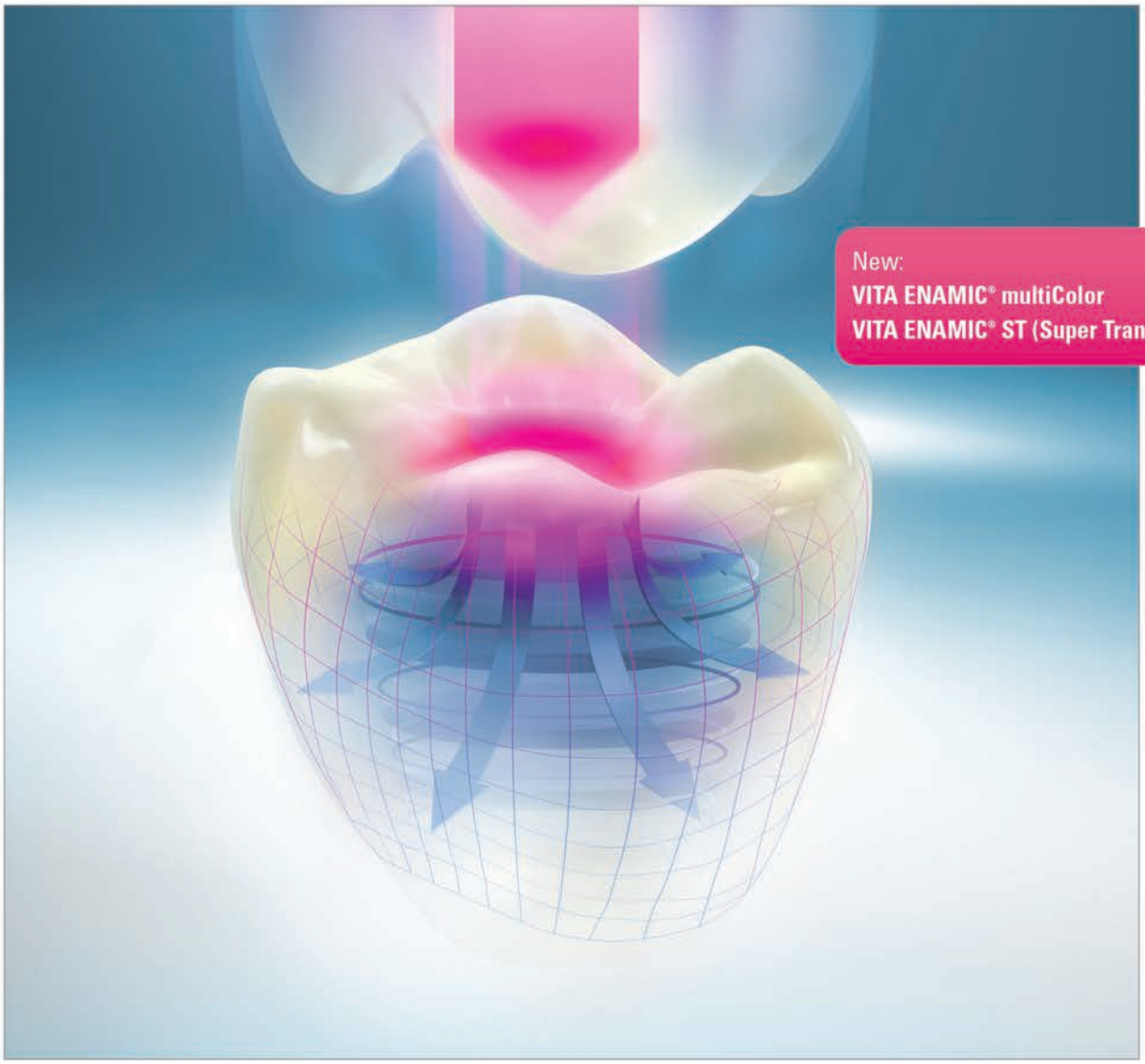

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Figure 8: One month after finishing treatment the lesion appears to have mild repair even though no permanent crown has been placed on the tooth.
Figure 9: One year after finishing treatment the lesion appears to be healing correctly with total integration and proper function of the dental structures.

(for example, possible damage to adjacent vital teeth and anatomic structures in the vicinity, pain and discomfort) its use is limited in the management of periapical lesions, as shown by Thomas, Dhanapal and Simon (2012). However, non-surgical endodontic treatment focuses on the removal of all bacteria and their by-products from the root canal system (Tavares et al, 2012; Torabinejad et al, 2005); adherence to these treatment objectives should result in maintaining normal radiographic and clinical conditions in teeth with and without preoperative periradicular lesions (Torabinejad et al, 2005). Based on available studies that offer the best evidence, it appears 92-98% of teeth without periapical lesions remain free of disease after root canal therapy and 74-86% of teeth with apical lesions completely heal after initial treatment or retreatment. In addition, similar data shows that 91-97% of teeth that have had root canal treatment remain functional over time (Torabinejad et al, 2005). Still, in some cases, a bone lesion takes a considerable time to heal, which means that conclusions about outcome are sometimes uncertain. Apical periodontitis may also heal with fibrous tissue rather than bone. Such scar tissue healing is usually thought to have a typical radiographic appearance and is mostly seen after endodontic surgical procedures (Peterson et al, 2012).

Broon and colleagues showed that the inability to achieve infection control after root canal treatment can result in a chronic inflammatory process (2007). For such cases, the use of intracanal medication is widely advocated. Various studies found that the use of Ca(OH)2 dressing for one to four weeks efficiently removed bacteria from the root canals (Estrela et al, 2001; Zmener, Pameijer and Banegas, 2007; Han, Park and Yoon, 2001).

Although the use of these Ca(OH)2 pastes is highly effective, its removal from the root canal is often a difficult task. Removal of pastes like Vitapex is often done by instrumentation of the root canal with the master apical file combined with abundant irrigation of both NaOCl and EDTA.

In a recent study, passive ultrasonic irrigation (PUI) proves to be effective in Ca(OH)2 removal (63.3%) from the root canal wall due to its cavitation and microstreaming effect on NaOCl compared with syringe delivery (van der Sluis, Wu and Wesselink, 2007). In the present case, the extrusion of Vitapex through the apex possible delayed the apical healing, but did not prevent it. Our case results agree with findings by Arslan, Broon, Soares, Thomas, van der Sluis and Xia (2012; 2007; 2006; 2012; 2007; 2013), as the large periapical lesion was retreated without surgical intervention, the intentional extrusion of Vitapex promoted the periapical healing and PUI served as an excellent

Ca(OH)2 paste (Vitapex) remover from the root canal as well as the diffusion of NaOCl into the dentinal tubules.

Conclusion

When endodontic therapy cannot eliminate bacteria from the canal and large periapical lesions develop on previously treated teeth, non-surgical root canal retreatment should always be considered before a surgical approach. In the present case, a non-surgical approach in combination with calcium hydroxide/iodoform paste as an intracanal medicament contributed effectively in limited healing of periapical lesion at one month and nearly fully repaired at one year. This confirms that large periapical lesions can respond positively to non-surgical retreatment.

Acknowledgement

The authors deny any conflicts of interest related to this study.

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Stratified layering of composite restorations after the use of orthodontic aligners

Linda Greenwall[1] and Robert Katz[2]

There is a trend towards minimally invasive aesthetic dentistry and ensuring that no healthy enamel is cut in the preparation of an enhanced smile.

This case illustrates the use of orthodontic aligners, whitening treatment in the aligners, and composite bonding using a stratified layering technique and the placement of glass ionomer restorations on the cervical erosion areas.

The use of aligners in orthodontics

The use of removable aligners has increased greatly over the last 18 years. In 1999, Align Technology addressed the demand for an aesthetic alternative to braces by developing an 'invisible' method of orthodontic treatment (Invisalign) that uses a series of computer-generated, clear, removable aligners to move the dentition (Kunicio et al, 2007). Align Technology reports that, since then, more than four million Invisalign cases have been undertaken worldwide.

Aligner popularity has increased in adult patients who do not want to wear fixed braces, as they find them more difficult to tolerate, due to their effect and impact on daily life (Bernabe et al, 2008). The simple idea that a clear aligner can be used to align and reposition teeth is appealing to adult patients.

Patients can remove the aligners for eating, brushing, flossing and important meetings, but can wear the aligners for most of the day (Joffe, 2003).

The aligners are usually comfortable and offer ease of use. They are made of polyurethane and are normally 0.75mm thick. Patients are asked to wear the aligners for two weeks and then change to the next number in the sequence of aligners.

Patient assessment

The orthodontist will normally undertake a full assessment of a new patient. Treatment options are enumerated and discussed.

While fixed orthodontic braces may move the teeth more predictably and quickly, many patients do not want to wear braces. They want the effects of the treatment without having fixed braces. It is often the preference of orthodontists to undertake fixed appliance therapy because it can be more predictable and, in some cases, the teeth can move quicker. However, patients are given all the treatment options to align their teeth and many choose to have clear aligners. There are now several aligner brands on the market that the orthodontist can choose.

A recent systematic review of Invisalign research by Lagravere and Flores-Mir (2005) found that no strong conclusions could be made regarding the treatment effects of Invisalign appliances. It is the personal selection of the orthodontist and their patient.

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[2] Dr Robert Katz, Specialist - Orthodontics, London UK

Figure 1: Retracted smile before treatment commenced. The patient was unhappy with the overlapping of the anterior teeth and wanted the teeth to be whiter.

Figure 2: The results after Invisalign, whitening and restorative bondings.

Figure 3: Patient commenced upper and lower Invisalign treatment with orthodontist Dr Katz to improve the positioning of the teeth.

Figure 4: While wearing the Invisalign aligners, the patient bleached with 10% carbmide peroxide to improve the shade of her teeth. This photo illustrates the whitening gel has started to work and starts on the incisal edges first and moved up to the neck of the tooth.

The computerised Clincheck

With Invisalign treatment, the number of aligners needed is assessed with a computer scan called Clincheck (Align Technology).

Each aligner is programmed to produce a precise movement on a tooth of about 0.15- 0.25mm (Vlaskalic et al, 2001).

The stereolithographic technology is used to fabricate custom aligners from an impression or an intraoral digital image scanned in the dental practice.

Patient compliance is mandatory to achieve good results with Invisalign. It is important for patients to wear their aligners for 22 hours a day or more (Malik et al, 2013).

Once the Clincheck is undertaken, the number of aligners needed is calculated and the position and location of the attachments determined. The attachments are fabricated from clear composite resin and are transferred onto the teeth with an attachment template. The attachments are removed at the end of treatment. Where interproximal enamel reduction (IPR) is necessary, this is calculated in the Clincheck.

Studies have been undertaken to assess the accuracy of the computerised Clincheck assessment. In a study by Houle et al (2017), the mean accuracy of posterior expansion planned with Invisalign for the maxilla was 72.8% and 87.7% in the mandible.

There are limited data on the amount of discrepancy between predicted and actual achieved movements with Invisalign (Krieger et al, 2012). In a prospective clinical study by Kravitz et al (2009), the mean accuracy of tooth movement in the anterior region was found to be 41% with Invisalign.

An internal study from Align Technology found that one should expect about 80% of tooth movement seen on Clincheck (Tuncay and Orhan, 2006).

A multidisciplinary case – which treatment first?

This case involved multidisciplinary treatment including orthodontic treatment, restorative treatment and aesthetic

Figure 5: Study models used to make the retainer after Invisalign treatment was completed. The aligner had to be fitted immediately after treatment started and before undertaking the restorative bonding to lengthen the upper right anterior. The technician made a stent so we knew how much length we needed to add.

Figure 6: SDI Aura is applied onto the tooth to check the shade of the composite against the tooth after whitening. A test composite is placed onto the tooth at the very beginning of the bonding procedure prior to isolation so that the correct shade of composite is selected before the tooth dehydrates to a lighter shade. The translucent enamel shades are tested first. Here Aura E1 and E2 are being tested onto the transluscent incisal tip.

Figure 7: SDI Aura is built-up in layers to look like natural enamel, starting with the placement of the enamel layer on the incisal and palatal edge. Lobes are created to give the effect of the mamelons and the transluscency at the tip. The lobes also help to determine the secondary anatomy and correct form and shape. The composite is always over built and the restoration reshaped and polished afterwards.

Figure 8: The results after Invisalign, whitening and restorative bondings with SDI Aura on the upper right and left centrals. The composite is shaped and polished with discs, rubber wheels and then final polish with felt wheels and SDI polishing paste for the enamel lustre. As the Aura has the enamel as a microfill it can be polished to a high gloss afterwards. The dentine layer is a nanohybrid.

home whitening treatment (Figures 1 and 2).

Invisalign treatment was commenced first (Figure 3). After the teeth had moved significantly, when the central incisors had straightened and towards the end of treatment, tooth whitening was undertaken in the upper and lower aligners (Figure 4).

Once whitening was satisfactorily completed, new retainers were made from new study casts (Figure 5). Composite bonding was undertaken (Figures 6-8) to repair the worn and shorter incisal edges of the upper central incisors. This was followed by glass ionomer treatment placed in the lower cervical areas to reduce sensitivity.

Normally, class V glass ionomer restorations are placed first prior to commencing any treatment as this helps to reduce sensitivity during whitening and also reduce sensitivity of the orthodontic tray rubbing against the cervical area of the tooth. However, it was decided that the erosion of the cervical areas was not an area of concern and so Invisalign 'Each aligner is programmed to produce a precise movement on a tooth of about 0.15-0.25mm' treatment was started first.

Whitening treatment was next followed by composite bonding and class V restorations. The cervical areas of the lower premolars became extremely sensitive during whitening, so after whitening and waiting for the bond strength to improve, the areas were restored with a light-cured glass ionomer restoration.

Orthodontic treatment

In this case, the patient's main concerns where the uneven smile and the shortened upper central incisor teeth.

The characteristics of the malocclusion were as follows:

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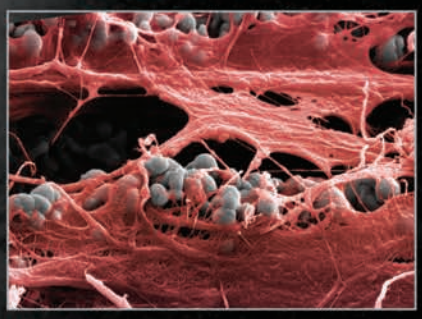
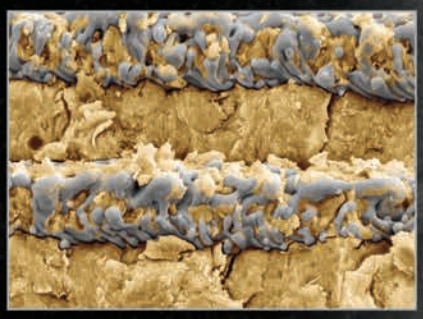


Colorized SEM shows connective tissue physically attached to the Laser-Lok surface.[1]



Colorized SEM of Laser-Lok® microchannels shows superior osseointegration[3]

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1. Human Histologic Evidence of a Connective Tissue Attachment to a Dental Implant. M Nevins, ML Nevins, M Camelo, JL Boyesen, DM Kim. International Journal of Periodontics & Restorative Dentistry. Vol. 28, No. 2, 2008. 2. Histologic evidence of a connective tissue attachment to laser microgrooved abutments: a canine study. M Nevins, DDS, DM Kim, DDS, DMSc, SH Jun, DDS, MS, K Guze, DMD, P Schupbach, PhD, ML Nevins, DMD, MMSc. Accepted for publication: IJPRD, Vol 30, No. 3, 2010. 3. Maintaining inter-implant crestal bone height via a combined platform-switched, Laser-Lok® mplant/abutment system: A proof-of-principle canine study. M Nevins, ML Nevins, L Gobbato, HJ Lee, CW Wang, DM Kim. Int J Periodontics Restorative Dent Volume 33, Number 3, 2013.
SPMP17297 REV A OCT 2017

- Class I molar and canine occlusion
- 5mm overjet
- Proclination of the upper and lower incisor teeth
- Mild lower anterior crowding
- Upper incisor irregularity.

After a new patient consultation and a treatment planning discussion where all the options were discussed with the patient, she elected to have an orthodontic assessment to explore the options to move and align the teeth.

She was presented with two options, that of fixed braces or aligning treatment.

She requested that aligning treatment was undertaken. PVS impressions were sent to Align Technology for conversion into 3D study models using the company's software.

The Clincheck Pro software was used to modify the initial set-up (Figures 10 and 11). When finalised, 20 upper and lower aligners were prescribed, giving a treatment duration of about 10 months (Figures 12 and 13). IPR, totalling 1.2mm in the lower arch and 2.4mm in the upper arch, was prescribed. IPR was necessary to make space to correct the crowding the decrease the incisor protrusion.

Treatment proceeded as expected with no complications, or need for refinement. The patient was compliant and wore the aligners 22 hours per day.

When treatment was finished and the restorative treatment completed, fixed retainers were bonded upper (palatal) and lower (lingual) on the incisors and canines.

The retention phase

Normally, the final aligner acts as the retainer in most cases of Invisalign treatment.

Despite extensive research, the various elements leading to relapse of treated malocclusions are not completely understood, which makes retention one of the most challenging aspects of orthodontic treatment (Kuncio et al, 2007).

However, in this case, immediately after composite bonding, the upper retainer was cut in the incisal area to allow for the increased incisal length. New impressions were taken after completion of the restorative treatment and new retainers were made to ensure that the occlusion was well maintained. It is essential to stress that patients should wear their Invisalign retainers as prescribed by the orthodontist to ensure stability of the occlusion and correct alignment of the teeth.

In a comparative study of the retention of fixed braces versus Invisalign retainers, Kuncio et al (2007) found that, in many cases, aligner treatment can relapse more than fixed braces, and so patients are instructed to continue to wear their retainers for maintenance treatment.

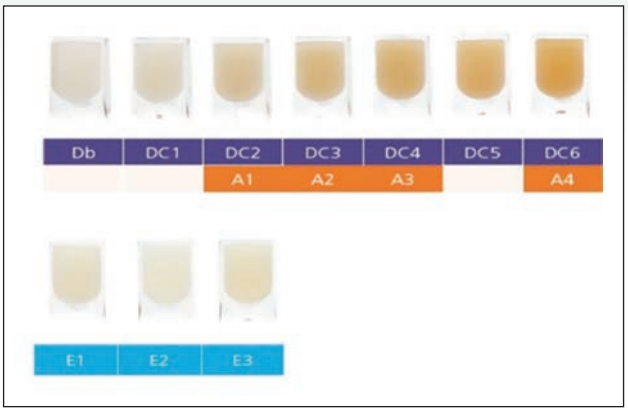

Figure 9: Shades of Aura composite.

However, the total number of patients in each group was 22, which is a very small number and further research is necessary.

Whitening in Invisalign aligners

Using the Invisalign aligners as whitening trays has become a viable treatment option for patients.

The recommendation is to wait for a month after the first aligners are placed and after the initial discomfort has settled down. The patient applies the whitening gel directly into the aligners.

A similar Van Haywood protocol can be adopted, namely to whiten the upper teeth first followed by the lower teeth.

The upper teeth whiten quicker and have fewer side effects and so the first stage of whitening is relatively simple. The lower whitening normally takes longer. It is thought that this is due to the wash-out effect of the salivary glands.

Due to the rigid nature of the aligner, it seems that whitening may occur quicker than a normal bleaching tray, but this has not been studied significantly.

Most aligners do not reach over the gingivae, so the gingivae may be less irritated during whitening.

There is no effect of whitening around the orthodontic attachments, and the whitening occurs in a multidirectional way and can whitening around the attachments.

Whitening and composite bonding

It is essential after completion of home whitening treatment to wait for a period of two weeks to allow all the oxygen to be dissipated from the tooth and for the shade to settle to the actual shade.

After tooth whitening, there is maximum saturation of

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References: 1. Prasad & Mateo, July 2016, internal report. 2. Garcia-Godoy F, et al. J Clin Dent, submitted August 2018.

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Figure 10: Initial centre view using Clincheck software.

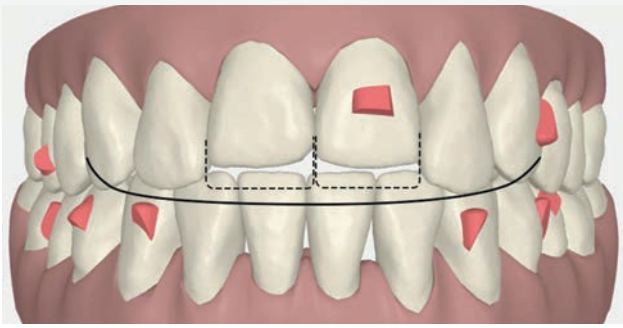


Figure 11: Final centre view.

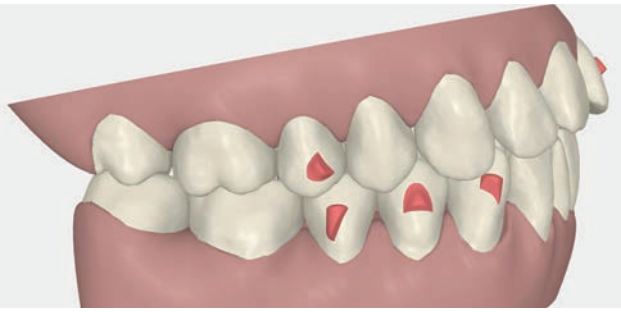


Figure 12: Initial right buccal view.

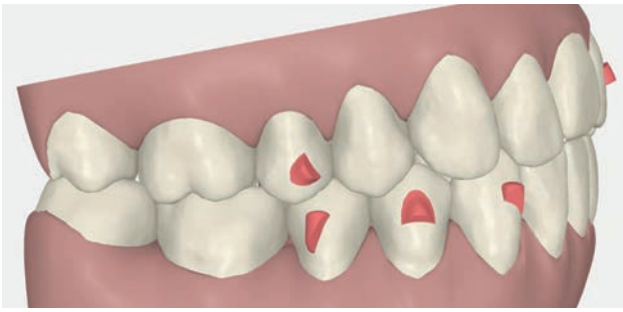


Figure 13: Final right buccal view.

oxygen inside the enamel. This causes a reduction in bond strength of 20%. It is thus essential to wait for two weeks for the enamel bond strength to recover back to the normal levels prior to commencing direct bonding onto the surface of the tooth.

Stratified layering technique

With the introduction of multiple component composite systems, it is now possible to create beautiful natural restorations using multiple layers of composite using their different optical and material properties. The Aura composite system is ideal as it contains both enamel and dentine shades (Figure 9).

The enamel shades are a microfill composite, which give the properties of a glass-like appearance of natural enamel (Figure 5). The dentine shades are a nanohybrid material (Figure 6), which gives extra strength for occlusal build-ups and they can be used as a bulk-fill material. There are separate bulk-fill syringes available for this purpose.

Shade selection of composite resin

According to Vanini (1996), it is essential to undertake a detailed evaluation of hue, chroma, opalescence, and fluorescence of the tooth in order to simplify the composite stratification technique.

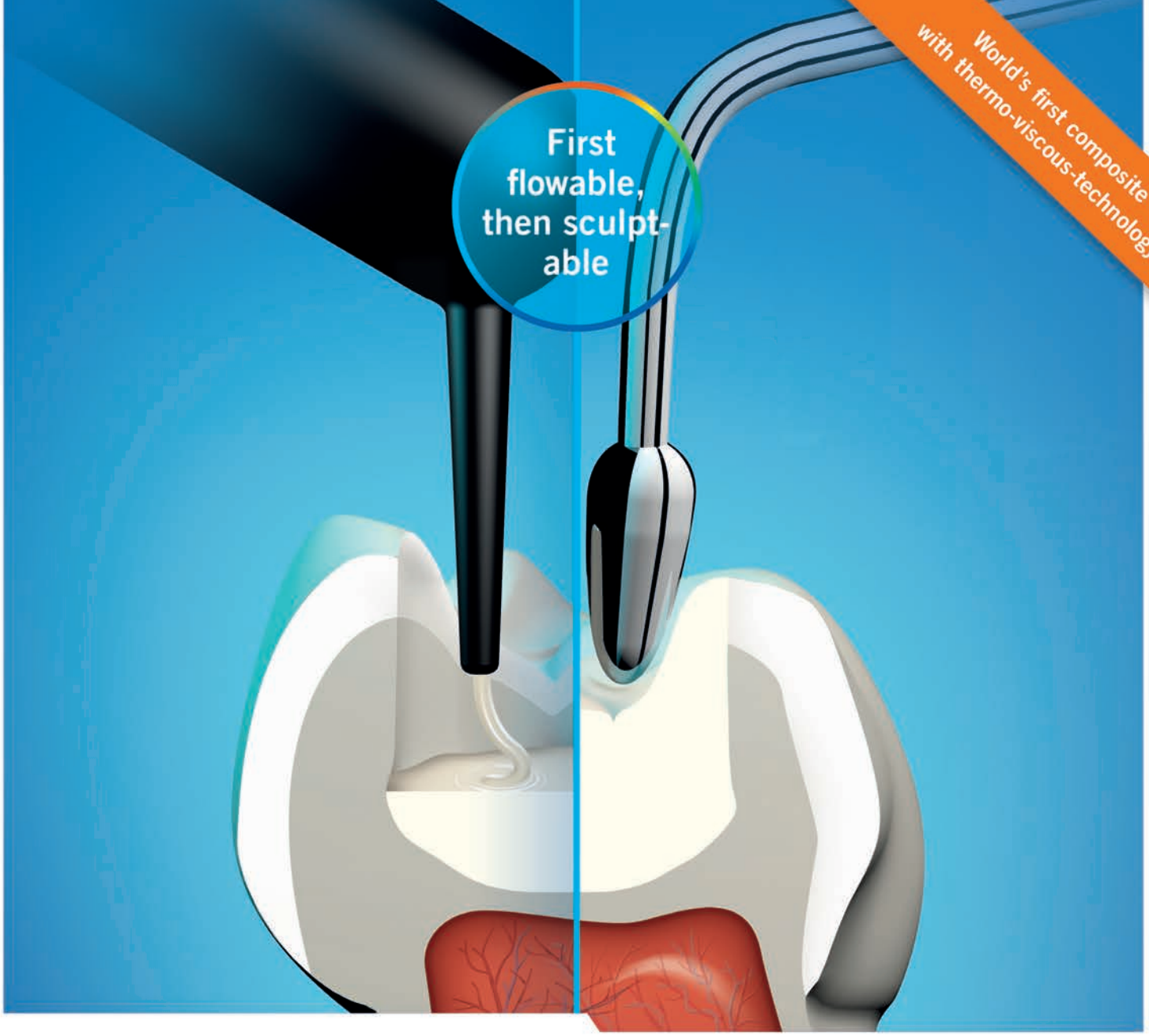
This is done early in the clinical procedure to ensure that there is no dehydration of the tooth when the tooth is fully isolated (Figure 5).

Once the tooth is fully isolated, it dehydrates and lightens and this can result in the selection of a shade that is too light. Blends of composite colours are normally used and, after selection of the transluscent enamel shade (Dietchi, 2008), the dentine shade is used (Figure 6).

The hue is given by the dentine. The hue remains the same, although the greater thickness of the enamel interferes in its perception, giving it a less saturated aspect. Therefore, the hue of the tooth is given by the dentine and influenced by the enamel. The enamel does not change the hue, but only confers a greater or lesser saturation or chroma according to its thickness (Franco et al, 2007).

This is applied from darkest to lightest to give the restoration a lifelike appearance. Different translucencies may be selected for the mesial corners as, often, these are more translucent than the distal corners (Figure 7).

Used with an understanding of tooth morphology, restorative material selection, colour options, and the physical properties of light, these layering techniques allow optimally aesthetic restorations to be predictably achieved (Terry, 2003).



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Applying the composite resin

A test run is undertaken first using a variety of composite shades. A clinical photograph is taken after the first test to review how the shades appear on a digital photograph. A polarised light photograph can also be taken to understand the nuances of the existing anatomy of the tooth, which needs to be copied.

As the teeth have been bleached, the bleaching composite shades can be used. In Aura composite, the DB shade blends very well to the bleached enamel (Figure 8). The enamel shades are tested first and light-cured followed by the dentine shades.

Placing the layers

Normally, the tooth is built-up from the palatal part first. A clear matrix is adapted to help form the shape of the missing incisal edge.

A wax-up can be used and a silicone stent can be made for ease of placement and for patient and dentist visualisation of the final outcome. The clear matrix is curved and rolled in the operator's gloved hand to form a curve. This is placed on the missing incisal edge and bonded into place using a dentine bonding agent. This helps to keep the hands free so that the layering of the composite can commence.

The layers are placed into the area with a flat plastic tool and then sculpted into place and refined with a fine haired brush dipped into bonding liquid or a rubber sculpting instrument.

The tooth is built-up in layers and light-cured (Figures 6 and 7). Each layer is checked after placement and modifications made as the restoration takes shape. Once the layering is completed, the final form is created with finishing instruments.

Sof-lex polishing discs (3M Espe) are used first to remove any bulk excess and then fine flame finishing burs are used.

After the form is completed, the patient is asked to sit up so that the incisal edges can be checked from the front of the patient. When the dentist is in a working position behind the patient, there is tendency to build the incisal edge restorations too long. This final length of the incisal edge is checked when the patient is supine in the chair.

The occlusion is checked and the final polishing can commence with the use of rubber wheels and a felt tip rubber wheel and polishing paste. The final glossy layer is created with a special rotary rubber wheel and polishing paste.

Conclusion

A multidisciplinary case such as this requires essential communication between the specialists undertaking the treatment, and also between the dentist and the patient, so that the patient is fully aware of the risks and the benefits of the different treatment procedures, and what is involved in each treatment so that an ideal outcome can be achieved.

The patient also needs to be fully aware of the retention phase needed to maintain the teeth in the same position, and to maintain a beautiful smile and when further whitening may be needed. In addition, any repairs to composite need to be detailed and occlusal checks need to be made regularly to maintain a beautiful smile. From time to time, during recall appointments, further polishing of the composite may be required, including retention recall evaluations.

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Prosthodontic solutions for elderly patients

Ramona Buser,[1] Qin Yue,[2] Patrick Zimmermann,[3] Valerie G. A. Suter,[4] Samir Abou-Ayash,[5] Martin Schimmel[6]

Abstract

With the so-called "baby boomer" generation reaching retirement, a new challenge in implant dentistry has emerged. Predominantly, tooth loss occurs later in life, accompanied by increased demand for partial dental prostheses. Edentulous patients are more difficult to treat due to advanced age, functional dependence, illness, and financial instability. Prosthetic planning becomes more complex as interindividual diversity increases with age. Considerations such as resilience, physical and mental status, medical history, and drug prescriptions must be individually assessed. Treatment planning and restoration design should fulfill both functional requirements and esthetic demands. Prosthesis design should prevent further harm to the patient. This tertiary prevention approach should prevent local inflammation of the oral tissues, but also prevent secondary systemic infections, such as aspiration pneumonia. There are many prosthetic options for partially or fully edentulous patients. Dental technicians should be aware of the advantages and disadvantages of the various treatment concepts and materials, and contribute professional knowledge to the patient, dentist, and often thirdparty milling centers. Using CAD/CAM technology, customized attachments and prostheses can be individualized according to each patient's requirements. Utilizing a combination of manual and digital production techniques, oral reconstructions can be rationally manufactured. The duration of implant osseointegration remains unknown, but reports of up to 30 years' follow-up are emerging. Hence, the environment of the implant – the patient – will change significantly, and implant restorations should be flexibly designed to meet the changing needs of an aging patient. This "back-off strategy" should be implemented, and prostheses should be continuously subjected to critical reevaluations and adaptation.

Keywords: Gerodontology, prostheses, edentulous, dental laboratory work

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Introduction

The main focus of this article lies on elderly, partially dentate and edentulous patients with implant-supported or implant-retained reconstructions. Individual patient needs and how they are met are discussed, as are fabrication technologies, questions regarding choice of material, and the conceptual collaboration between the dentist and the dental technician. Ultimately, this article makes a case for modern reconstructive dentistry that offers a sophisticated treatment concept adapted to the needs of each patient. It intends to raise awareness of the variety and versatility of the available approaches.

At what age is an individual considered elderly or old? There is no hard and fast rule, as this question has a philosophical component in which medical, social, and psychological factors play a role (Bürger 1960; Rowe et al. 1997). The natural process of aging is progressive and irreversible, and pathological changes may influence and accelerate the process.

The far-reaching consequences of the aging process are also felt in the field of dentistry. Physiological and pathological changes can affect teeth, nerves, muscles, and hard and soft tissues. Aging can thus influence the ability to chew, swallow, and interact as well as esthetics (Müller et al. 2016a). Poor chewing efficiency and/or pain related to teeth or dentures affect food intake, which may have consequences for general health (Schimmel et al. 2015). Missing teeth or poorly fitting dentures can

have a negative effect on social interactions and self-esteem (Stenman et al. 2012). Dental care is an indispensable aspect of maintaining quality of life in old age.

Oral hygiene to maintain oral and general health is the primary goal in care for elderly patients. Well-designed and well-fitting prosthetic reconstructions of missing teeth are further important factors to restore function, esthetics, and quality of life. Whereas in former decades, prosthetic treatment for elderly patients meant in most cases full denture prosthodontics, the picture has changed in recent years. An increasing number of individuals retain their natural dentition until late in life, and the relative number of edentulous patients is decreasing at a high rate (Jordan et al. 2016; Schneider et al. 2017; Slade et al. 2014). However, the total number of elderly patients is increasing dramatically due to demographic changes; hence, edentulism is not likely to be eliminated in the near future. In the United States alone, it is estimated that 10 % of the total adult population is edentulous, i.e. 32–35 million edentulous patients (Slade et al. 2014).

"Soft" factors when dealing with patients

Each member of the reconstructive team must naturally be familiar with the basics of partial and full denture prosthetics, static and dynamic load and occlusion, as well as phonetics. Equally important are the "soft" factors when dealing with patients that make personal contact with the patient advisable, if not indispensable. Here, it is worth considering some characteristics of the age group. Among these are possible difficulties associated with the loss of a partner, physical or psychological illness, use of medication, eating habits, or a change in the ability to adapt and react. Dealing with (older) patients demands empathy and understanding for their situation. Dentists and dental technicians should, therefore, periodically update their awareness of the basic tasks carried out by natural teeth, and the oro-facial system in general (Chen et al. 2012). Tooth loss leads to anatomical and morphological changes with which many patients have difficulty coping. Quality of life is restored only when patients are in possession of a functional prosthesis tailored to their individual needs.

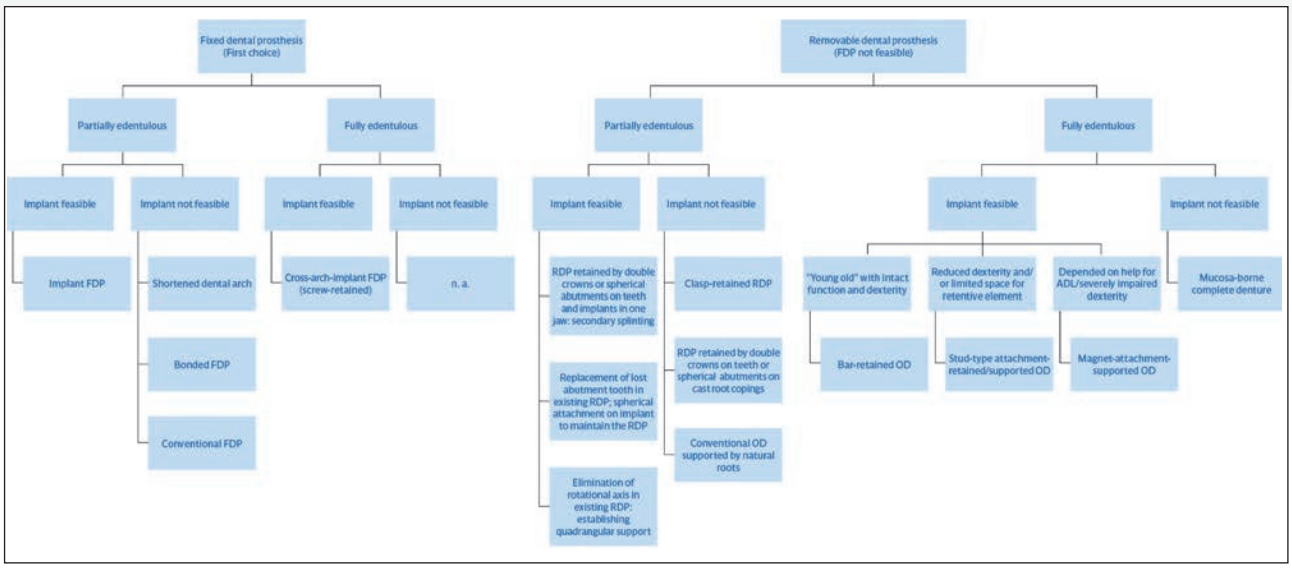
Meeting high expectations

The expectations of young-old patients, the so-called baby boomers now reaching retirement age, has increased with respect to the quality, function, and esthetics of their prosthetic restorations. We are currently observing the transition from one generation of older patients – the postwar generation – to the next – the baby boomers (Schimmel et al. 2017a). The

Figure 1: Not only younger but also many older people have no desire to be seen wearing clearly identifiable dentures – the demand is for a prosthesis that mimics natural dentition, as shown here with overdentures in both jaws.

latter are accustomed to a high level of service from dentists and dental technicians that they do not intend to forego as they grow older. Many older people are looking for an esthetic restoration that looks perfectly natural (Fig. 1). As a result, a stronger focus on implant prosthetics is developing in the rehabilitation of elderly patients. Implant therapy renders various therapy options possible to edentulous patients – from simple and functional to functionally and esthetically high-end solutions. In order to provide this kind of restoration, dental technicians need detailed knowledge of the positioning of prosthetic teeth, materials, and function as well as of the abovementioned soft factors. They must also understand how these individual aspects interact, and appraise the significance of the restoration to the patient.

Regrettably, the manufacture of removable partial and full dental prostheses is frequently given little attention by the dental laboratory. What is achieved to perfection by dental technicians in other areas such as fixed restorations, should also be a matter of course for removable prostheses. This is where priorities need to be set in an age cohort in which up to 50 % wear removable dental prostheses (RDP) (Schneider et al. 2017). Highly qualified dental technicians are needed within the treatment team that looks after partially dentate and edentulous patients in order to assist in finding the single optimal choice from the variety of restoration options available. As both the complexity of reconstructive work and average patient age continue to increase, one person needs to take the lead and maintain an overview of the entire process. This influences communications between the dentist, patient, and dental technician in which digital channels of communications are playing an increasingly greater role.



Flow chart to illustrate prosthodontic treatment options for the elderly patient. The most important decision is whether to plan a fixed (FDP) or a removable dental prosthesis (RDP); RDPs should only be planned if the restoration with FDPs is contraindicated, e.g. when the patient is no longer as resilient to extensive dental treatment, cannot maintain correct oral hygiene or the dental/general prognosis is doubtful. Overdentures (OD) retained or supported by natural teeth provide better tactile sensitivity than implant-supported ODs, but abutment teeth may develop caries or periodontal problems

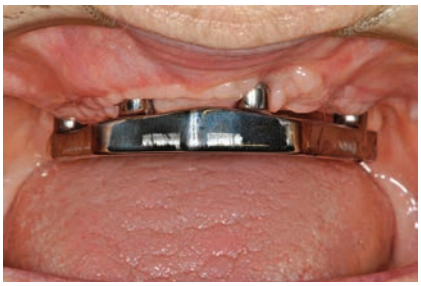


Figure 2a-c: Depending on the indication, a removable implant-supported, bar-retained prosthesis is recommended for edentulous patients. It can be cleaned more easily than fixed full arch prostheses, but is still extremely stable. Labwork mundwerk dental (Bern).

Figure 3: Where abutment teeth are available, the clasp-retained denture represents a cost-efficient option.

Selecting the restoration concept
Implant-supported restorations

Implant therapy is a thoroughly investigated approach for restoring partially dentate and edentulous patients. Treatment planning is managed by a team of professionals.Age-related factors, such as multimorbidity, manual dexterity and potential limitations thereof, as well as reduced adaptability are included as part of the process. It should be considered that the restoration may need to be modified at a later date to account for diminished strength and dexterity of the hands and/or other co-morbidities, including cognitive

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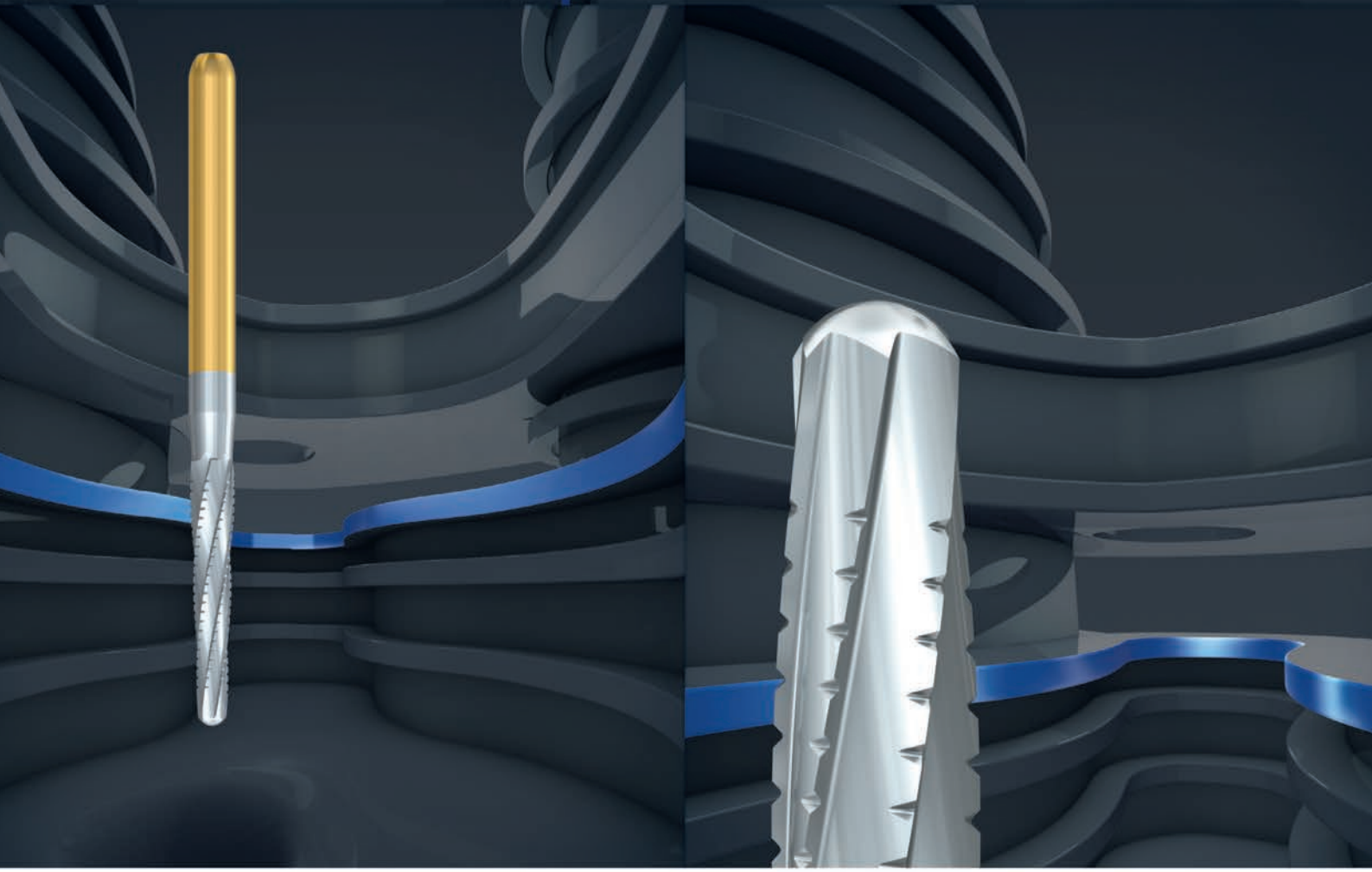

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Figure 4: Clasp-retained restorations often fulfill esthetic requirements, even in the anterior mandible. The amount of metal should be kept to an absolute minimum; two clasps normally suffice.

Figure 5: The distribution of abutment teeth in the lower jaw at the front and side allows for clasp-retained prostheses.

Figure 6: Design and retentive force of an implant overdenture should be adapted to the patient's individual capacity. Therefore, the dental team should increasingly pay attention to "non-dental" planning factors.

impairment. With increasing multimorbidity, it should be possible to revert to a prosthesis that is easier to handle in order to facilitate hygiene care for nursing staff if necessary (Müller et al. 2013). In addition, the individual needs of the patient, as well as general health and financial means must be considered during treatment planning. Ultimately, subjective factors and individual adaptability are key to the success or failure of prosthetic therapy.

The initial decision is whether to opt for a fixed or removable solution (see flow chart). In addition to oral comfort, hygiene plays a role here. As long as a few basic principles are followed, an implant-retained removable prosthesis facilitates oral hygiene (Figs 2a–c). If a fixed solution is selected, it must be designed with accessibility for oral hygiene.

Clasp-retained dentures

In addition to classic crown or bridge restorations, removable devices are frequently provided for patients in the third and fourth phase of life. For financial reasons, claspretained dentures are often the first choice for partially dentate patients. The aim is to have as few clasps as possible and as many as necessary to establish an equilibrium between damage and benefit from the metallic structures. N.B.: 5-year survival rates were reported to be as low as 86.6 % for direct abutment teeth (Tada et al. 2013). If the abutment teeth are favorably distributed and provide appropriate support, two clasps are sufficient (Budtz-Jorgensen et al. 1995) (Fig. 3). The restoration should be designed to facilitate repair if further teeth are lost. The palatal plate has an advantage over the bikini design in terms of force distribution and when transitioning to a full denture, but is sometimes not well tolerated by patients. Here too, the periodontally and interdentally open design of the structure is very important to allow for good oral hygiene even in old age (Budtz-Jorgensen 1999) (Figs 4–5).

Age- and function-oriented dental care concept

We recommend an age- and functionoriented care concept – this also applies to implant-supported overdentures. At the School of Dental Medicine of the University of Bern, we follow a graded approach of implant prosthetics that is adapted to the manual strength and dexterity of the patient (Fig. 6). Given that the implant's success is to be secured, if possible, for the remainder of the patient's life, implant treatment must therefore be aligned to whether the patient can autonomously insert, remove, and clean the restoration (Müller et al. 2016b). Additionally, it must also be possible to remove the restoration. Two-piece implantabutment retentive elements are preferred on the shortest and smallest implants possible that will still assure long-term function under masticatory forces. This will reduce invasiveness and morbidity during the treatment's surgical phase. Ideally, implants should also be retrievable or easily put to sleep, if adequate care can no longer be assured (Schimmel et al. 2017a).

We design our implant prosthetic concept for edentulous patients according to the McGill consensus and a functional classification for completely edentulous patients. These concepts should only be applied if the IOD is opposed by a complete mucosaborne prosthesis, otherwise a higher number of supporting implants should be discussed (Fig. 7):

- for young-old people: maximal rigidity via a bar restoration. Typically a milled bar on two tissue-level implants with distal extensions (max. 7 mm)
- when there are vertical space constraints or potential

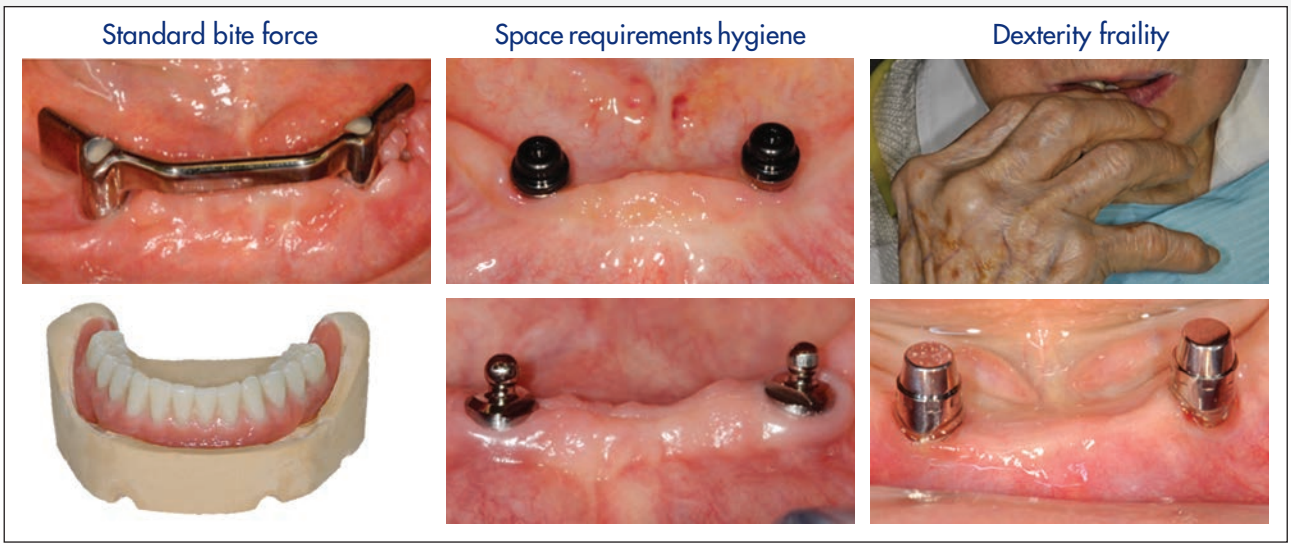

Figure 7: At the University of Bern a phased approach is followed for edentulous patients, depending on anatomy and functional capacity. We prefer two-piece implants placed with minimally invasive surgery and adapted to co-morbidities. The length and diameter should be as small as possible, but as large as necessary.

difficulties cleaning a bar restoration: stud-type attachments like the Novaloc™ anchor (Straumann, Basel/Switzerland)
- for patients with nursing care requirements and/or severely reduced dexterity: magnets (e.g. Titanmagnetics K-Line, steco, Hamburg)

Examples of tooth- and implant-supported restorations

Restorations can be retained in a variety of ways and we select the approach on a case-by-case basis (Fig. 8).

Spherical abutments with residual dentition (removable prostheses)

In Switzerland, a method frequently applied following root canal treatment is the use of cast root caps with soldered spherical or Gerber attachments. Given the correct indication and treatment, this treatment modality shows good survival of anchor teeth and prostheses (Mercouriadis-Howald et al. 2018). When used in combination with implants, they offer patients a securely retained removable restoration (Fig. 9). This option is a relatively simple, implant-supported solution, particularly in terms of after-care. In just a few easy steps, the retention force (e.g. DalboPlus anchor, C+M, Biel, CH) can be increased or the retentive part replaced. If it needs to be extended, an additional anchor can be easily integrated into the existing prosthesis. If an abutment tooth is lost, an implant can be placed in the same position and the well-adapted prostheses can continue to be used.

Stud-type anchors (removable prostheses)

For edentulous patients, it is recommended to retain an overdenture with at least two implants in the mandible and four in the maxilla. However, a recent review found evidence that four or six implants should preferably be placed in the mandible and maxilla, respectively (Kern et al. 2016; Schley et al. 2013). The actual retention element consists of a stud-shaped retention part and a transmucosal cuff (Figs 10a–b). While the male part serves as the implant abutment, the female retentive element is incorporated into the base of the prosthesis. Impression-taking is sometimes challenging due to space requirements – the prosthesis must be milled out generously. An example of modern retention systems is the Novaloc™ attachment (Straumann AG, Basel) (Schimmel et al. 2017b). The retention force is individually set via the retention caps so that the patient can handle the prosthesis him- or herself. This must be clinically tested, as manual strength is often overestimated. Another challenge comes with reline impressions: we always remove the housings before the impression, as stud-type attachments are very sensitive to even subtle changes in height. Alternatively, the housings can be secured with a direct technique, which promises the best clinical results.

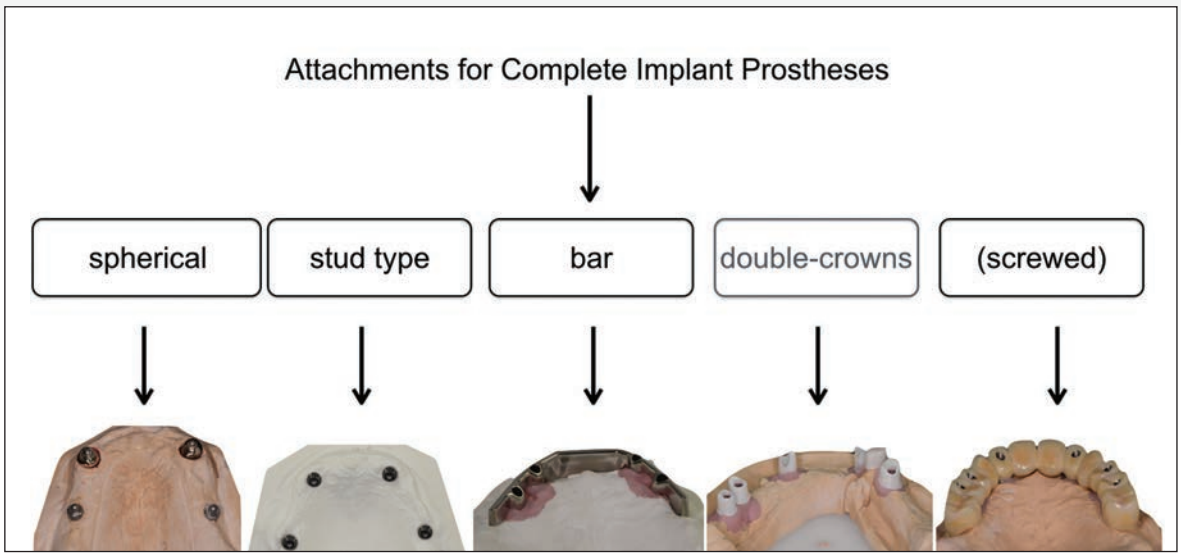

Figure 8: Examples of anchorage.

Figure 9: Distal implants in implant-assisted overdentures help to avoid a rotational axis by establishing quadrangular support. This reduces movement of the denture under function and improves the prognosis of the abutment teeth.

Figure 10a-b: Straumann Novaloc-retained removable prosthesis without a palatal plate where space is too limited for primary splinting. At least four implants are indicated.

Bar retention (removable prostheses)

In this era of CAD/CAM technology, we can mill highly individualized bars and could manufacture the bar clips with electroplating techniques for optimal results. However, given financial constraints and the demand for easily manufactured/maintained designs, the goal should be simplicity. Experience with the CAD/CAM-fabricated titanium parallel Dolder bar with distal extensions has been very positive at the University of Bern for many years (Fig. 11a) (Katsoulis et al. 2011).

At least two implants are required in the mandible and four or more in the maxilla (Kern et al. 2017); other concepts are still experimental with high rates of complications (Zembic et al. 2017). The implants are primarily splinted via the parallel-milled bar, also enabling the use of short implants in the maxilla. The minimum length of the retentive bar should be 20 mm to allow for adequate retention and horizontal stability.

One should bear in mind that the minimum height of the bar in the maxilla can significantly affect speaking. A minimum of 12 mm space from implant neck to incisal edge is recommended (Phillips et al. 2001), and an offset of 2 mm between the apical side of the bar and the mucosa has proved clinically valuable in maintaining correct hygiene and avoiding hyperplasia (Fig. 3a). Further attention should be given to not blocking the anterior third of the palate with the bar-overdenture, where the tongue forms consonants like "s", "l", "t" or "n". If there is still a large amount of alveolar

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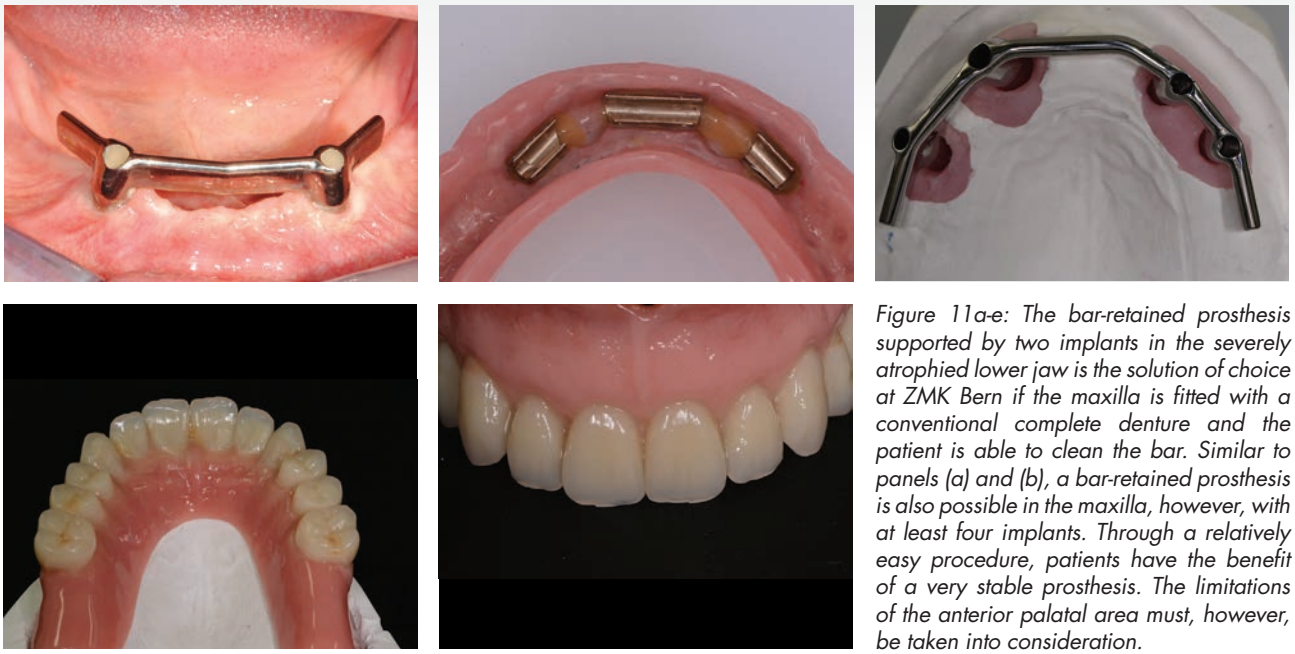

Figure 11a-e: The bar-retained prosthesis supported by two implants in the severely atrophied lower jaw is the solution of choice at ZMK Bern if the maxilla is fitted with a conventional complete denture and the patient is able to clean the bar. Similar to panels (a) and (b), a bar-retained prosthesis is also possible in the maxilla, however, with at least four implants. Through a relatively easy procedure, patients have the benefit of a very stable prosthesis. The limitations of the anterior palatal area must, however, be taken into consideration.

bone present, either another retention system must be chosen, or sufficient osteoplasty must be performed during implant surgery.

The bar is milled out of a solid block of titanium or CoCrMd alloy with increased stability relative to soldered gold bars, allowing for non-linear geometries that help respect functionally important anatomical areas, like the anterior third of the palate or the floor of the mouth. Also, there is no necessity for additional abutments, which helps to reduce costs and avoid potential technical complications.

Ideally, diagnostic steps for a bar-retained overdenture comprise a diagnostic set-up with critical appraisal of the available vertical and horizontal space. This is especially true for maxillary implant overdentures.

To anchor the milled bar, we prefer the appropriate prefabricated Dolder gold clips (C+M, Biel, Fig. 11b). These can be easily activated and deactivated and show very reliable retention over a long time (Kobayashi et al. 2014). Finally, the overdenture is finalized (Figs 11c–e); both pink and white esthetics can be individually adapted as desired. This therapeutic approach has many functional advantages and is well accepted by patients.

Double-crown retained prostheses (removable prostheses)

Double-crown, e.g. telescopic-crown, retained prostheses represent a valuable form of treatment with many advantages; for example, they can be easily converted, extended, and repaired, and are suitable for patients with limited manual dexterity. In addition, they allow the combined use of both natural dentition and implants in one jaw. There is now a wide variety of ma terials suitable for use with this indication, but only a few material combinations are well documented. The standard of care remains gold primary and secondary abutments, cast and electroformed, respectively. Another popular combination is zirconium dioxide primary with electroformed secondary crowns. Several recent reports also describe a complete CoCrMd primary-secondary-tertiary system (Kurzrock 2017). Modern subtractive and additive CAD/CAM manufacturing techniques are now expanding the horizon to a variety of new materials, e.g. PEEK or PEKK. However, only when long-term clinical experience is available will we know how these materials tolerate sustained use. One disadvantage is the high cost of manufacturing and the combination of various materials, although CAD/CAM technology (from milling to selective laser melting) promises lower costs in the future (Figs 12a–d).

Simple reconstructions using implants (fixed removable)

An efficient approach to fixed restorations for edentulous patients is the Straumann Pro Arch concept. This concept is the subject of an ITI-supported study at the Department for Reconstructive Dentistry and Gerodontology (ZMK Bern) and Queen's University Belfast, Northern Ireland. Patients

Figure 12a-d: Clinically demanding situations, as with the tumor patient shown here, can be handled efficiently using CAD/CAM technologies.

receive four or six implants in the edentulous mandible on a randomized basis. Standard tissue level implants with a minimum length of 8 mm are used interforaminally. Ultra-short (4 mm) tissue level implants are used for posterior support. The idea behind this approach is to provide a fixed implant-supported prosthesis without inserting long implants at an angle or having to perform bone augmentation. Furthermore, it is often possible to avoid time-intensive and costly bone augmentation procedures. In addition, it would be easy to remove the four posterior implants should it be necessary to "downgrade" to an overdenture when the patient can no longer clean or handle the prostheses at an advanced age (Figs 13a–c).

Oral hygiene

When planning prosthetic implant therapy, the top priority is to facilitate oral hygiene. In this regard, removable prostheses have a clear advantage over fixed prostheses.

With patients whose manual dexterity is limited, unsplinted retaining elements (e.g. spherical attachments, or Novaloc™) are preferred. If oral hygiene can be assured by the patient, family, or nursing staff, an implant-supported bridge or bar-supported overdenture is possible, supported by a minimum of four implants. Space for cleaning must be ensured when designing fixed restorations (Figs 14a–b).

Materials

A great deal has changed in recent years with regard to materials for removable prosthetic restorations. The use of CAD/CAM technology allows for the use of numerous innovative materials (Fig. 15).

All-metal frameworks

The history of porcelain-fused-to-metal crowns is documented in detail. In addition to casting, frameworks are now also produced via machine milling and additive fabrication by means of laser sintering on a powder bed.

Metal-free frameworks

All-ceramic restorations on a high-strength zirconium-oxide framework have also become accepted as reliable. These offer an excellent fit thanks to CAD/CAM manufacturing processes. The current focus for framework materials is on high performance polymers that are generally thought to present many advantages. There is, however, a significant disadvantage that should be considered. To properly enable oral hygiene, restorations must be designed to allow easy cleaning (self-cleaning, inter-dental spaces for the inter-dental brush). Designing the framework to fulfill this need involves maintaining the distance to the gingiva, which can be difficult when using PEEK or PEKK. The materials'

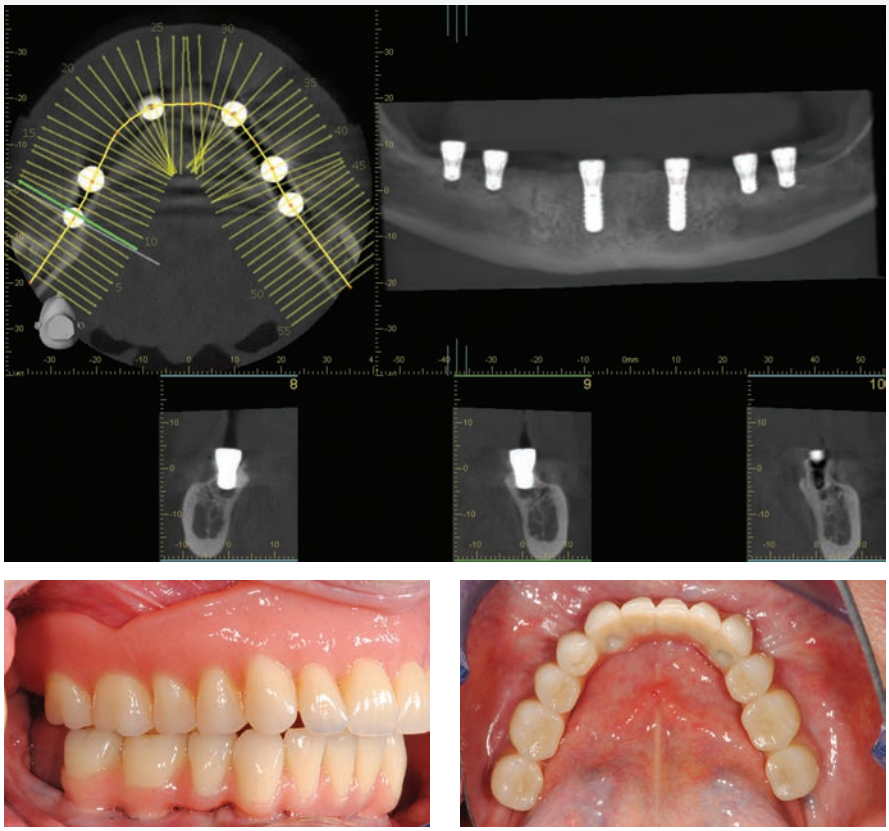

Figure 13a-c: Bone augmentation procedures can often be avoided by using the Straumann Pro Arch concept, even for fixed cross-arch prostheses. It is currently being investigated in a clinical study at the ZMK Bern, supported by the ITI Foundation.

characteristics make it difficult to maintain adequate dimensions for the framework. If this can be achieved, such polymers could be suitable for use in implant prosthetics (Fig. 16). The material has a certain elasticity, and is adaptable to a certain point compared to high-tensile material (Silla et al. 2016).

Esthetic finishing

According to the indication and the patient's wishes, lithium disilicate, zirconium dioxide, composite resins, or preformed teeth can be used for esthetic finishing. Once again, a customized restoration concept in combination with the needs of the patient are the primary points of consideration (Zimmermann et al. 2016). From experience, we know that wear must be taken into consideration when working with composites and/or synthetic teeth (Fig. 17). Pronounced wear leads to loss in the vertical dimension, accompanied by reduced chewing function. In such cases, depending on the load, the teeth must be replaced after several years (Balshi et al. 2016).

"Digital dentistry" for aging patients

Using new concepts, we are able to offer a variety of therapeutic options to patients in their third or fourth life phase. Digital solutions for the edentulous jaw are particularly patient-friendly; for instance, when using the digital workflow, depending on the situation and system, the number of appointments can be reduced (Schimmel et al, 2016). For example, patients who are very advanced in age often have difficulty getting used to a new prosthesis. In this instance, we can (e.g. using the AvaDent system, Global Dental Science Europe, Tilburg, Netherlands) simply copy the old prosthesis and use it as the basis for a new set of dentures (Figs 18a–c). Similarly, if a set of dentures is lost, it can be reproduced within a short time at no great effort.

It should also be noted that it is now possible to produce bar- or screw-retained implant-supported prostheses without a model following a completely digital workflow (Figs 19a–c).

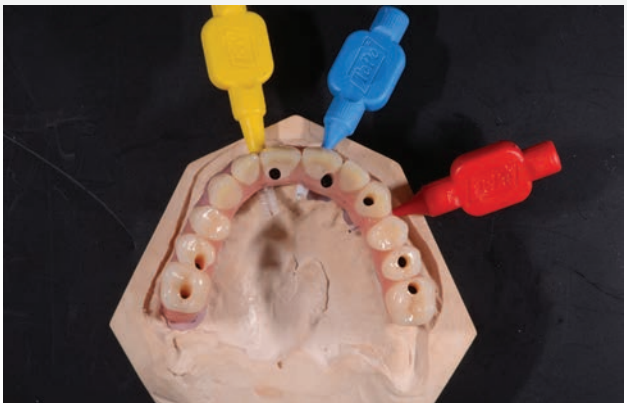

Figure 14a-b: Facilitated oral hygiene is a crucial component of geriatric dentistry. The restorations shown here are very demanding of patients and should only be realized in this form if the patient is still able to handle fine oral hygiene tools.

Figure 15: Dentistry today is characterized by the variety of materials available – this demands a broad knowledge of materials on the part of the dental technician.

Figure 16: New machine-processible materials, such as PEEK or PEKK, are accompanied by new characteristics that must, however, prove themselves over time.

Figure 17: Implant-supported fixed hybrid prostheses in a case with advanced resorption Cawood IV.

Conclusion

Many questions in implant dentistry remain unanswered as we face a rapidly aging society and frequently see patients who are advanced in age. Will patients be able to afford an implant-supported prosthesis? Are the boom years of well-funded pensions over? How will increasing life expectancy and the current discussions regarding pension funding be addressed (McKenna et al. 2015)? Already today, many older patients whose quality of life depends on a good prosthesis can only finance it thanks to financial support from third parties. Cost-efficient options will be required when moving forward. As in every other area of prosthetic dentistry, the edentulous patient should have the possibility to choose between various treatment options without having to sacrifice reconstruction quality. Whether the optimal solution involves removable complete dentures, a removable implant-supported prosthesis, or a fixed prosthesis, this area is an important component of reconstructive dentistry and should be given sufficient attention. The exacting partially dentate or edentulous patient in the future will spend more time consulting the practice and dental laboratory. Here, it is important to be able to supply a suitable concept for every need. In the end result, there is no better feeling for the dental team than to be able to provide patients with a functioning restoration that improves their quality of life.

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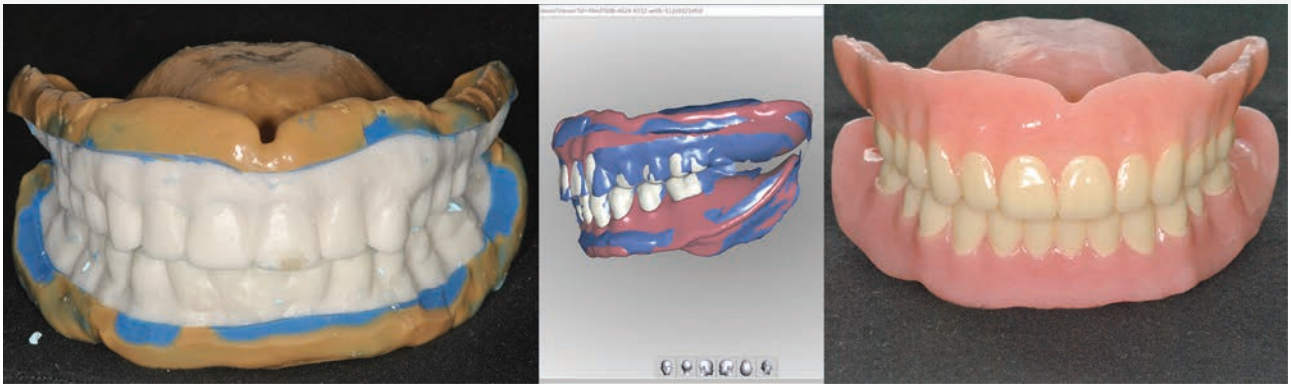

Figure 18a-c: Example of cost-effective option with a computer-aided workflow: complete copy denture using the AvaDent system. More processes are needed for the elderly patients of today and tomorrow that are light on the wallet and enable a more than adequate quality of life.

Figure 19a-c: The AvaDent system allows a complete denture to be transformed into a fixed supraconstruction by means of digital duplication techniques.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

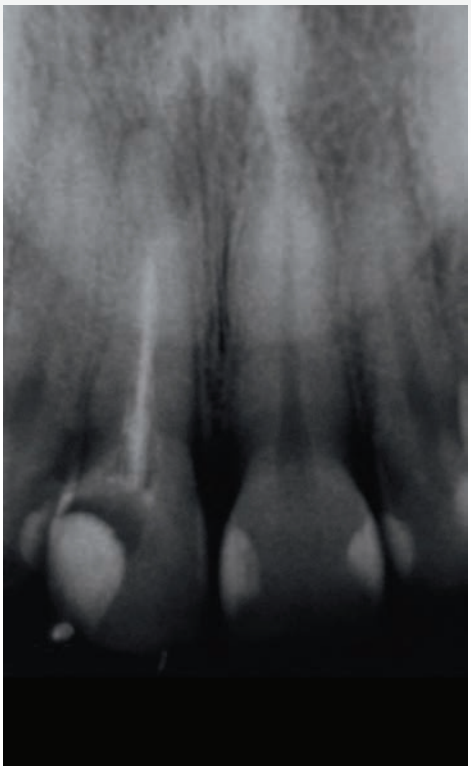

Figure 2: - Radiographic evaluation revealed an inadequate endodontic treatment with an alteration in the periapical area.

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

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

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

Clinical report

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

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

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

Figure 5: Final appearances after bleaching treatment.

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

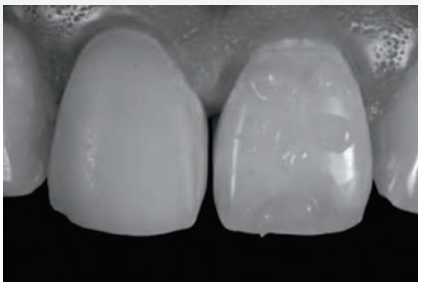

Figure 7: Greyscale photography used for evaluation of value of the resin composites to be used in the stratincation.

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

The treatment plan included the following phases:

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

Phase one

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

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

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

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

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

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

Phase two

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

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

Phase three

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

Wave-shaped white bands could be detected in the

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Figure 9: Dental preparation finished.

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

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

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

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

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

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

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

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

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

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

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

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

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

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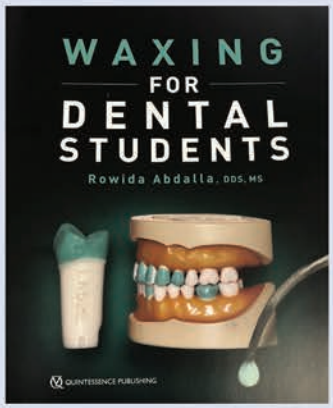
Waxing for Dental Students

Rowida Abdalla



When dental students are first taught how to wax teeth, they need clear instructions with logical steps and plenty of illustrations.

With the omission of any distracting information about dies, crowns, bridges, and occlusion, this concise book is squarely directed to first-year dental students and can be used as a primary laboratory manual.

The author covers the basics of wax instrumentation and addition, but the bulk of the book details the steps for waxing incisors, canines, premolars, and molars. Each chapter includes an introductory waxing exercise for the tooth type, followed by the key points of morphology for the tooth in question. Photographs detail the waxing steps for both a maxillary and a mandibular full crown on a tooth peg and show how the wax-up should mimic the contralateral tooth in terms of dimension, embrasures, heights of contour, line angles, and point angles. The logical and straightforward protocols in this book will help dental students quickly improve their waxing skills and reach expected goals.

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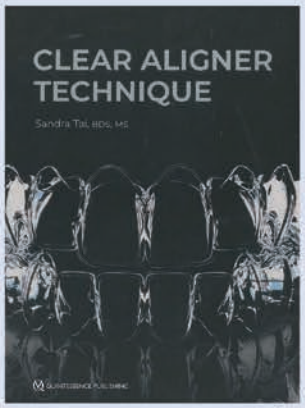
Clear Aligner Technique

Sandra Tai



Clear aligners are the future of orthodontics, but digital orthodontics evolves so rapidly that it is hard to keep pace.

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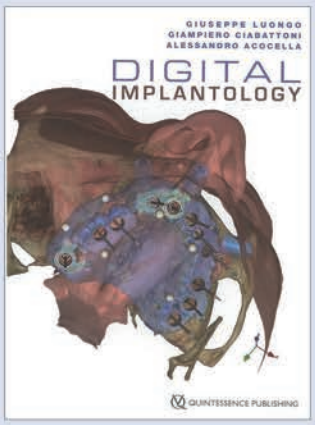
Digital Implantology

Giuseppe Luongo, Giampiero Ciabattoni and Alessandro Acocela



Digital planning of implant therapy ensures predictable and successful treatment by allowing clinicians to visualize the surgical procedure before they perform it. With this goal in mind, this book lays out the latest research on implant dentistry as well as effective case presentations to demonstrate cutting-edge imaging and surgical techniques.

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

Figure 13: Application of the enamel layer.

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

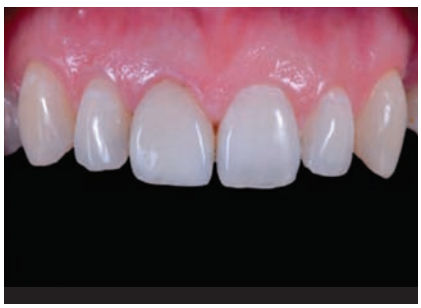

Figure 14: A pencil was used to highlight the line angles, and a caliper was used to check the symmetry between central incisors. Blue stain was applied between dentine lobes to obtain an opalescence effect at the incisal third.

Discussion

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Conclusions

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

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

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

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Minimally invasive treatment of the single dark tooth with vital bleaching

Amit Patel[1] and Tanvi Bagtharia[2]

The most common reasons for discolouration of a single tooth tend to be local causes of intrinsic discolouration.

When it comes to treatment of the single dark tooth, guidelines suggest that there should be a logical order of treatment options to achieve a satisfactory cosmetic outcome, beginning with the least invasive. This is known as progressive smile design.

Vital tooth whitening is a popular and a non-invasive technique of treating single discoloured teeth.

Causes of discolouration

Most single-tooth discolouration tends to be due to local causes of intrinsic discolouration.

Trauma to teeth is one such cause. This may result in intrapulpal haemorrhaging, which leads to blood components flowing into dentinal tubules.

Initially this will appear as a pink discolouration, however with time, if pulp canal obliteration (PCO), also known as calcific metamorphosis, or necrosis occurs, this colour darkens and leads to a yellowish, then a grey-black shade.

PCO is defined by the deposition of secondary and tertiary dentine within the root canal space (McCabe and Dummer, 2011). The extent of the discolouration is directly associated to the duration of time that the pulp has been obliterated or necrotic (Barber and King, 2014).

Clinical and radiographic assessment

After a smile analysis, there are a few techniques that are currently used in order to clinically assess the colour and stain of a tooth. These can be divided into subjective (visual) and objective (instrumental) assessments.

Subjectively, the most common method is visual shade matching with comparison to a commercial shade guide.

Although this technique is simple and quick to use, the limitations of this method need to be appreciated.

Factors such as age, lighting, experience and eye fatigue can result in variations in results from assessors.

Instrumental methods of assessment include the use of colourimeters, reflectance spectrophotometers and digital image analysis but even these have their disadvantages, such as cost and the intrusive nature of equipment (Brook, Smith and Lath, 2007).

Sensibility tests should also be carried out. The most reliable method here is electric pulp testing.

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[2] Tanvi Bagtharia is a fourth year dental student at Plymouth University with a keen interest in restorative dentistry.

Figure 1: Patient presenting with a dark single central upper left central incisor due to trauma. We can see how this would be of aesthetic concern, especially for a young patient.

Figure 2: Retracted view demonstrating the preoperative Vita shade for the single tooth.

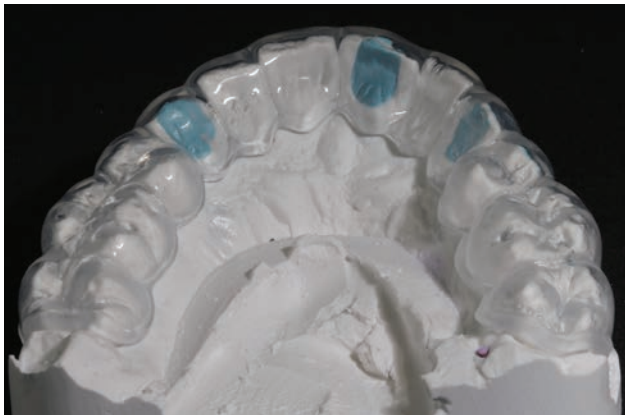

Figure 3: The palatal reservoirs on individual teeth with recommended bleaching tray.

The high specificity of this test means that it is more likely to identify vital teeth correctly in comparison to cold pulp testing. It is important to use a control of a contralateral tooth when doing sensibility testing to allow the patient to compare the sensation of a known vital tooth with the tooth that is being tested.

If the clinician suspects that the discolouration is due to PCO or necrosis then a periapical radiograph is essential.

However, in the case of pulp necrosis, there may be an absence of any radiographical change.

Data shows that only about 7-27% of teeth with PCO will progress into pulp necrosis with periapical disease showing on a radiograph (McCabe and Dummer, 2011).

Figures 1 and 2 show the appearance of a patient that suffered dental trauma in her teens.

Consent

Other than in certain ethical situations, tooth whitening is only permitted for 18-year-olds or older.

The consent procedure with this treatment needs to be extremely robust: patients need to be very aware of the possible outcomes and associated risks, and expectations must also be carefully managed.

The patient must be told that the result cannot be guaranteed, that the time taken to complete the treatment can be variable and that relapses can occur.

Treatment options

When it comes to treatment of the single discoloured tooth, guidelines suggest there should be a logical order of treatment options, beginning with the least invasive. This is known as progressive smile design.

Pink discolouration sometimes found after trauma is still reversible and therefore monitoring and review may be the only requirement.

Scaling and polishing are also good initial steps to take so that any extrinsic stains can be removed and the true colour of the tooth can be assessed.

Vital tooth whitening is a popular and non-invasive technique of treating single discoloured teeth (Barber and King, 2014).

However, if the whitening does not prove to be effective, minimally invasive composite veneers can aid in masking

Figure 4: Postoperative result after six weeks of bleaching.

Figure 5: Postoperative shade. Note we have bleached past Vita shade B1.

Figure 6: Before treatment with vital bleaching.

Figure 7: After treatment with vital bleaching.

residual darkness of the tooth, or more invasive procedures such as ceramic veneers or full coverage crowns can be placed instead.

Clinical techniques

There are a few techniques that can be performed when whitening single dark teeth. The method the authors use most frequently is where the discoloured tooth is bleached first, followed by the rest of the arch.

Impression taking

The teeth are dried thoroughly with a three-in-one tip and impressions are taken using perforated metal trays with Hydrogum 5 alginate (Zhermack). Assistance from the dental nurse is required during this stage to hold cheek retractors to allow easy insertion of the loaded tray. Impressions should be examined for the presence of all the teeth and for any air blows or drags.

Laboratory prescription

The lab prescription should request super-sealing, scalloped, silicone upper- and lower-whitening trays with palatal and labial reservoirs on the discoloured tooth.

Figure 3 shows the custom super-sealing trays produced by the lab.

Both canines in the arch should also have buccal and labial reservoirs as these teeth are generally darker than the rest of the arch. While waiting for the whitening trays, the patient should take home Tooth Serum paste (Enlighten) to use which reduces the risk of sensitivity with this procedure.

Fitting the trays

Once the trays have arrived, accuracy of fit and the seal at the cervical margin is checked. Ensure there is no bubbling in this area, which would suggest a leaking margin. The patient should be shown how to remove and insert the trays.

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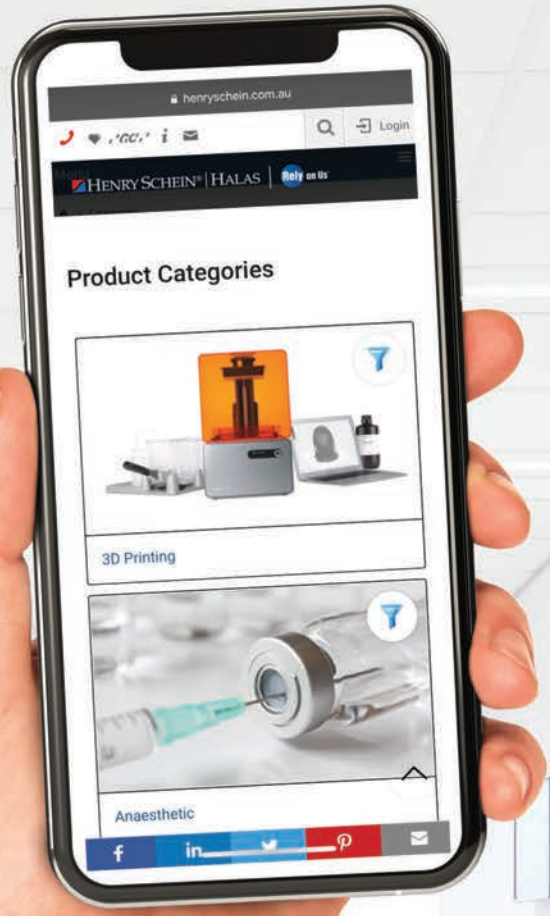

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Patient compliance and instructions

The patient should use 10% carbamide peroxide (CP) gel nightly for one to four weeks on the discoloured tooth.

A reassessment of the tooth colour should be planned with the dentist.

If the single discoloured tooth still requires further whitening then the patient can continue to do so but if not, the rest of the buccal surfaces of the arch can be bleached at the same concentration.

Another reassessment should take place where the patient can be given a 16% CP gel to use for another two weeks on the trays. Finally, a last reassessment to determine the outcome of the treatment should be scheduled.

Postoperative instructions must be given for maintenance as there is some risk that the newly-whitened teeth may rebound and become discoloured again. A top-up regime should therefore be established for around every six months, although for some patients this can reach up to three years (Greenwall, 2018).

Figures 4 and 5 show the same patient after treatment with Enlighten tooth whitening. Figures 6 and 7 show a dramatic improvement in the shade of the single dark tooth.

We can see here how this can greatly improve the confidence of our patient while avoiding more invasive treatments such as veneers.

Risks

As the treatment of discoloured teeth is done for cosmetic reasons, it should have more benefits than harmful effects and the consent procedure must be thorough.

Although the use of 10-16% carbamide peroxide strives to have the best results with the minimum amount of side effects, there are still some that occur.

The most common risk that occurs with vital tooth bleaching is tooth sensitivity.

The patient must be warned about this as it can affect compliance and therefore a dentist should always aim to keep this to a minimum. The use of Tooth Serum paste (Enlighten) helps this.

Gingival irritation is also an issue that is frequently reported and so it is important to ensure that the tray has a good, secure fit and is scalloped and free from sharp edges and flashes of resin (Pretty et al, 2006).

Discussion

Vital bleaching is a safe, minimally invasive and cost-effective method for improving the appearance of dark single teeth.

Patient assessment and managing expectations is key.

Your treatment plan is case dependent and patients must be informed of ongoing maintenance and the costs associated with this.

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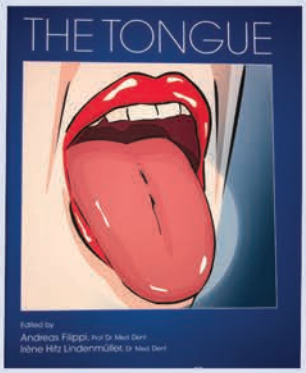
The Tongue

Andreas Filippi and Irène Hitz Lindenmüller

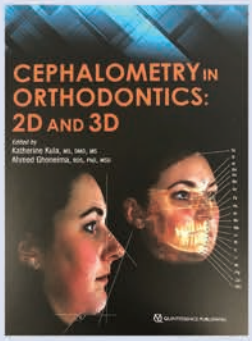


As the largest organ in the oral cavity, the tongue not only plays a primary role in masticatory and speech function—it is also a significant indicator of health, demonstrating signs of both oral pathologies and diseases that can affect the entire body. Because no health care provider gets the opportunity to examine a patient's tongue as often as the dentist, it is essential for dentists to recognize when there may be a problem with the tongue and what the problem is. In addition to an overview of tongue anatomy and general diagnosis and treatment recommendations, this book contains an atlas of more than 50 specific diseases and health concerns that may present signs and symptoms in the tongue. Each is outlined in a quick-reference table describing etiology, prognosis, and more and is accompanied by photographs of different ways the condition can present. A true diagnostic aid, this guide will allow clinicians to identify and address any abnormality a patient's tongue may exhibit.

Q-5120867 | 216pp 591 illus | **$217.09**

Cephalometry in Orthodontics: 2D and 3D

Katherine Kula and Ahmed Ghoneima



Cephalometrics has been used for decades to diagnose orthodontic problems and evaluate treatment. However, the shift from 2D to 3D radiography has left some orthodontists unsure about how to use this method effectively. This book defines and depicts all cephalometric landmarks on a skull or spine in both 2D and 3D and then identifies them on radiographs. Each major cephalometric analysis is described in detail, and the linear or angular measures are shown pictorially for better understanding. Because many orthodontists pick specific measures from various cephalometric analyses to formulate their own analysis, these measures are organized relative to the skeletal or dental structure and then compared or contrasted relative to diagnosis, growth, and treatment. Cephalometric norms (eg, age, sex, ethnicity) are also discussed relative to treatment and esthetics. The final chapter shows the application of these measures to clinical cases to teach clinicians and students how to use them effectively. As radiology transitions from 2D to 3D, it is important to evaluate the efficacy and cost-effectiveness of each in diagnosis and treatment, and this book outlines all of the relevant concerns for daily practice.

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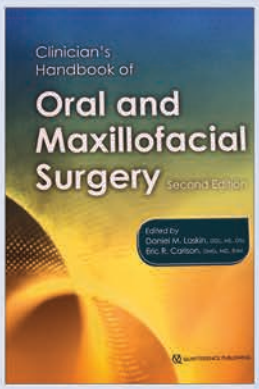
Clinician's Handbook of Oral and Maxillofacial Surgery, Second Edition

Daniel M Laskin and Eric R Carlson



There are frequent situations in which oral and maxillofacial surgeons find themselves in need of an immediate answer to a clinical problem. However, this can involve a time-consuming search for the appropriate reference source. This book continues the format of the previous edition by providing a single place to quickly find information on a diverse range of clinical topics, including dentoalveolar surgery, maxillofacial trauma, craniofacial anomalies, and oral pathology. All of the previous chapters have been updated, and new chapters on implantology, cleft lip and palate, maxillofacial reconstruction, oral squamous cell carcinoma, and cosmetic surgery have been added. Moreover, increasing the size of the book has allowed for the inclusion of many summary charts, tables, clinical photographs, and radiographs, which was not possible in the previous version. As a result, this new edition provides expanded information in an improved format.

Although this book is designed as a quick reference source, familiarizing oneself with its content in advance will both add to the reader's general knowledge base and improve the ability to find information quickly in urgent situations. Residents in oral and maxillofacial surgery should find its content particularly useful during their clinical training, and the concise organization of the material should also be helpful to them in retaining information when subsequently preparing for the American Board of Oral and Maxillofacial Surgery.

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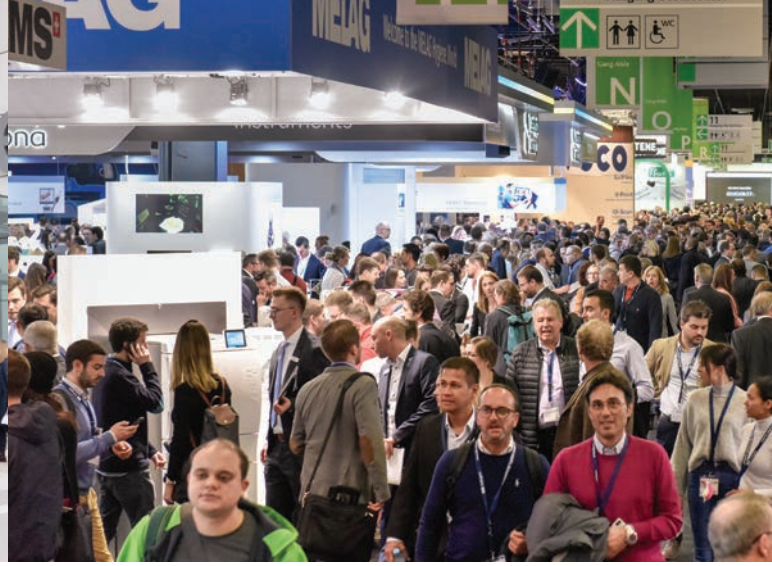

IDS 2019: Leading global trade fair of the dental industry underlines its outstanding position

Excellent results again - even more international and higher quality in both offer and demand

IDS 2019, which ended in Cologne on 16 March 2019 after five days, more than fulfilled the high expectations of the international industry. As such, the undisputed leading global trade fair of the dental industry once again underlined its exceptional position. The event was able to replicate the excellent results of the previous event in 2017 and at the same time realise the ambitious goals for more internationality and higher quality in offer and demand. The outcome of the trade fair consequently led to satisfied exhibitors and trade visitors. With 2,327 companies from 64 countries, the number of exhibitors increased once again. They came together with over 160,000 trade visitors from 166 countries, an overall increase of 3.2 percent, with the number of foreign trade visitors increasing by 6 percent. At the same time, the exhibition space expanded by over four percent up to 170,000 m².

Mark Stephen Pace, Chairman of the Association of the German Dental Manufacturers e.V. VDDI, said: "The motto 'The sportsmanlike fair competition of IDS' expresses in six words the strengths of this leading trade fair: The comprehensive and internationally unique offer as well as the extraordinary high performance and innovative strength of the industry, combined with the firm intention of all market players to improve continually and seek the success in the direct competition. Everyone, who wants to be successful in the dental industry, faces the performance comparison in Cologne. It is thus no surprise that the level of internationality of IDS has taken on huge dimensions."

Gerald Böse, President and Chief Executive Officer of Koelnmesse, added: "IDS is a trade fair event in a class of its own and always sets new benchmarks. It manages to surpass the already excellent result of the previous event every time. It is only in Cologne that supply and demand are provided in this scope, in this quality and with this level of internationalit. IDS is the undisputed leading global trade fair for the dental industry."

The dental world does business at IDS

The official figures confirm the excellent level of internationality at IDS: 73 percent of the exhibitors from 64 countries came from abroad, as well as 62 percent of the visitors from 166 countries - from Argentina, Brazil and Chile, to Japan, Korea, Egypt and South Africa, Australia and New Zealand, the whole of Europe through to the USA and Canada. The number of countries of origin thus increased once again by 6 percent. IDS 2019 recorded significant growth in the number of visitors from Asia (+23.1 percent), Eastern Europe (+19.6 percent), Africa (+17 percent), Central and South America (+14.6 percent) and North America (+5.3 percent).

High interest in innovations

IDS is the ideal business platform especially for new companies in the dental market, which want to establish themselves with high-quality innovations. The focus of IDS 2019 lay on products and systems for improved digital workflows and the additive production, new prophylaxis formulas and filling materials, innovative intraoral scanners and implant designs as well as flexible workflows for the management of the laboratory.

Dominik Kruchen, President of the German Dental Technicians Guild, summed up as follows: "The International Dental Show demonstrated at what speed the digital dental world is developing. One has to weigh up the risks, recognise one's own chances and take investment decisions based on good judgement."

The next IDS - the 39th International Dental Show - is scheduled to take place in Cologne from 9 to 13 March 2021.

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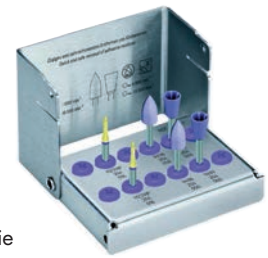

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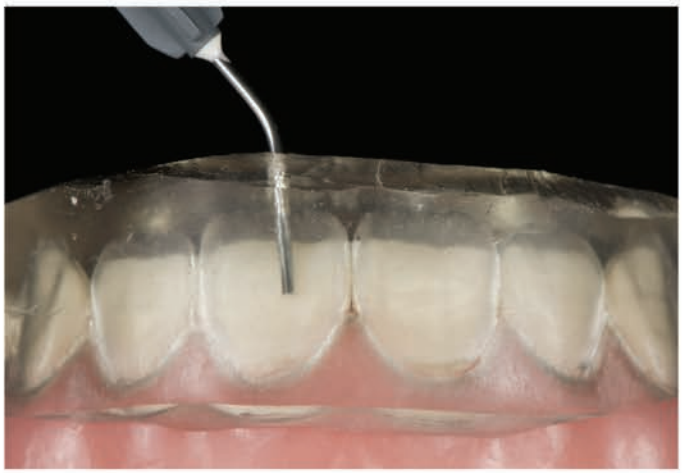

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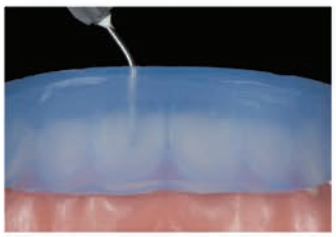

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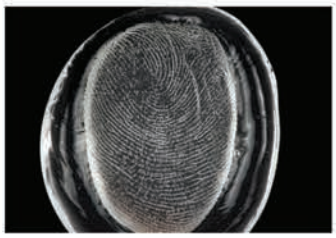

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