INTERNATIONAL

Dentistry

AUSTRALASIAN EDITION

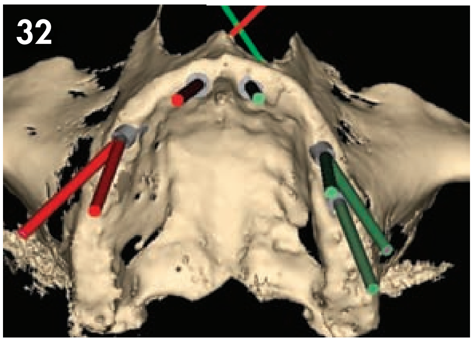
ADIA AUSTRALIAN DENTAL INDUSTRY AWARDS 2012 WINNER

VOL. **14** NO. **1**

IN THIS ISSUE

Contents

Volume 14 No. 1



Special needs dental specialist treats young man's toothache in Papua New Guinea

Edwin with his family and dentist, Dr Daniel Sundaresan.

At 18 years old, Edwin is a charmer. When he first met the YWAM (Youth With A Mission) volunteers, he grinned, waved, and took photos with them as he waited for a YWAM dinghy to arrive on the shores of Sohe District in Oro Province, Papua New Guinea. The dinghy would take Edwin and his mother, Jesset, to the dental clinic aboard the MV YWAM PNG.

His visit to the clinic was special: Edwin has Down Syndrome, a chromosomal disorder characterised by developmental and intellectual delays. Although Edwin is nonverbal, he used signs to tell his mother that his teeth were hurting him. He first complained of the pain two years past, but this was his first trip to the dentist.

Unbeknownst to Edwin and his mother, one of the ship's volunteer dentists, Dr Daniel Sundaresan, specialised in special needs dentistry. As Edwin's Down Syndrome merited a nuanced approach, Dr Sundaresan's presence was invaluable.

"If you've got a patient with Down Syndrome, it's a case of behaviour management, it's a case of knowing what comorbidities tend to present with Down Syndrome, and then making allowances for that," said Dr Sundaresan.

Dr Sundaresan worked quickly, using smiles and hand gestures to assure the young man. By the end of the procedure, Edwin had three teeth extracted — including the tooth that had pained him for two years.

His mother was grateful for Dr Sundaresan's compassion for her son. "He was very good with Edwin. It was interesting to watch. Edwin didn't resist, he just lay there, still and calm," she said.

The experience was deeply meaningful for Dr Sundaresan as well. Several days later, when asked for the highlight of his outreach, he said simply, "Edwin."

Interested in volunteering with YWAM Medical Ships? Dentists, dental assistants, dental hygienists, dental therapists and dental specialists are invited to volunteer aboard the MV YWAM PNG for two-week outreaches in 2019. Visit www.ywamships.org.au/volunteer/ for dates and information.

Patient receiving treatment aboard MV YWAM PNG.

MV YWAM PNG in Milne Bay Province, Papua New Guinea.

INTERNATIONAL Dentistry AUSTRALASIAN EDITION

Vol. 14 No. 1
ISSN 2071-7962

PUBLISHING EDITOR
Ursula Jenkins

EDITOR
Prof Simone Grandini

ASSOCIATE EDITORS
Prof Cecilia Goracci
Dr Andre W van Zyl

EDITOR-IN-CHIEF EMERITUS
Prof Dr Marco Ferrari

PRINTED BY
KHL PRINTING, Singapore

International Dentistry - Australasian Edition is published by Modern Dentistry Media CC, PO BOX 76021 WENDYWOOD 2144 SOUTH AFRICA
Tel: +27 11 702-3195
Fax: +27 (0)86-568-1116
E-mail: dentsa@iafrica.com
www.moderndentistrymedia.com

Adhesion, biomaterials, and CAD/CAM

Pascal Magne[1]

We're living in a challenging and intense world, with an unclear future on the horizon. In a context that challenges our beliefs, we must strive to be professionals and experts – to keep the faith. In dentistry, the plethora of materials and techniques available to us can be challenging for our 'dental faith'. As a practitioner trying to find their way amidst an avalanche of new dental products, new technologies, and contradictory scientific publications, it is more important than ever to examine our beliefs, our values, and the foundations that will allow us to make the best choices.

Four synergistic components play their part in making these decisions: science, experience, good sense, and the patient.

Science

In theory, the scientific method is a fundamental basis according to which a hypothesis is tested using varied levels of evidence (expert opinions, in vitro tests, clinical case presentations, series of cases, cohort and random clinical studies, systematic reviews and meta analyses). Unfortunately, the scientific approach has its failings.

Clinical study conditions don't always represent clinical reality. For medical ethical reasons it isn't possible to standardise all clinical conditions. Results are 'polluted' by a multitude of confusing variables, such as the operator, the nature of the clinical table, the patient habits, and so on.

Consequently, it's not unusual to have a null hypothesis (absence of differences between the method or material tested and the control method), especially with clinical studies which present a majority of factors provoking confusion, by default.

With this in mind, studies combined with digital simulation and in vitro tests represent considerably more advantageous research tools thanks to the possibilities of extreme standardisation (Korioth and Versluis, 1997; Magne et al, 1999).

Experience

It has been shown that one of the significant variables of clinical practice is represented by the practitioner himself and by his skill to master a specific approach. For example, in medicine, a study on carotid stenting clearly showed that patients treated by experienced operators presented lower risks of complications (Calvet et al, 2014).

Similar data exist concerning the performances of dental bonding as much in vitro as in vivo (Unlu et al, 2012; Kemoli et al, 2009).

Clinicians who participate in numerous training courses and who develop bonding skills will consequently be more likely to produce more reliable results (Bouillaguet et al, 2002).

Good sense

It is clear that numerous daily clinical acts lack high level scientific substantiation. The scientific community itself recognises the existence of a 'speaking pig', according to Bandolier's parable. This is a parable that explains that good sense must be employed even in scientific methods.

According to this parable, a researcher trained a pig to speak. You might think this is crazy, but if the aforementioned pig spoke to you to wish you a good evening, we

[1] Pascal Magne,
Dr Med Dent MSc PhD
The Don and Sybil Harrington Professor of Esthetic Dentistry, Herman Ostrow School of Dentistry of USC, Division of Restorative Sciences

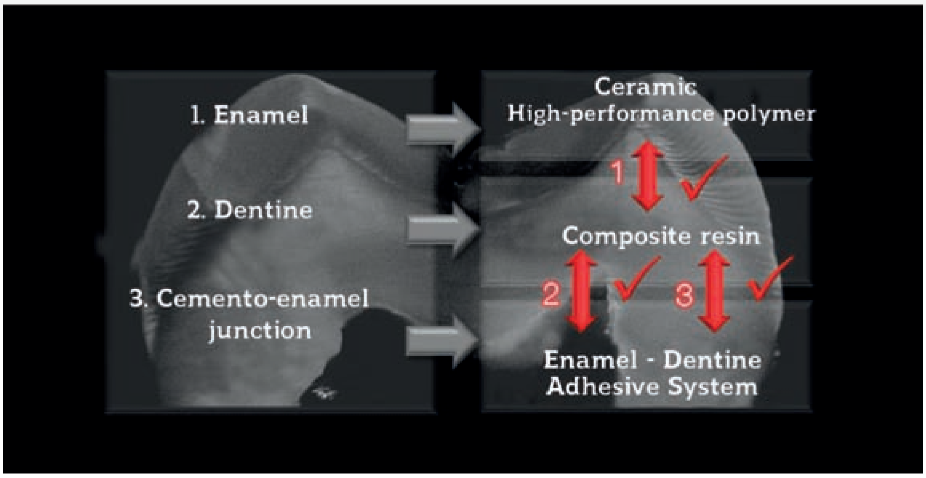


Figure 1: Three skill levels of adhesion are necessary to apply the biomimetic principle.

Table 1. The De Munck et al meta-analysis revealed the adhesive performances (dental bonding resistance in micro-tension) of the 10 most tested adhesives in research, as well as the loss of adhesion after one year (in % in brackets

Meta-analysis of adhesive performance (dentine bond strength in microtension)			
1. Optibond FL	49.7 MPa	44.8 MPa	(-10%)
2. Clearfil SE Bond	45.4	38.6	(-15%)
3. Scotchbond 1	42.2	30.9	(-27%)
4. Xeno III	38.6	28.6	(-26%)
5. Scotchbond MP	38.4	30.3	(-21%)
6. Clearfil S3	37.8	26.1	(-31%)
7. One-Step	36.3	23.2	(-36%)
8. Prime & Bond NT	35.9	23.5	(-36%)
9. Prompt L-Pop	31.4	20.4	(-35%)
10. One-up Bond F	27.9	18.0	(-35%)

hope that you would be surprised without necessarily thinking about the 100 pigs selected randomly so as to verify the phenomena. What's most important is the fact that the pig speaks.

Along the same lines, we can ask the question, is a randomised study necessary to prove that the use of a parachute will prevent death in the event of an air crash (Verkamp, 2010)?

These examples show that good sense must be applied in each situation. Equally, it's not unusual that contradictory scientific data is produced, thus requiring a decision based on experience and good sense.

The patient

Finally, it is entirely possible that science, experience, and good sense all indicate the same therapeutic solution. Nevertheless, the patient can be unable to choose this solution due to, for example, questions of finance or availability.

A part of the treatment, or a 'low cost' alternative, that doesn't necessarily correspond to the ideal solution proposed by the treatment team must therefore be explored.

The biomimetic approach and Bio-Emulation

The retention and type of resistance of dental preparations has, for a long time, been a key reference for the placement of traditional restorations, as much for prosthetics (bridges and crowns) as for 'conservation' (fillings). These approaches (which are unfortunately still to be found in the armamentarium of certain of our colleagues) didn't give the optimal maintenance of healthy tissue and pulp vitality and could result in a reduced life cycle for the dental organ concerned (Simonsen, 1991).

Fortunately, over the last 20 years, a fundamental element that has characterised natural tooth restoration has been unanimously approved of by new generations: it concerns the deep respect for healthy dental tissues and the recognition of the fact that an intact natural tooth is not the result of human willingness, but is the result of a divinely conceived, engineered, work of art.

Therefore, it is the clinician's responsibility to maintain the biological, functional, mechanical, and aesthetic balance of the dental tissues in relation to the restorations required (Magne and Douglas, 1999). The socio-economic stakes can be critical. The success of developing restoration materials and techniques in these domains has an immediate and long-term impact on dental surgery, as much in poor as in rich countries around the world.

With this in mind, the study of the natural tooth at all levels remains the driving force behind the approach known as 'biomimetic' or 'Bio-Emulation' (Magne, 2006; Bazos and Magne, 2014; Bazos and Magne, 2011).

Natural teeth are composed of a 'brain' (the pulp), itself protected by a hybrid mechanical structure, both resistant and resilient. Indeed, the dentine forms an elastic structure, capable of absorbing the repeated shocks of chewing thanks to elastic and viscoelastic deformation.

Equally, the periodontal ligament and alveolar bone support this compensatory deformation. The enamel operates in total synergy with the dentine, furnishing it a morphological and functional stability in spite of the abrasive, attrition and chemical erosion 'attacks'.

The cornerstone: 'trinitarian' adhesion

The combining of the enamel with the dentine via the dentino-enamel junction (DEJ) forms the cornerstone of the long-term operation of the natural tooth (Lin and Douglas, 1994). The same goes for dentino-enamel adhesion in the biomimetic approach, which has enabled the total abandon of the principles of retention and forms of resistance (including dental and root posts) and the application of the principal of the absolute preservation of healthy tissues, even in the most desperate of situations concerning anterior and posterior teeth (Walls, 1995a; Walls, 1995b; Magne and Magne, 2005a; Magne et al, 2016).

Nonetheless, a profound knowledge of adhesion principles is necessary to correctly apply biomimetic principles so as to reproduce structural continuity between the enamel and the dentine (DEJ).

Three adhesive interphases must be considered (Figure 1): the composite resins constitute the hub of this 'trinitary' adhesion because they enable the combining of the restoration material and the tooth. It is generally agreed that resinous adhesion to restoration material can be easily mastered, be it resin (direct or indirect in the form of high performance polymer) or ceramic.

A methodical approach by micromechanical retention (etching by fluorhydric acid for ceramic, microabrasion for polymer), meticulous cleaning (by ultrasonic wash) and chemical coupling (silane application and heat-drying) is generally recommended (Roulet et al, 1995; Jardel et al, 1999; Magne and Cascione, 2006; Magne and Knezevic, 2009).

There are two distinct aspects to resinous tooth adhesion. First of all, bonding to the enamel by acidic etching and secondly dampening through a low viscosity resin, both are generally acknowledged as being stable and extremely reliable. Nevertheless, it must be noted that the enamel, once etched, remains fragile and specific precautions (gentle pressure) are essential so as not to damage the hydroxyapatite prisms during the dentine conditioning, or even during the application of the adhesive on the enamel itself.

It is also important to note the importance of the bevels for a transversal section of the prisms and for an optimal adhesion, especially in the interdental zone (Carvalho et al, 2000; Hugo et al, 1992).

Figure 2: A structural adhesion to the dentine requires a filled adhesive such as Optibond FL, which contains 48% of filling (weight).

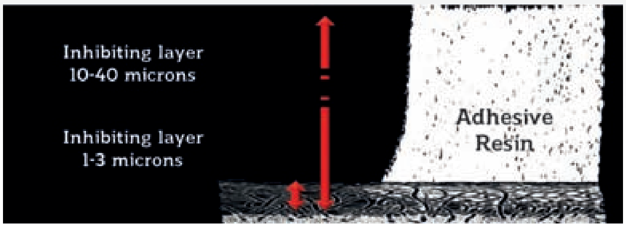


Figure 3: Problematics of the inhibiting layer in dentine adhesion. This layer can attain a thickness of 40 microns, which poses a problem of polymerisation of adhesive systems that are too thin. The hybrid layer itself only presents a thickness of between 1 and 3 microns

Dentine adhesion is a much more controversial subject. This is because more than a hundred adhesive systems are used around the world, many of which lack established and 'proven to be efficient' clinical surveillance. Adhesive systems are the perfect example of the plethora of commercial methods and products used and of a dental market influenced by competition between brands rather than by clinical performance. Consequently, certain adhesives are developed and promoted uniquely to target a competitor brand.

A healthy and structured dental adhesion

In 2012, a meta-analysis conducted on the parameters involved in dental adhesion highlighted the unjustified plethora of commercialised adhesive systems (Table 1). The study revealed a list of the 10 most tested adhesive systems. Optibond FL (Kerr) and Clearfil SE Bond (Kuraray) are the top two systems.

First commercialised in 1992 (first version – dual polymerisation), then replaced by the current version in 1994, Optibond FL (Figure 2) remains the uncontested market leader, with an adherence close to 50 MPa and the weakest level of degradation.

Purely for comparison purposes, a study on dentino-enamel adhesion revealed a constraint between 47.7 and 51.5 MPa (Urabeet al, 2000). It must be concluded that adhesive systems have the potential to reproduce the DEJ, on condition that simplified systems are avoided, particularly the 'all-in-one' systems (De Munck et al, 2012).

Another essential element is the adhesive application. Dentine hybridisation implies the demineralisation of the surface layer of the dentine. Nevertheless, the hybrid layer remains extremely thin, between 1 and 3 microns, depending on the system. An adequate polymerisation of the adhesive layer is primordial to protect the hybrid layer (Van Landuyt et al, 2009).

For this reason, it is essential to recognise the inhibiting effect of oxygen on the polymerisation of the resins, which can easily reach a depth of 40 microns (Shawkat et al, 2009) and impact on the adhesive quality on the dentine (Figure 3) (Endo et al, 2005).

Hence, a perfect polymerisation of the interphase adhesive requires a layer of approximately 60 to 80 microns of adhesive resin. Thus, a micro-filled adhesive system such as Optibond FL offers a clear advantage thanks to the resin viscosity, which contains approximately 48% of fillings (includes fillings noticeably radiopaque).

As such, this adhesive acts as a composite fluid (liner) and enables a structural adhesion with the restoration. Indeed, a thick layer of adhesive resin is recommended to improve restoration adaptation (Pecie et al, 2013). It is important to understand this structural aspect in the adhesive dentine. An extremely fine adhesive, the all-in-one type, carries the risk of being badly polymerised (Van Landuyt et al, 2009) with all the complications that can ensue (compression with damage to the hybrid layer during the placement of the restoration, solubility increased etc).

Immediate dentine sealing (IDS) of dental preparations

Structural dentine adhesion requires a substantial and uniformly dense adhesive layer of roughly 80 microns. Therefore, it is essential that this layer be included during the restoration impression (semidirect or indirect), be it an analogue or a digital impression. This explains why we need

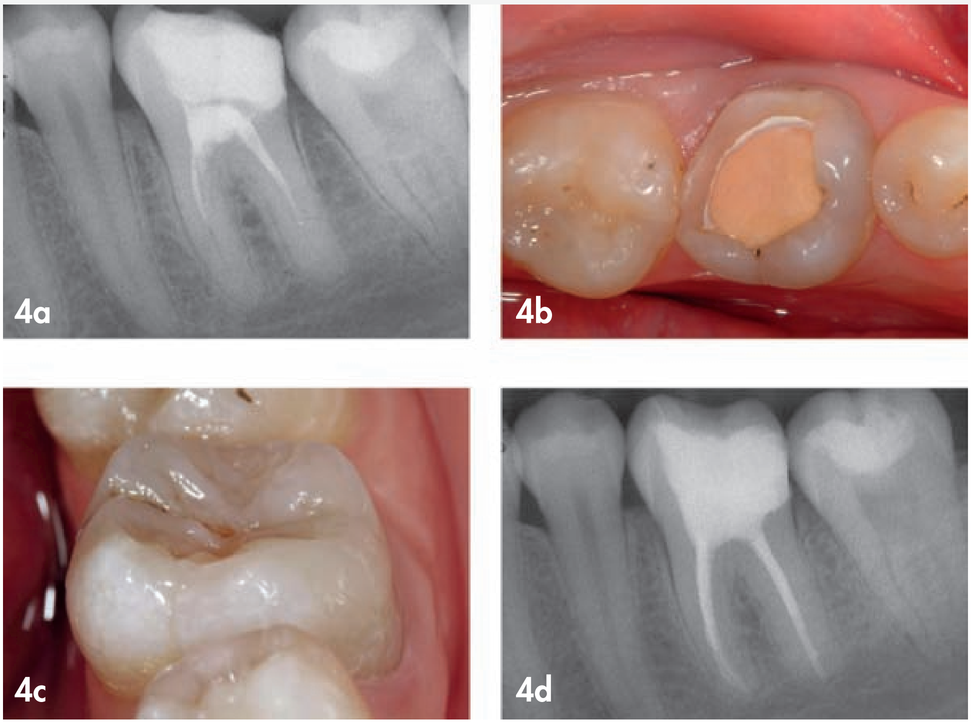


Figure 4: Restoration without posts or crown of a severely decayed first molar. Radiological situation (a) and clinical (b) following the elevation of the distal margin by direct adhesive restoration. Clinical (c) and radiological (d) situation after laying an indirect composite resin onlay (sealing of the onlay done in the Geneva Student University Clinic with Philippe Beuret).

to apply the adhesive system to the dentine immediately following the dental preparation (Magne, 2005).

In addition to demonstrating an adhesive quality that is superior to that of the traditional technique, the IDS assures a multitude of protective functions during and subsequent to the provisional phase and avoids the use of anaesthetic for the final restoration test, as well as facilitating the occlusal adjustments after the adhesive sealing.

A methodical application of the IDS has been described (Magne, 2014), and more than 20 advantages of the technique have been listed by the author, who possesses more than 20 years' experience.

An adhesive filler such as Optibond FL represents a clear benefit for the IDS technique through its capacity to generate a consistent resin layer, whereas a non-filled resin has an insufficient depth in the convex zones of the dental preparation (Stavridakis et al, 2005).

Neither posts nor crowns: an achievable goal?

In this context, it is particularly interesting to explore the possibility of completely abandoning the use of posts and crowns, even in the case of extreme situations. Clinical data appears very favourable (Walls, 1995c; Magne et al, 2000; Magne and Magne, 2005b). This approach has been used by the author for over 20 years with major implications including both the medico-biological aspect (specifically, the saving of the healthy tissues and the maintenance of the tooth vitality) and the socio-economic context (namely the reduction of costs when compared to the traditional, more invasive, prosthetic approach).

The bases of the concept 'neither posts nor crowns' have also been documented in an experimental and numerical manner (Magne and Douglas,1999). For teeth having a significant loss of coronary tissue (Figures 4 and 5), a traditional treatment by prosthetic crowns involves the removal of large quantities of intact dental substance (Edelhoff and Sorensen, 2002a; Edelhoff and Sorensen, 2002b), with potentially negative effects on the biomechanical coronary and the periodontal tissues (the necessity for a clinical elongation of the crown for short teeth), as well as considerable financial consequences.

By using the adhesive system, we are able to preserve the tissues as much as possible and limit the costs. Several publications that are currently being prepared by the author

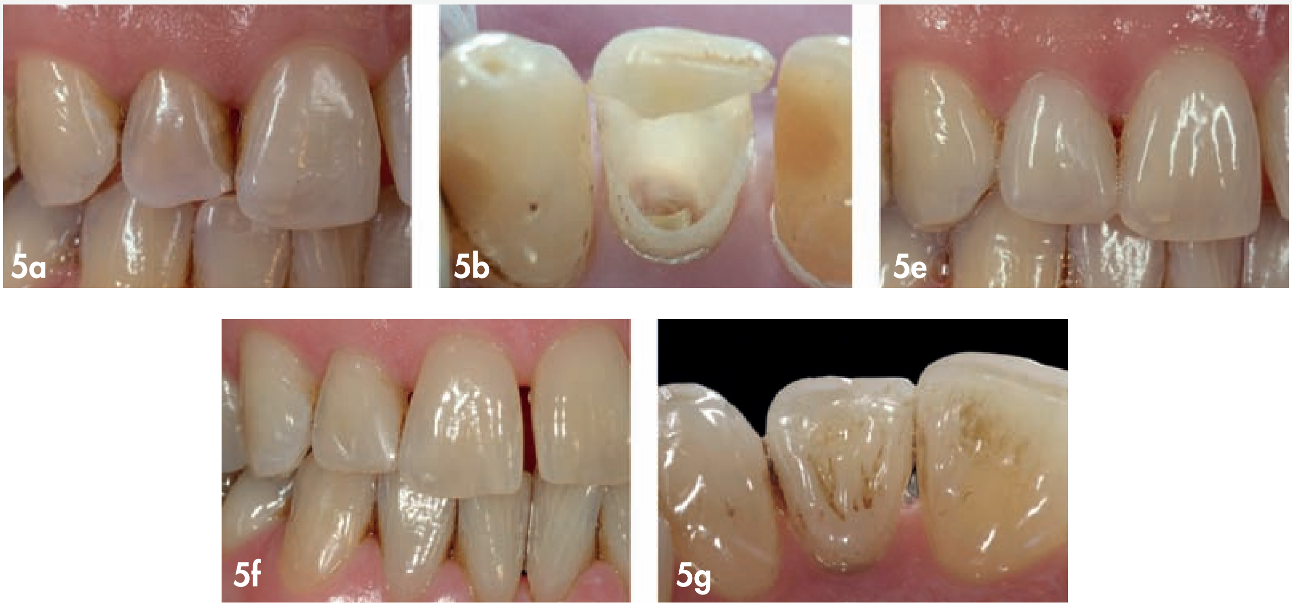


Figure 5: Long-term monitoring of a case of lateral incisive treated with neither post nor crown. Initial situation on 1994 (a, b). Tooth UL4 is devitalised, discoloured and presents considerable decay (b). Clinical situation following internal whitening and direct adhesive restoration (c). Follow-up at 11 years from the buccal view (d) and lingual view (e). The restoration is still functioning today more than 20 years later (2015).

and his research team also prove that the utilisation of root posts is unnecessary, even when the anterior or posterior teeth entirely lack the dental banding effect.

It has also been shown that in the case of complications, adhesive restorations are generally replaced or repaired very economically in sharp contrast to prosthetic crown failure, which often necessitates costly major ductal surgery or extraction (Smales and Berekally, 2007).

Lastly, the adhesive technique sometimes enables the saving of teeth at great risk, especially when it concerns very submucosal carious lesions. In this case, the use of the elevation of deep margins technique is suggested (Dietschi and Spreafico, 1998; Magne and Spreafico, 2012; Kielbassa and Philipp, 2015).

In the case of indirect restorations (Figure 4), the technique is applied in conjunction with the IDS, thus facilitating the impression (especially the numerical impression), isolation, and placement of the final restoration.

Restorative materials: a secondary choice

Once adhesion is mastered, the choice of the type of restorative material would seem to become of secondary importance. Indeed, the decision to use either ceramics or composite resin must not be based purely on the physical properties and mechanical performances of the materials.

Their position on the dental arch and the type of antagonist teeth are also critical elements. For posterior teeth, numerous in vitro researches into resistance to fatigue have clearly demonstrated the superiority of high performance polymers (HPP) and materials based on lithium disilicate (Schlichting et al, 2011; Magne et al, 2010).

The astonishing performance of composite resin CAD/CAM blocks justifies the use of the initialism HPP in order to differentiate them from hand stratified restorations, which can present intercalary deficiencies and porosities.

A CAD/CAM block can be manufactured in much better conditions using, for example, heat and pressure. The mechanical properties are potentially improved, giving them an astonishing combination of resilience (principal property of the dentine) and resistance to wear (property attributed to the enamel).

Equally, the HPPs have numerous practical advantages

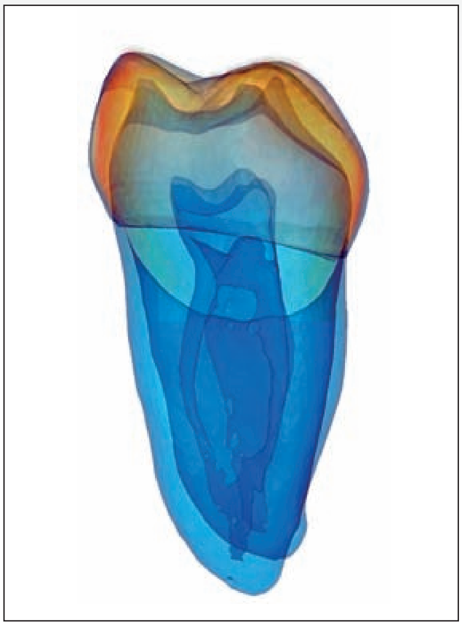


Figure 6: Natural teeth can be used as databanks in the form of stereolithographic files, which allow the three-dimensional impression of prosthetic structures.

compared to ceramic, such as the speed of machining (no additional firing), machining in fine layers (Tsitrou and van Noort, 2008), reduced wear of milling instruments, and a lower risk of fracture during occlusal adjustments before sealing (Magne et al, 2011).

Lastly, the resins have a chameleon effect (they combine very naturally with the dental tissues) (Fasbinder et al, 2005). The price to pay is the progressive loss of the form and texture of the surface, which doesn't occur with ceramic.

Another advantage of ceramic is this marvellous surface finish (if it's obtained in an appropriate manner), which facilitates hygiene and maintenance. Given that the clinical performances of the HPPs and ceramic are very similar, it is important to apply good sense and to thus use ceramic when the existing antagonist is in ceramic, in order to have a better collective resistance to wear.

When the antagonist tooth is intact, composite resins should be considered, as they offer the best resistance to total wear (material and antagonist) (Kunzelmann et al, 2001). As far as anterior teeth are concerned, there is no doubt that porcelain is the ideal material for indirect veneers.

The CAD/CAM revolution

Today, it is clear that CAD/CAM is much more than a simple restoration tool. It is also a diagnostic tool (Kurbad and Kurbad, 2013; Reiz et al, 2014), a prognosis tool (Zaruba et al, 2014), and above all, a fantastic platform for the biomimetic approach.

It is equally a research tool without parallel because the design and restoration quality can be highly standardised (Magne and Knezevic, 2009). Lastly, it is a necessary tool in the development of virtual dental patients or VDP (Delong et al, 2002), which allows a complete image of the clinical data and the ability to access additional data, otherwise inaccessible, on the patient himself.

The rapid prototyping techniques combined with 3D printing techniques enable the generation of pre-stratified restorations, based on the database, which includes not only the dental morphology but equally the thickness of the dentino-enamel layers (Figure 6).

Now that it has been clearly established that the ideal materials are the natural tooth, the enamel and the dentine, it is possible to envisage totally innovative approaches.

A recently published article revealed that it was possible to produce a natural restoration from a wisdom tooth provided by a donor (Schlichting et al, 2014). The trick was to position the natural crown (ideally) in the milling chamber to avoid any occlusal adjustment whilst having a perfect match with the preparation. This was able to be done thanks to CAD/CAM.

This breakthrough opens the door to other total biomimetic solutions, including on implants etc. Ironically, while millions of dollars are being spent on stem cell research to produce a biomimetic tooth in a petri dish, countless wisdom teeth are extracted and eliminated every day – teeth that could be recycled and used to produce 100% biomimetic restorations.

Conclusion

Using the scientific method, but also applying experience and good sense, it is now possible to offer our patients minimally invasive restorative solutions when we base ourselves on the biomimetic approach.

A total mastery of bonding techniques as well as the implementation of new CAD/CAM tools has permitted the progressive elimination of the old concepts based on mechanical retention and the type of resistance of dental preparations.

References

Bazos P, Magne P (2011) Bio-emulation: biomimetically emulating nature utilizing a histoanatomic approach; structural analysis. Eur J Esthet Dent 6(1): 8-19

WHY EXTRACT A TOOTH WHEN YOU CAN SAVE IT

- Preserves pulp and promotes pulpal healing
- Pure Tri-calcium Silicate
- Hydrophilic
- Proven clinical results*
- A bioactive bioceramic**

Biodentine®

A BIOACTIVE DENTIN REPLACEMENT

A SAFE & EFFECTIVE WAY TO REGENERATE AND SAVE PULP*

*Burgess J. et al.: Mechanical and Physical Properties of Vital Pulp Materials. Poster, AADR, Tampa 2012.

**About I.: Bioactivity of Biodentine®: A Ca3SiO5-based Dentin Substitute. Oral session, IADR Congress, Barcelona 2010.

Strassler H. et al.: Compressive Deflection of Composite Layered on Biodentine and Two Bases. Poster, AADR, Tampa 2012.

septodont

Septodont.com
From the manufacturer of Septanest®
anesthetics · materials · endodontics · infection control

HENRY SCHEIN® DENTAL

Orders 0800 808 855 www.henryschein.co.nz

HENRY SCHEIN® Rely on Us™

Orders 1300 65 88 22 www.henryschein.com.au

Bazos P, Magne P (2014) Bio-emulation: biomimetically emulating nature utilizing a histoanatomic approach; visual synthesis. Int J Esthet Dent 9(3): 330-352

Bouillaguet S, Degrange M, Cattani M et al (2002) Bonding to dentin achieved by general practitioners. Schweiz Monatsschr Zahnmed 112(10): 1006-1011

Calvet D, Mas JL, Algra A. et al (2014) Carotid stenting: is there an operator effect? A pooled analysis from the carotid stenting trialists' collaboration. Stroke 45(2): 527-532

Carvalho RM, Santiago SL, Fernandes CA et al (2000) Effects of prism orientation on tensile strength of enamel. J Adhes Dent 2(4): 251-257

Delong R, Ko CC, Anderson GC et al (2002) Comparing maximum intercuspal contacts of virtual dental patients and mounted dental casts. J Prosthet Dent 88(6): 622-630

De Munck J, Mine A, Poitevin A et al (2012) Metaanalytical review of parameter involved in dentin bonding. J Dent Res 91(4): 351-357

Dietschi D, Spreafico R (1998) Current clinical concepts for adhesive cementation of tooth-colored posterior restorations. Pract Periodontics Aesthet Dent 10(1):47-54

Edelhoff D, Sorensen JA (2002a) Tooth structure removal associated with various preparation designs for anterior teeth. J Prosthet Dent 87(5):503-509

Edelhoff D, Sorensen JA (2002b) Tooth structure removal associated with various preparation designs for posterior teeth. Int J Periodontics Restorative Dent 22(3): 241-249

Endo T, Osada T, Finger WJ et al (2007) Effect of oxygen inhibition of self-etching adhesives on enamel-dentin polymer bond. J Adhes Dent 9(1): 33-38

Fasbinder DJ, Dennison JB, Heys DR et al (2005) The clinical performance of CAD/CAM generated composite inlays. J Am Dent Assoc 136(12): 1714- 1723

Hugo B, Lussi A, Hotz P (1992) The preparation of enamel margin beveling in proximal cavities. Schweiz Monatsschr Zahnmed 102(10): 1181-1188

Jardel V, Degrange M, Picard B et al (1999) Correlation of topography to bond strength of etched ceramic. Int J Prosthodont 12(1): 59-64

Kemoli AM, van Amerongen WE, Opinya G (2009) Influence of the experience of operator and assistant on the survival rate of proximal ART restorations: two-year results. Eur Arch Paediatr Dent 10(4):227- 232

Kielbassa AM, Philipp F (2015) Restoring proximal cavities of molars using the proximal box elevation technique: Systematic review and report of a case. Quintessence Int 46(9): 751-764

Korioth TW, Versluis A (1997) Modeling the mechanical behavior of the jaws and their related structures by finite element (FE) analysis. Crit Rev Oral Biol Med 8(1): 90-104

Kunzelmann KH, Jelen B, Mehl A et al (2001) Wear evaluation of MZ100 compared to ceramic CAD/ CAM materials. Int J Comput Dent 4(3): 171-184

Kurbad A, Kurbad S (2013) Cerec Smile Design – a software tool for the enhancement of restorations in the esthetic zone. Int J Comput Dent 16(3): 255-269

Lin CP, Douglas WH (1994) Structure-property relations and crack resistance at the bovine dentinenamel junction. J Dent Res 73(5): 1072-1078

Magne P, Magne M (2005a) Treatment of extended anterior crown fractures using Type IIIA bonded porcelain restorations. J Calif Dent Assoc 33(5): 387-396

Magne P (2005b) Immediate dentin sealing: a fundamental procedure for indirect bonded restorations. J Esthet Restor Dent 17(3): 144-54; discussion 155

Magne P (2006) Composite resins and bonded porcelain: the postamalgam era? J Calif Dent Assoc 34(2):135-147

Magne P (2014) IDS: Immediate Dentin Sealing (IDS) for tooth preparations. J Adhes Dent 16(6):594

Magne P, Cascione D (2006) Influence of postetching cleaning and connecting porcelain on the microtensile bond strength of composite resin to feldspathic porcelain. J Prosthet Dent 96(5): 354-361

Magne P, Douglas WH (1999) Rationalization of esthetic restorative dentistry based on biomimetics. J Esthet Dent 11(1):5-15

Magne P, Goldberg J, Edelhoff D et al (2016) Composite Resin Core buildups with and without post for the restoration of endodontically treated molars without ferrule. Oper Dent 41(1): 64-75

Magne P, Knezevic A (2009) Simulated fatigue resistance of composite resin versus porcelain CAD/ CAM overlay restorations on endodontically treated molars. Quintessence Int 40(2): 125-133

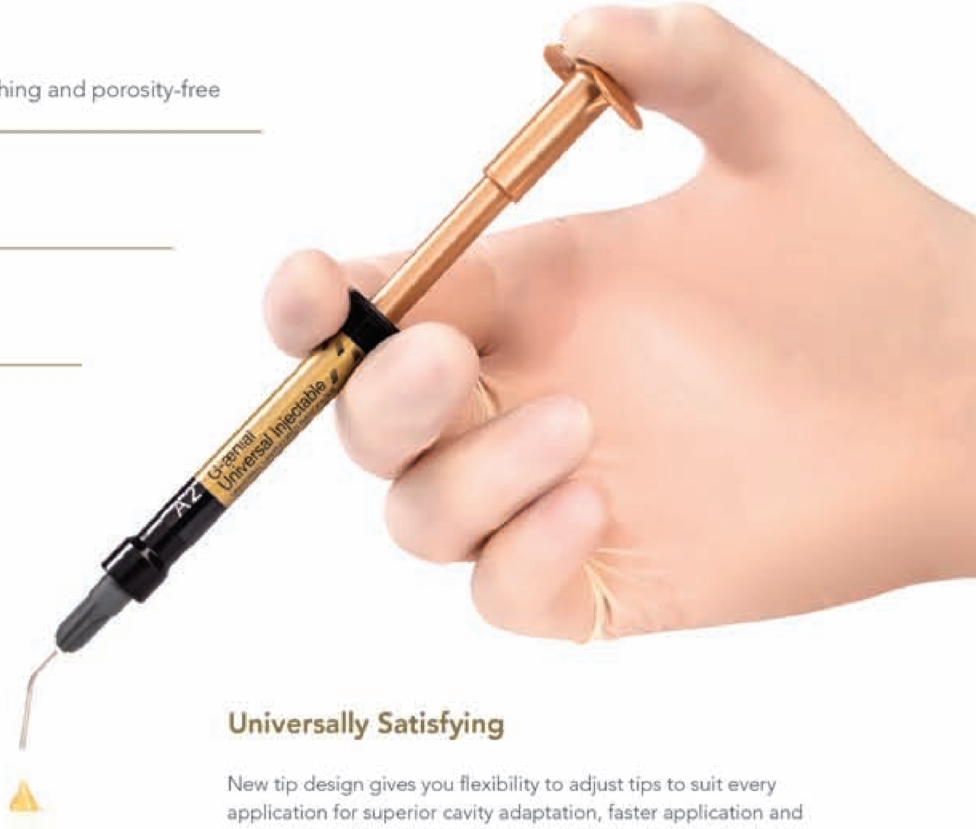
Magne P, Magne M (2005b) Treatment of extended anterior crown fractures using TypeIIIA bonded porcelain restorations. J Calif Dent Assoc 33(5):387- 396

Magne P, Perroud R, Hodges JS et al (2000) Clinical performance of novel-design porcelain veneers for the recovery of coronal volume and length. Int J Periodontics Restorative Dent 20(5): 440-457

Magne P, Schlichting LH, Maia HP et al (2010) In vitro fatigue resistance of CAD/CAM composite resin and ceramic posterior occlusal veneers. J Prosthet Dent 104(3):

NEW G-ænial® Universal Injectable

Discover the absolute genius behind our strongest universal composite ever



Amazing characteristics
Full strength, beautiful aesthetics, self polishing and porosity-free

Work faster
With direct injection delivery

High radiopacity
252%Al for optimal diagnostic contrast

Adapt, shape & contour
All at once as you inject with effortless extrusion

No wastage
Use just the amount you need

Total control
No slumping, no stringing, more stackable

Now available in 2 x syringe pack shades A1, A2, A3

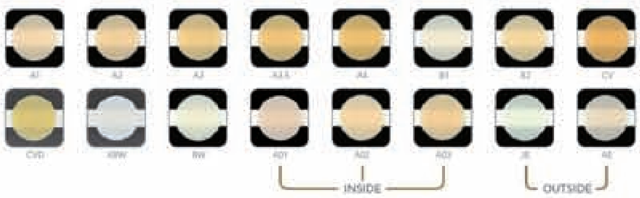
Available in shades: XBW, BW, A1, A2, A3, A3.5, A4, B1, B2 CV, CVD, AO1, AO2, AO3, JE, AE

Dispensing tip refill long needle x 20

Despensing tip refill regular needle x 20

Universally Satisfying

New tip design gives you flexibility to adjust tips to suit every application for superior cavity adaptation, faster application and greater control. Highly aesthetic restorations can be achieved using a single shade or multi-shade layering technique.



www.gcaustralasia.com

Since 1921

HENRY SCHEIN® DENTAL
Orders 0800 808 855 www.henryschein.co.nz

HENRY SCHEIN® Rely on Us
Orders 1300 65 88 22 www.henryschein.com.au

149-157

Magne P, Schlichting LH, Paranhos MP (2011) Risk of onlay fracture during pre-cementation functional occlusal tapping. Dent Mater 27(9): 942-947

Magne P, Spreafico RC (2012) Deep margin elevation: a paradigm shift. Am J Esthet Dent 2: 86

Magne P, Versluis A, Douglas WH (1999) Rationalization of incisor shape: experimental numerical analysis. J Prosthet Dent 81(3): 345-355

Pecie R, Onisor I, Krejci I et al (2013) Marginal adaptation of direct class II composite restorations with different cavity liners. Oper Dent 38(6): E210- 220

Reiz SD, Neugebauer J, Karapetian VE et al (2014) Cerec meets Galileos – integrated implantology for completely virtual implant planning. Int J Comput Dent 7(2): 145-157

Roulet JF, Söderholm KJ, Longmate J (1995) Effects of treatment and storage conditions on ceramic/ composite bond strength. J Dent Res 74(1): 381-387

Schlichting LH, Maia HP, Baratieri LN et al (2011) Novel-design ultra-thin CAD/CAM composite resin and ceramic occlusal veneers for the treatment of severe dental erosion. J Prosthet Dent 105(4):217-226

Schlichting LH, Schlichting KK, Stanley K et al (2014) An approach to biomimetics: the natural CAD/CAM restoration: a clinical report. J Prosthet Dent 111(2): 107-115

Shawkat ES, Shortall AC, Addison O et al (2009) Oxygen inhibition and incremental layer bond strengths of resin composites. Dent Mater 25(11): 1338-1346

Simonsen RJ (1991) New materials on the horizon. J Am Dent Assoc 122(7): 24-31

Smales RJ, Berekally TL (2007) Long-term survival of direct and indirect restorations placed for the treatment of advanced tooth wear. Eur J Prosthodont Restor Dent 15(1): 2-6

Stavridakis MM, Krejci I, Magne P (2005) Immediate dentin sealing of onlay preparations: thickness of pre-cured dentin bonding agent and effect of surface cleaning. Oper Dent 30(6):747-757

Tsitrou EA, van Noort R (2008) Minimal preparation designs for single posterior indirect prostheses with the use of the Cerec system. Int J Comput Dent 11(3- 4): 227-240

Unlu N, Gunal S, Ulker M et al (2012) Influence of operator experience on in vitro bond strength of dentin adhesives. J Adhes Dent 14(3): 223-227

Urabe I, Nakajima S, Sano H et al (2000) Physical properties of the dentine namel junction region. Am J Dent 13(3): 129-135

Van Landuyt KL, Cardoso MV, De Munck J et al (2009) Optimization of the concentration of photoinitiator in a one-step self-etch adhesive. Dent Mater 25(8): 982-988

Verkamp J (2010) Why we should stop proving a parachute works in a RCT. Eur Arch Paediatr Dent 11(5): 216

Walls AW (1995a) The use of adhesively retained all-porcelain veneers during the management of fractured and worn anterior teeth: Part 1. Clinical technique. Br Dent J 178(9): 333-336

Walls AW (1995b) The use of adhesively retained all-porcelain veneers during the management of fractured and worn anterior teeth: Part 2. Clinical results after 5 years of follow-up. Br Dent J 178(9): 337-340

Walls AW (1995c) The use of adhesively retained all-porcelain veneers during the management of fractured and worn anterior teeth: Part 2. Clinical results after 5 years of follow-up. Br Dent J 178(9): 337-340

Zaruba M, Ender A, Mehl A (2014) New applications for three-dimensional follow-up and quality control using optical impression systems and OraCheck. Int J Comput Dent 17(1): 53-64

Reprinted by ADT October 2018

Vital pulp therapy with bioceramic cement in two immature, traumatized teeth

Marga Ree[1]

Introduction

If pulp vitality in a young, permanent tooth is lost before root formation is completed, the clinician is confronted with a tooth that is more prone to fracture in case of a trauma, due to the presence of a root with very thin dentinal walls. In addition, the affected tooth might exhibit a poor crown-root ratio. Therefore, it is of utmost importance that pulp vitality should be preserved in an immature tooth with pulp involvement.

According to the definition of the AAE, the American Association of Endodontists, vital pulp therapy is a procedure to encourage apexogenesis.

The requirements for a successful vital pulp therapy are a the presence of a non-inflamed or a reversibly-inflamed pulp, the ability the control the hemorrhage, the use of a biocompatible and bioactive pulp capping material and the creation of a bacteria-tight seal.

Over the course of time, several materials have been used as pulp capping agents. Calcium hydroxide has traditionally been the material of choice, followed by Mineral Trioxide Aggregate (MTA). MTA is described as a first generation bioactive material. It has many advantages, but also some disadvantages.[1, 2] The initial setting time is at least 3 hours. It is not easy to manipulate, resulting in considerable wasted material, and is hard to remove. Clinically, both gray and white MTA stain dentin, presumably due to the heavy metal content of the material or the inclusion of blood pigment while setting.[3, 4] Efforts have been made to overcome these shortcomings with new compositions of MTA[5-7] or with additives.[8, 9] However, these formulations affect MTA's physical and mechanical characteristics.

Bioceramics are inorganic, non-metallic, biocompatible materials that have similar mechanical properties as the hard tissues they are replacing or repairing. They are chemically stable, non-corrosive, and interaction well with organic tissue. Bioceramic materials used in endodontics can be categorized by composition, setting mechanism and consistency. There are sealers and pastes, developed for use with gutta-percha, and putties, designed for use as the sole material, comparable to MTA. Biodentine™ is a calcium silicate cement that was developed as a dentine substitute in deep cavities. Comparable to MTA, Biodentine™ is biocompatible and in contact with vital tissues it has been demonstrated to be bioactive and suitable to be used as a pulp capping agent.[10, 11, 12] It has a higher compressive strength than MTA[12] and most glass ionomer cements, a higher flexural strength and flexural modulus than MTA Angelus[12] and can be applied in a bulk on dentin without any conditioning.[13, 14] The material sets in 12 minutes and is capable to withstand deterioration when used as a temporary filling for up to 6 months.[15]

In the opinion of the author, bioceramic materials have several advantages over MTA. In general, bioceramic materials have better clinical handling properties. The difficulties in handling of MTA have been frequently reported by clinicians.[16] Another drawback of MTA is the potential for staining dentin, which has been shown in several in vitro studies,[4, 17, 18] clinical investigations[19, 20] and case reports,[3, 21] which have shown that both white and gray MTA cause discoloration. To date, there have been no reports of staining of dentin by Biodentine™ or comparable bioceramic products, which has also been the experience of the author.

[1] Marga Ree DDS, MSc
Private Practice limited to Endodontics, Purmerend, Netherlands

Figure 1a: Preoperative radiograph of #21 showing an immature tooth with an open apex and a complicated crown fracture.
Figure 1b: Clinical picture showing a complicated crown fracture in #21.

Several studies report that bismuth oxide, which acts as a radiopacifier in MTA as a radiopacifier,[22, 23] may increase the cytotoxicity of MTA, because bismuth oxide does not encourage cell proliferation in cell culture.[24] Biodentine™ contains zirconium oxide as opacifier.

Case reports

Patient #1 was a 7-year old female who suffered a traumatic dental injury to tooth #21 three days earlier. Her main complaints were sensitivity to warm and cold, and her medical history was noncontributory. Clinical examination revealed a crown fracture with pulp exposure of tooth #21 (Fig. 1a). Radiographically, #21 had an open apex and no peri-apical pathosis (Fig. 1b). The diagnosis was a complicated crown fracture with reversible pulpitis of tooth #21

Treatment options were discussed with the patient and her parents, and a partial pulpotomy was selected as the treatment of choice. The fragment was stored by her parents, but due to the subgingival fracture site (Fig. 1c) and missing tooth structure in the fragment itself (Fig. 1d), it was not possible to re-attach the fragment to the tooth. Local anesthesia was administered (Septanest N, Septodont, Saint-Maur-des-Fossés, France) and a partial pulpotomy was carried out with a new diamond bur in a high speed handpiece with copious water cooling. Since it was not possible to apply a rubber dam, utmost care was taken to keep a dry field and prevent saliva to contaminate the pulp tissue after the Cvek pulpotomy. A cotton pellet soaked in

Figure 1c: The palatal aspect of the fracture site, covered with plaque.

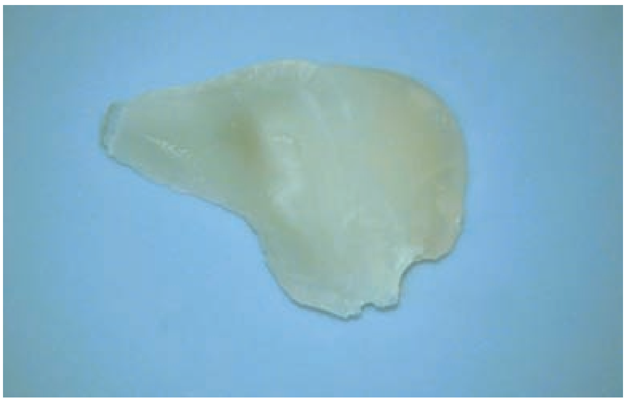


Figure 1d: Photograph of the fragment, showing an oblique fracture line with the palatal outline below the gum line

Figure 1e: After a partial pulpotomy was carried out, a cotton pellet soaked in NaOCl 5% was applied to the pulp stump to stop the bleeding.
Figure 1f: Clinical picture showing the hemorrhage was controlled.
Figure 1g: Biodentine was used as a pulp capping material.

Figure 1h: Postoperative radiograph of the pulp cap with Biodentine, showing a material with moderate radiopacity.
Figure 1i: After one week, the Biodentine had not washed out.
Figure 1j: A retraction cord was packed into the sulcus to obtain a dry field and expose the subgingival margin of the palatal fracture site.

Figure 1k: Postoperative radiograph showing the teeth restored with composite resin.
Figure 1l: Clinical picture of the restoration of composite core material layered with a micro-filled composite at the buccal site.
Figure 1m - n: Recall radiograph at 6 and 12 months, showing continued root formation.

sodium hypochlorite 5% was applied on the pulp stump with moderate pressure (Fig. 1e). After five minutes, the bleeding had stopped (Fig. 1f), and Biodentine™ (Septodont, Saint-Maur-des-Fossés, France) was applied as a pulp capping material to a thickness of approximately 3 mm with a Dovgan MTA carrier (Hartzell and Son, Concord, CA) (Fig. 1g-h). After the material had set in approximately 20 minutes, it was used as a temporary restoration. This is one of the advantages of the use of Biodentine™ over MTA, and makes it the material of choice in these type of cases. The patient was rescheduled for a second visit. After one week, the patient returned and was asymptomatic. The Biodentine™

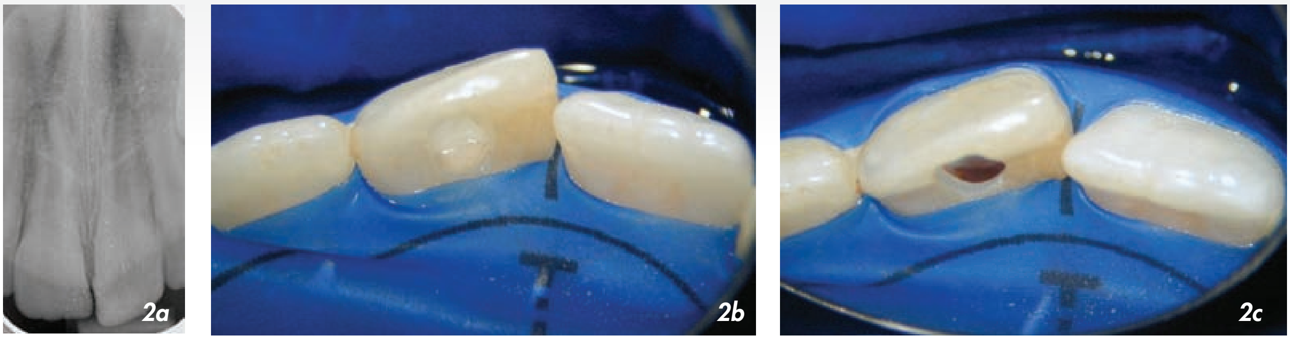
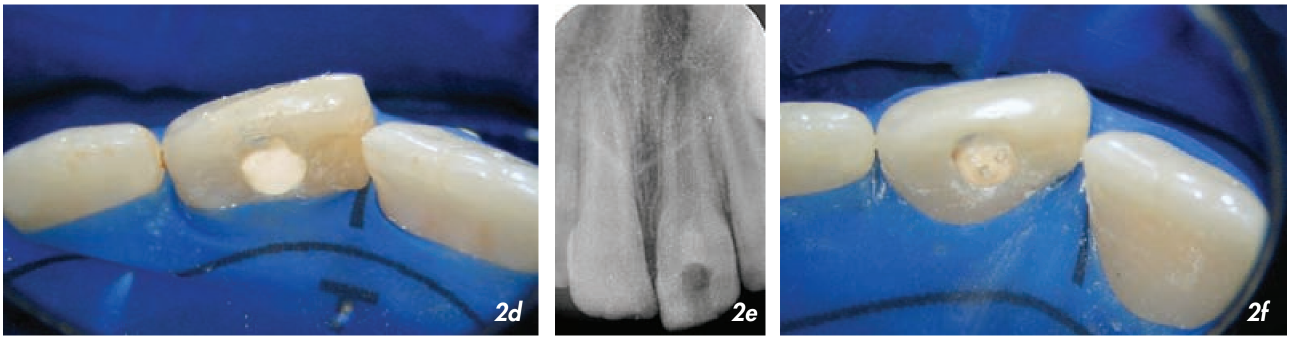


Figure 2a: Preoperative radiograph of 21 showing a class IV restoration of composite resin and an immature root with an open apex.
Figure 2b: After a partial pulpotomy was carried out, a cotton pellet soaked in NaOCl 5% was applied to the pulp stump to stop the bleeding.
Figure 2c: After a couple of minutes, the bleeding had stopped, which is indicative of healthy pulp tissue.



Figures 2d - e: Biodentine was used as a pulp capping material.
Figure 2f: Photograph of the set Biodentine.

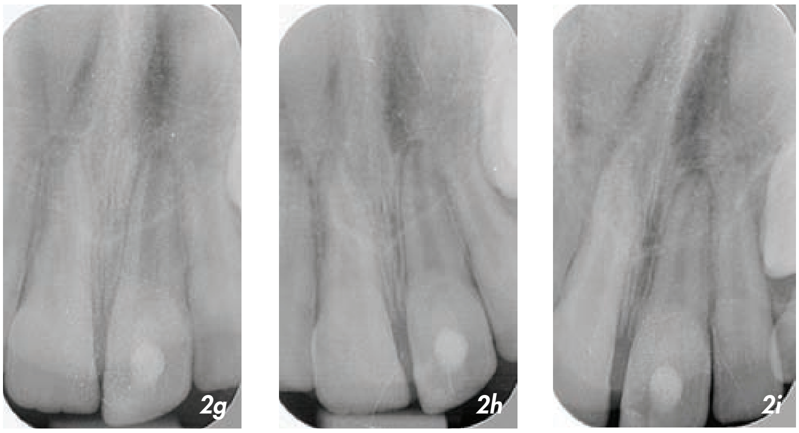
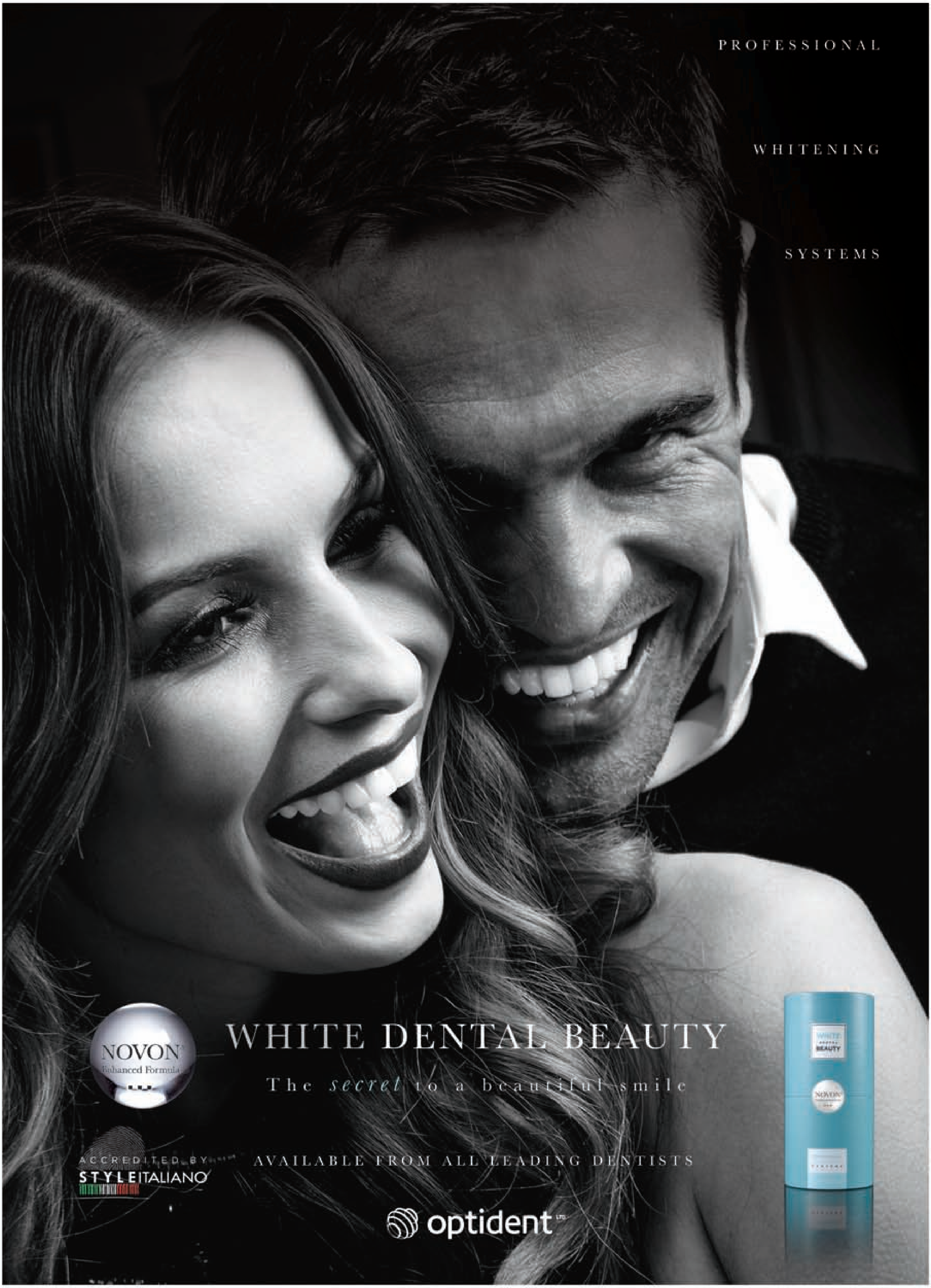


Figure 2g: Postoperative radiograph showing the pulp-capped tooth restored with a composite resin.
Figure 2h-i: At 6 and 18 months respectively, the patient was asymptomatic and the recall radiographs showed continued root development.

had fully set and had not washed out (Fig. 1i). A gingivectomy was carried out, and a retraction cord (Gingibraid, van R, Oxnard, CA, USA) was packed into the sulcus (Fig. 1j). Then a build-up of composite core material was placed (Luxacore; DMG, Hamburg, Germany), which was cut back on the buccal site and layered with a micro-filled composite (Filtek Supreme Ultra Universal Restorative, 3M ESPE, St. Paul, MN, USA) (Fig. 1k-l). Follow-up after 6 (Fig. 1m) and 12 months (Fig. 1n) showed a healthy tooth in full function with continuous root development.

Patient #2 was an 8-year old male who was referred for advice and possible treatment of tooth #21. His medical


PROFESSIONAL
WHITENING
SYSTEMS
NOVON
Enhanced Formula
WHITE DENTAL BEAUTY
The *secret* to a beautiful smile
ACCREDITED BY
STYLE ITALIANO
AVAILABLE FROM ALL LEADING DENTISTS
optident

history was noncontributory. Some months ago, he sustained an uncomplicated crown fracture of # 21. His dentist made a restoration of composite resin, that had to be replaced 5 times, because it came loose every single time. For one week, the patient had experienced severe sensitivity to hot and cold food and drinks. Clinical testing confirmed that tooth #21 was very sensitive to cold. A radiographic examination revealed that #21 had an open apex and no peri-apical pathosis (Fig. 2a). The diagnosis was an uncomplicated crown fracture with a reversible pulpitis in tooth #21.

Treatment options were discussed with the patient and his parents, and a partial pulpotomy was selected as the treatment of choice. Local anesthesia was administered (Septanest N, Septodont, Saint-Maur-des-Fossés, France), rubber dam was applied (Optradam, Ivoclar Vivadent, Schaan, Lichtenstein) and a partial pulpotomy was carried out with a new diamond bur in a high speed handpiece with copious water cooling. A cotton pellet soaked in sodium hypochlorite 5% was applied on the pulp stump with moderate pressure (Fig. 2b). After five minutes, the bleeding had stopped (Fig. 2c), and Biodentine™ (Septodont, Saint-Maur-des-Fossés, France) was applied as a pulp capping material to a thickness of several mm with a Dovgan MTA carrier (Hartzell and Son, Concord, CA) (Fig. 2d-e). A moist cotton pellet was introduced on top of the Biodentine™, the access cavity was filled with a temporary filing, and the patient was rescheduled for a second appointment. After a week the patient returned asymptomatic. The Biodentine™ had fully set (Fig. 2f) and a build-up of composite core material was placed in the endodontic access cavity (Luxacore; DMG, Hamburg, Germany), with a top layer of a hybrid composite (Tetric Ceram, Ivoclar Vivadent, Schaan, Lichtenstein) (Fig. 2g). At the 6-month (Fig. 2h) and 18-month recall (Fig. 2i), the tooth was asymptomatic and showed apical maturation and continuous root development.

Conclusion

The author has presented 2 cases in which Biodentine™ was successfully used as a pulp capping material in an immature tooth with pulp involvement. In both cases, treatment provided elimination of symptoms and continuation of root formation. In addition, no signs of discoloration were noticed after 6, 12 and 18 months respectively.

References

1. Parirokh M, Torabinejad M. Mineral Trioxide Aggregate: a comprehensive literature review Part II – Leakage and biocompatibility investigations. J Endod 2010 Feb; 36 (2): 190-202.
2. Parirokh M, Torabinejad M. Mineral Trioxide Aggregate: a comprehensive literature review Part I – Chemical, physical and antibacterial properties. J Endod 2010 Jan; 36(1): 16-17.
3. Belobrov I, Parashos P. Treatment of tooth discoloration after the use of white mineral trioxide aggregate. J Endod 2011 Jul;37(7):1017-20.
4. Akbari M, Rouhani A, Samiee S, Jafarzadeh H. Effect of dentin bonding agent on the prevention of tooth discoloration produced by mineral trioxide aggregate. Int J Dent. 2012;2012:563203.
5. Antunes Bortoluzzi E, Juárez Broon N, Antonio Hungaro Duarte M, de Oliveira Demarchi AC, Monteiro Bramante C. The use of a setting accelerator and its effect on pH and calcium ion release of mineral trioxide aggregate and white Portland cement. J Endod 2006;32:1194–7.
6. Wiltbank KB, Schwartz SA, Schindler WG. Effect of selected accelerants on the physical properties of mineral trioxide aggregate and Portland cement. J Endod 2007;33: 1235–8.
7. Ber BS, Hatton JF, Stewart GP. Chemical modification of ProRoot MTA to improve handling characteristics and decrease setting time. J Endod 2007;33:1231–4.
8. Kogan P, He J, Glickman GN, Watanabe I. The effects of various additives on setting properties of MTA. J Endod 2006;32:569–72.
9. Jafarnia B, Jiang J, He J, Wang YH, Safavi KE, Zhu Q. Evaluation of cytotoxicity of MTA employing various additives. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2009;107:73944.
10. Shayegan A, Jurysta C, Atash R, Petein M, Abbeele AV. Biodentine used as a pulp-capping agent in primary pig teeth. Pediatr Dent. 2012 Nov-Dec;34(7):e202-8.
11. Nowicka A, Lipski M, Parafiniuk M, Sporniak-Tutak K, Lichota D, Kosierkiewicz A, Kaczmarek W, Buczkowska-Radlińska J. Response of human dental pulp capped with biodentine and mineral trioxide aggregate. J Endod. 2013 Jun;39(6):743-7.
12. Natale LC, Rodrigues MC, Xavier TA, Simões A, de Souza DN, Braga RR. Ion release and mechanical properties of calcium silicate and calcium hydroxide materials used for pulp capping. Int Endod J. 2014 Mar 20.
13. Laurent P, Camps J, De Méo M, Déjou J, About I.

Induction of specific cell responses to a Ca(3)SiO(5)-based posterior restorative material. Dent Mater. 2008 Nov;24(11):1486-94

14. Raskin A, Eschrich G, Dejou J, About I. In vitro microleakage of Biodentine as a dentin substitute compared to Fuji II LC in cervical lining restorations. J Adhes Dent. 2012 Dec;14(6):535-42.

15. Koubi G, Colon P, Franquin JC, Hartmann A, Richard G, Faure MO, Lambert G. Clinical evaluation of the performance and safety of a new dentine substitute,Biodentine, in the restoration of posterior teeth - a prospective study. Clin Oral Investig. 2013 Jan;17(1):243-9.

16. Parirokh M, Torabinejad M. Mineral Trioxide Aggregate: a comprehensive literature review Part III – Clinical applications, drawbacks and mechanisms of action. J Endod 2010 Mar; 36 (3): 400-13.

17. Boutsioukis C, Noula G, Lambrianidis T. Ex vivo study of the efficiency of two techniques for the removal of mineral trioxide aggregate used as a root canal filling material. J Endod 2008 Oct;34(10):1239-42.

18. Jang JH, Kang M, Ahn S, Kim S, Kim W, Kim Y, Kim E. Tooth discoloration after the use of new pozzolan cement (Endocem) and mineral trioxide aggregate and the effects of internal bleaching. J Endod 2013 Dec;39(12):1598-602.

19. Maroto M, Barbería E, Vera V, García-Godoy F. Dentin bridge formation after white mineral trioxide aggregate (white MTA) pulpotomies in primary molars. Am J Dent. 2006;19:75–79.

20. Percinoto C, de Castro AM, Pinto LM. Clinical and radiographic evaluation of pulpotomies employing calcium hydroxide and trioxide mineral aggregate. Gen Dent. 2006;54:258–261.

21. Jacobovitz M, de Lima RK. Treatment of inflammatory internal root resorption with mineral trioxide aggregate: a case report. Int Endod J. 2008 Oct;41(10):905-12.

22. Camilleri J, Montesin FE, Brady K, Sweeney R, Curtis RV, Ford TR. The constitution of mineral trioxide aggregate. Dent Mater. 2005 Apr;21(4):297-303.

23. Park JW, Hong SH, Kim JH, Lee SJ, Shin SJ. X-Ray diffraction analysis of white ProRoot MTA and Diadent BioAggregate. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2010 Jan;109(1):155-8.

24. Camilleri J, Montesin FE, Papaioannou S, McDonald F, Pitt Ford TR. Biocompatibility of two commercial forms of mineral trioxide aggregate. Int Endod J. 2004 Oct;37(10):699-704

Mandibular first molar with four canals in the mesial root

Hamed Karkehabadi[1], Ricardo Machado[2] and Lucas da Fonseca Roberti Garcia[3]

Abstract
A 35-year-old female patient with intermittent pain in the lower right jaw was referred to the dental practice. The right mandibular first molar did not respond to thermal testing and the patient reported moderate pain to percussion and palpation in the region of this tooth. Radiographic findings confirmed the presence of periradicular disease and previous root canal treatment. Initially, only four treated canals were found (two mesial and two distal) Two extra canals were found in the mesial root. The treatment was performed and the success confirmed after 12 months. This case report reiterates the complexity of mandibular first molar variation and is intended to reinforce the clinicians' need to be aware of the variable morphology of root canals in this tooth.

Introduction

The goal of endodontic treatment is to clean and shape the root canal system and obturate it in all its dimensions (Almeida et al, 2015). Before starting treatment, aberrant root or root canal morphology should be investigated, detected and adequately treated (Lea et al, 2014). Failure to recognise any unusual canal configuration could eventually lead to an unsuccessful treatment outcome (Almeida et al, 2015; Lea et al, 2014; Ghoddusi et al, 2007). Thus, the proper knowledge of the root and root canal morphology, along with any related anatomical variations, is essential to achieve a successful treatment (Almeida et al, 2015; Lea et al, 2014; Ghoddusi et al, 2007)

Mandibular first molars are the teeth that most require endodontic treatment, as they are the first posterior teeth to erupt in permanent dentition (Ghoddusi et al, 2007). Although mandibular first molars usually have two canals in the mesial root, named as mesiobuccal and mesiolingual canals, the presence of a middle mesial canal in the developmental groove has been widely reported in 1 % (Vertucci, 1964), 1.5% (Martinez-Berna and Badanelli, 1983), 2.1 % (Fabra-Campos, 1985), 2.6% (Fabra-Campos, 1989), 12% (Pomeranz et al, 1981), I4.7% (Akbarzadeh et al, 2017), 15% (Goel et al, 1991) and 18.6% (Versiani et al, 2016) of the cases. In addition, mandibular first molars may have one or two canals in the distal root (Ghoddusi et al, 2007).

As reported in several studies, the prevalence of a middle mesial canal in mandibular first molars may significantly range among researches. Clinical studies and case reports that demonstrated the presence of negotiable middle mesial canals present different data from studies which used extracted teeth model (Vertucci, 1984; Martinez-Berna and Badanelli, 1983; Fabra-Campos, 1985; Fabra-Campos, 1989; Pomeranz et al, 1981, Akbarzadeh et al, 2017; Goel et al, 1991; Versiani et al, 2016).

To the best of the authors' knowledge, just one case has ever been reported in the scientific literature of a mandibular first molar with four canals in the mesial root (Reeh, 1998) In this particular case, the author reported a successful endodontic retreatment of a mandibular first molar with seven canals, where the other three canals were located

[1] Hamed Karkehabadi
Department of endodontics, dental school, Hamadan University of Medical Sciences, Hamadan, Iran

[2] Ricardo Machado
Clinical practice limited to endodontics in Navegantes, Santa Catarina, Brazil

[3] Lucas da Fonseca Roberti Garcia
Department of dentistry - endodontics division, Federal University of Santa Catarina, Florian6polis, Santa Catarina, Brazil

Case Report 1

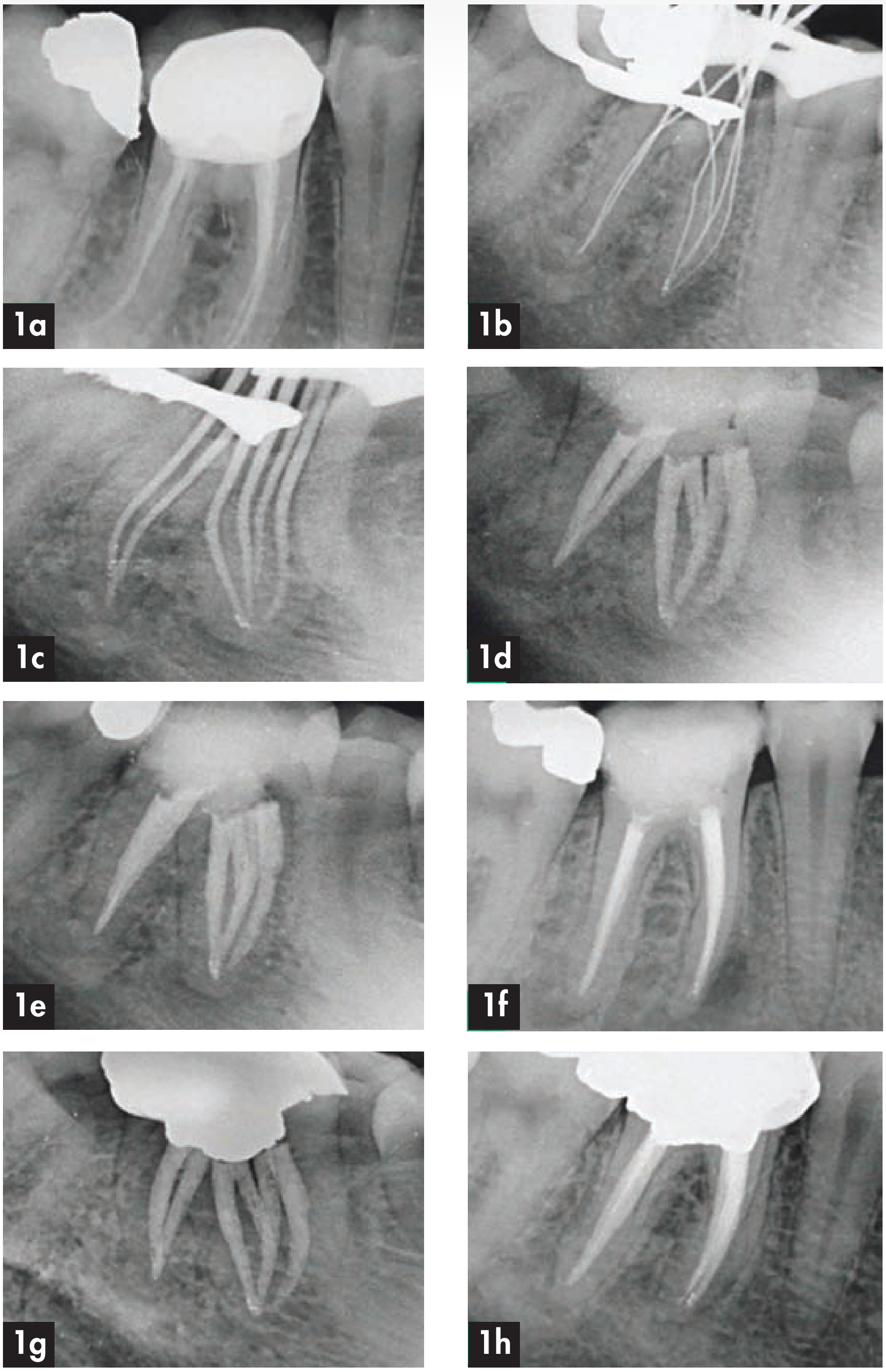


Figure 1: Initial radiograph (a); Radiographic working length confirmation (b); Radiograph of main cones (c); Final radiographs (d-f); Radiographs of 12-month follow-up (g and h).

in the distal root. Initially, the clinician failed to detect the complexity of the root canal system of this tooth, and only three canals were treated endodontically. Such factors demonstrate the importance of knowing the root canal system morphology and its anatomical variations (Reeh, 1998). Furthermore, according to the author of the case report, looking for additional canals was crucial for a successful outcome (Reeh, 1998).

Therefore, the aim of this article is to report a clinical case of a mandibular first molar with four canals in the mesial root, and two canals in the distal root. All canals were properly prepared and filled, and the success of the treatment was confirmed after 12 months by clinical and radiographic findings.

Case report

A 35-year-old female patient, with a history of intermittent prior to being seen, was referred to the dental practice. Medical history was non-contributory. The right mandibular first molar did not respond to thermal testing (heated gutta percha and dry ice), and the patient reported moderate pain to percussion and palpation in the region of this tooth. Furthermore, the tooth had a total crown and there was no significant probing depth. Radiographic findings confirmed the presence of periradicular disease and previous root canal treatment (Figure la). Correlation of clinical and radiographic findings led to a diagnosis of a chronic periradicular abscess due to previous unsuccessful endodontic treatment. Therefore, a nonsurgical root canal retreatment was recommended.

After administrating infiltration anaesthesia (Lidocaine 2% 1:80.000 epinephrine), the crown was removed, and rubber dam isolation of the operative area was performed. An endodontic access cavity was prepared by using 1016HL and Endo Z burs (Dentsply Sirona), and four previously treated root canals were found. Removal of root canal filling was performed using a Neoniti Al size 20 file (Neolix, Châtres-la-Forêt, France). After careful analysis of the floor of the pulp chamber, two additional root canals were found in the mesial root, totalling four canals in this root. Initially, extra canals were explored with a size 10 k-file (Mani, Inc; Tochigi, Japan) under copious irrigation with 5.25% sodium hypochlorite solution (Chloraxid, Cerkamed, Poland). Next, the working length of each root canal was established 1mm up to the apical foramen, using an electronic apex locator (Root ZX, Morita, Tokyo,Japan). A radiograph was then taken to confirm the measurements (Figure 1b). The chemo-mechanical preparation was performed using the crown-down technique, with the Neoniti system (Neolix). The first four root canals found (MB1, MLl, DB and DL) were prepared up to a Neoniti Al size 25 file (Neolix). The two additional root canals found in the mesial root (MB2 and ML2) were prepared up to a Neoniti Al size 20 file. Irrigation was performed with 2.5 ml of 5.25% sodium hypochlorite solution (Chloraxid) at each change of file, using a 30-gauge, open-ended needle (Navitip; Ultradent, South Jordan, UT, USA) placed slightly short of the binding point. After a final rinse with MTAD (Dentsply Tulsa, USA), the root canals were dried with sterile absorbent paper points (Dentsply Sirona, Ballaigues, Switzerland) and a radiograph was taken of the main cones to confirm if they reach the working length (Figure lc). Afterwards, the canals were filled with gutta percha (Dentsply Sirona, Ballaigues, Switzerland) and AH Plus sealer (Dentsply Sirona, Ballaigues, Switzerland), using the lateral condensation technique. The pulp chamber was properly cleaned to remove the excess of gutta percha and sealer, and was temporarily restored with a provisional material (Figures 1d -1f).

Clinical and radiographic findings, as no painful symptomatology and regression of the periapical lesion, confirmed the success of the proposed therapy. Continued follow-up over 12 months has shown a positive outcome from endodontic perspective (Figures lg and lh).

Discussion

The prevention and treatment of apical periodontitis are the main objectives of endodontic therapy (Siqueira and Rôças, 2008). An adequate biomechanical preparation and filling of the root canal system, associated to the placement of a proper coronal sealing, are crucial and should be taken to achieve this goal (Gillen et al, 2011). Furthermore, all these steps performed during the treatment require a good understanding of root canal anatomy to attain a successful outcome (Reeh, 1998).

The purpose of this article was to present the case report of a mandibular first molar clearly showing the presence of four canals in the mesial root, and two canals in the distal root. The patient was referred to the dental practice, because of the persistent symptoms after the first endodontic treatment, at which time, only four root canals were located and treated (two in the mesial root and two in the distal root).

The clinician should keep in mind that the internal morphology of the teeth does not always follow the known standards (Almeida et al, 2015; Lea et al, 2014). In this clinical case, the incomplete debridement of the six root canals probably was the cause for the occurrence and perpetuation of the periradicular disease (Reeh, 1998). Once all the root canals were located and could be properly negotiated, shaped and cleaned, the symptoms disappeared, and a 12-month follow-up X-ray showed the

consistent healing of the periapical alveolar bone. To locate additional root canals can be a challenging procedure for professionals. For this reason, the findings reported in this clinical case highlight how important it is to have a good understanding of the canal anatomic complexities to achieve effective disinfection of the root canal system (Siqueira and Rôças, 2008).

The clinician should always suspect the presence of additional root canals, and investigate further when examining radiographs and/or locating and exploring the canals (Johal, 2001). Although there are inherent limitations, radiographic examination provides a clue to the type of canal configuration present (Hildebolt et al, 1990).

Previous reports have continuously used imaging technologies, such as spiral computed tomography (SCT) (Gopikrishna et al, 2006; Aggarwal et al, 2009) and conebeam computed tomography (CBCT) (Almeida et al, 2015; Lea et al, 2014), as an adjunctive tool for detection and management of variable root canal morphology. These imaging technologies may be helpful in detecting variations of root canals in doubtful circumstances related to unusual root canal anatomy (Gopikrishna et al, 2006; Aggarwal et al, 2009; Almeida et al, 2015; Lea et al, 2014). Although these imaging modalities offer an insight into the anatomical variations of the root or root canal configuration, they also potentially increase the effective dose of radiation exposure for the patient , often limiting their use (Patel et al, 2009).

The ALARA (as low as reasonably achievable) principle states that every effort should be made by professionals to keep the patient's exposure to ionising radiation as low as practically possible (Farman, 2005). As reported in the present clinical case, the use of radiographic examination associated to an adequate clinical inspection of the floor of the pulp chamber were enough to depict the variable anatomy clearly. For this reason, advanced imaging techniques (SCT and CBCT) did not have to be used to solve this clinical case.

It is also valid to emphasise that several other types of equipment, such as operative microscopes, may be used to facilitate the location and negotiation of additional root canals, significantly improving the quality of the endodontic the successful endodontic treatment of a maxillary first premolar with three root canals, with the aid of an optical microscope. The authors stated that the use of such technology was fundamental to detect the location of the third root canal, due to the complex internal anatomy of the tooth (Relvas et al, 2013) .

This article provides useful clinical information for performing endodontic therapy in a very complex case, thus contributing to the awareness of another anatomic variant of mandibular molars.

Conclusions

Reports of cases with unusual morphology have an important didactic value. Their documentation may facilitate the recognition and successful management of similar cases, which may require endodontic therapy. This case report reiterates the complexity of mandibular first molar variation and is intended to reinforce the clinicians' need to be aware of the variable morphology of root canals in this tooth.

References

Aggarwal VL, Singla M, Logani A, Shah N (2009). Endodontic management of a maxillary first molar with two palatal canals with the aid of spiral computed tomography: a case report. Endod 35;137-9

Akbarzadeh N, Aminoshariae A, Khalighinejad N, Palomo JM, Syed A, Kulild JC, Sadeghi G, Mickel A (2017) The Association between the Anatomic Landmarks of the Pulp Chamber Floor and the Prevalence of Middle Mesial Canals in Mandibular First Molars: An In Vivo Analysis.) Endod 43: 1797-1801

Almeida G, Machado R, Sanches Cunha R, Vansan LP. Neelakantan P (2015). Maxillary first molar with 8 root canals detected by CBCT scanning a case report Gen Dent 63:68-70

Fabra-Campos H (1985) Unusual root anatomy of mandibular first molars.) Endod 11 :568-72

Fabra-Campos H (1989) Three canals in the mesial root of mandibular first permanent molars: a clinical study. lnt Endod) 22:39-43

Ghoddusi J, Naghavi N, Zarei M, Rohani E (2007) Mandibular first molar with four distal canals. JEndod Dec 33: 1481-3

Goel NK, Gill KS, Taneja JR (1991). Study of root canals configuration in mandibular first permanent molar.) Indian Soc Pedod Prev Dent 8: 12-4

Lea C, Deblinger J, Machado R, Nogueira Leal Silva EJ, Vansan LP (2014). Maxillary premolar with four separate canals.) Endod 40:591-3

Martinez-Berna A, Badanelli P (1983). Investigacion clinica de molars inferiors con cinco conductos. Boletin de InformaCion Dental 43:27-31

Pomeranz HH, Eidelman DL, Goldberg MG (1981). Treatment considerations of the middle mesial canal of mandibular first and second molars.) Endod 7:565-8

Reeh ES1998. Seven canals in a lower first molar.) Endod 24:497-9

Siqueira JF Jr, Rôças IN (2008). Clinical implications and microbiology of bacterial persistence after treatment procedures.) Endod 34:1291-301

Gillen BM, Looney Sw, Gu LS, Loushine BA, Weller RN, Loushine RJ, Pashley DH, Tay FR (2011) Impact of the quality of coronal restoration versus the quality of root canal fillings on success of root canal treatment: a systematic review and meta-analysis.) Endod 37:895-902

Gopikrishna VL, Bhargavi N, Kandaswamy D (2006). Endodontic management of a maxillary first molar with a single root and a single canal diagnosed with the aid of spiral CT: a case report.) Endod 32:687-91

Hildebolt CF, Vannier MW, Pilgram TK, Shrout MK (1990). Quantitative evaluation of digital dental radiograph imaging systems. OralSurg Oral Med Oral Pathol 70:661-8

Johal S (2001). Unusual maxillary first molar with 2 palatal canals within a single root: a case report. Can Dent Assoe 67:211 -4

Patel S, Dawood A, Whaites E, Pitt Ford T (2009). New dimensions in endodontic imaging: part 1. Conventional and alternative radiographic systems.lnt Endod) 42:447-62

Farman AG (2005) ALARA still applies. OralSurg Oral Med Oral Pathol Oral Radiol Endod 100:395-7

Relvas JB, de Carvalho FM, Marques AA, Sponchiado EC Jr, Garcia Lda F (2013) Endodontic treatment of maxillary premolar with three root canals using optical microscope and NiTi rotatory files system. Case Rep Dent 2013:71 0408

Versiani MA, Ordinola-Zapata R, Keles A, Alcin H, Bramante CM, Pecora JD, Sousa-Neto MD (2016) Middle mesial canals in mandibular first molars: A micro-CT study in different populations. Arch Oral Biol 61: 130-7

Vertucci FJ (1984). Root canal anatomy of the human permanent teeth. Oral Surg Oral Med Oral Pathol 58:589-99

Reprinted with permission from ENDODONTIC PRACTICE August 2018

Rehabilitation of an atrophic maxilla

Andoni Jones[1]

The rehabilitation of a patient with atrophic jaws can be challenging for the dental team. Costs, healing periods, morbidity and complications can also be elevated for the patient. However, cone beam computed tomography (CBCT) and 3D implant planning software allow us to treat these patients in a less invasive and a more predictable way.

Traditionally, treatment of patients with atrophic jaws requiring implant therapy involved complex grafting procedures and extended healing periods. Many patients rejected these treatment modalities due to their high complication and morbidity rates and costs.

Since computer guided implant surgery was first introduced in 2002, digital technology has evolved into a very accurate tool. Inaccuracies in implant placement are considerably reduced, benefitting to a great extent those patients with atrophic jaws, in whom a very precise use of that limited bone for implant therapy is paramount.

This article will discuss this approach and present a case report of a 56-year-old woman with an edentulous maxilla who wanted a fixed restoration. The lack of teeth and use of a complete denture for 25 years had resulted in a considerable bone resorption.

She was treated using 3D planning and a surgical guide to place five implants that allowed us to transform her complete denture into an immediate fixed temporary restoration, and three months later she was restored with a permanent metal-ceramic fixed restoration.

Introduction

The treatment of edentulous patients with dental implants has proved to be highly successful, and a paradigm shift in the management of patients with complete dentures (Dudley 2015).

The loss of natural dentition along with the use of complete mucosa-borne dentures is related to different degrees of maxillary atrophy, on occasion making it very difficult to deliver fixed rehabilitation with implants. In the presence of an atrophic maxilla, different surgical techniques have been described for the surgical correction of such deficiencies to enable implant therapy (Sorní et al, 2005).

Sinus lifts, autogenous block grafts and guided bone regeneration procedures have been well described in the literature with good results. Nevertheless, it is a well-established fact that these complex procedures entail a high risk of surgical and postoperative complications such as infection, wound dehiscence, bone graft resorption or damage to adjacent anatomical structures (Boffano and Forouzanfar, 2014; Faverani et al, 2014).

Cost, the need for general anaesthesia, a second surgical site for bone harvesting, number of surgeries, extended healing periods and long treatment time – as well as the previously-mentioned complications – are factors that negatively impact on patient acceptance for these treatment modalities.

Since computer-guided implant surgery was introduced in 2002, the advances in 3D diagnosis and surgical and prosthetic planning allow the dental team to treat many edentulous patients in a simpler and safer way (Ganz, 2015). With this technology,

[1] Andoni Jones DDS, Private Practice, Dublin, Ireland

clinicians can accurately transfer the pre-planned position of the implants from the 3D software into the patient's mouth, having the advantage of predictably performing minimally invasive (flapless) surgery with immediate load in many cases.

With 3D implant planning software, it is possible to integrate the patient's surgical and prosthetic treatment into one single platform. Having the restorative plan on the computer screen before placing the implants is a key point in the diagnosis and execution of a prosthetically-driven implant treatment (Mora et al, 2014).

The transfer of CBCT images to 3D implant software considerably improves treatment planning, ensuring controlled implant insertion by the means of guided surgery. Doing this allows a surgical template to be created that will guide the implants into the right position, depth, angulation and orientation. Better use of the patient's existing bone can be made, thus considerably reducing the amount of patients that require complex reconstructive surgeries before implant therapy.

Case report

A 56-year-old woman, medically fit and with no allergies, wanted to replace her complete upper denture with a fixed implant restoration. On initial examination, photographs and an OPG were taken. This radiograph revealed extensive sinus pneumatization, with very little available bone for implants in the posterior regions (Figures 1 and 2).

The current complete denture met with the aesthetic criteria (incisal edge, mid line, smile line, lip support), so it was used as a reference to prosthetically guide the implant planning. To transfer her denture – and with it, the position of the teeth – into the 3D planning software (Nemoscan, Nemotec) a 'dual scan' protocol was utilised.

This involved inserting eight gutta percha markers into her denture; four in the buccal flange and four in the palate. A CBCT was taken with the patient wearing the denture, and a second CBCT was taken of the denture alone.

This allowed the 3D planning software to superimpose the denture onto the maxillary CBCT, thus showing the bony architecture, the desired position of the future teeth, and the shape of the soft tissue (this being the gap between the denture and the bone) in one single screen. A key step is to ensure the perfect adaptation and stability of the scanning appliance (in this case, the patient's denture) before taking the CBCT (Figures 3-7).

After careful examination of this CBCT, a surgical plan was made to place five implants where bone was sufficient, but still obtaining proper prosthetic support, combining two anterior implants with three posterior ones, two of which were tilted to avoid the sinus. This option, as well as alternative grafting techniques, was explained to the patient, and the decision was made to continue with this original plan.

A mucosa-borne surgical guide was prepared from this 3D planning, and used to place the implants using flapless surgery (Figures 8 and 9).

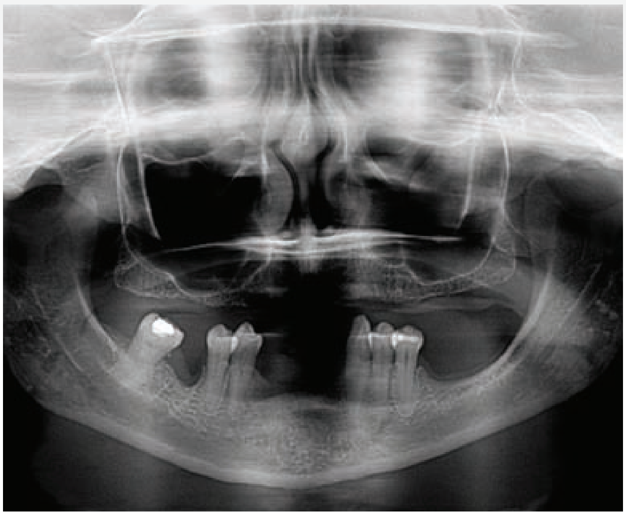
The patient took amoxicillin 2000mg two hours before the surgery, and articaine was used for anaesthesia.

The surgical guide was fitted onto the maxilla, checking its perfect adaptation by direct visualisation and tissue blanching. It was fixed to the maxilla with three titanium pins, and once in place, osteotomies as well as implant insertion were completed through the guide.

All implants achieved an insertion torque in excess of 40Ncm, and over 66 ISQ. After removing the surgical

Table 1. Implant deviation from planning to final position

Implant	Deviation at platform level (in mm)	Deviation at apex (in mm)
UR4	0.8	0.9
UR1	0.6	0.4
UL2	0.1	0.6
UL4	1	1.9
UL6	0.8	1.55



Figures 1 and 2: Preoperative OPG and intraoral view.

guide, another CBCT was taken to ensure all implants were correctly placed between the bony housing, allowing also to make a comparison between the final implant position and the 3D planning (Figures 10 and 11; Table 1).

Multiunit abutments were connected to all implants (Figure 12), using 30° angulated abutments on the tilted implants to correct the emergence and keep it in the prosthetic corridor.

The patient's conventional denture was converted into a screw-retained temporary fixed restoration (Figures 13 and 14) using titanium abutments and a pick-up technique. The patient was given a postoperative prescription of ibuprofen (400mg) for analgesia and a chlorhexidine 0.20% mouthwash, and instructed to keep a soft diet for three months.

Healing was uneventful and three months after implant placement the temporary prosthesis was unscrewed to find all five implants well integrated. The final prosthetic phase was to fabricate a screw retained metal-ceramic fixed restoration, which met with the patient's aesthetic and functional needs (Figures 15-17).

Discussion

In a society where time is important, more and more patients are looking for immediate results, reluctant to go through longer and more uncomfortable treatments.

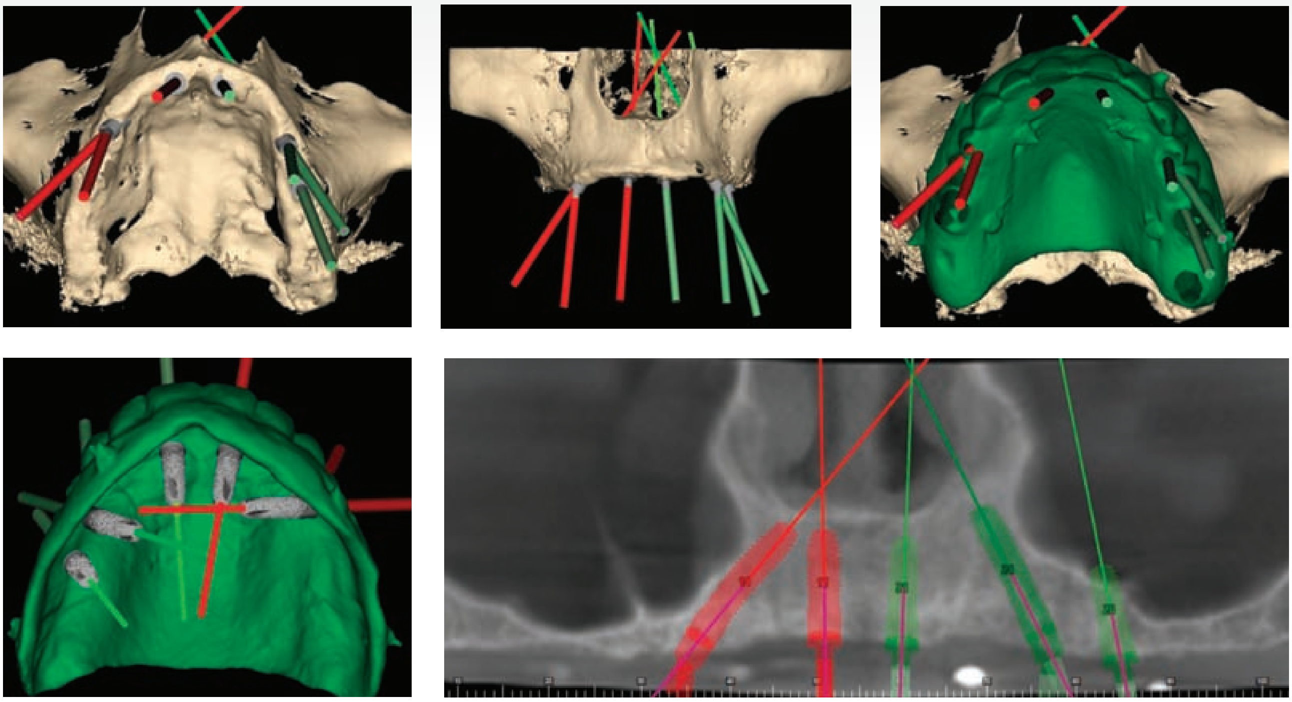
The possibility of performing the surgical and prosthetic techniques of implant dentistry in the same clinical visit represents a very effective approach that significantly reduces the treatment time and dramatically improves the patient's quality of life (Cannizzaro et al, 2008; Tarnow et al, 1997). Fewer hours spent chairside makes the experience more pleasant for the patient and less tiring for the clinician. Flapless surgery is also a very effective way of treating patients with a fear of surgery.

With no need to raise a flap or carry out suturing, postoperative pain and swelling are greatly reduced, as are recovery times (Van Steenberghe et al 2005). Intraoperative complications and bleeding are also minimised. Peri-implant tissues also benefit from flapless surgeries, as a quicker seal around the implants is possible from day one (Malo et al, 2007).

Current scientific evidence in implant dentistry has dramatically changed Brånemark's original guide for osseointegration. Immediate loading is a well-documented approach, with success rates similar to those of conventionally loading techniques (Salama et al, 1995).

For successful immediate load protocols, a number of factors must be considered. Firstly, a careful examination of the radiologic images for implant planning is key. New computer-assisted three-dimensional image technologies have revolutionised this field, allowing the implant surgeon to study the different possibilities for implant number and position for each patient in a virtual model. This way the most favourable surgical protocol can be established for each case (Marchack, 2007). Bone density can also be accurately measured in order to ensure that immediate load will be predictable (Shahlaie et al, 2003).

Another key point is implant selection. Implants with a roughened surface that will improve osseointegration, and a macro geometry that will allow high insertion torques and



Figures 3-7: Superimposition of scanned denture and the maxilla in order to prosthetically plan implant positioning.

good primary stability, are essential for immediate load.

These implants must always be splinted to provide favourable absorption and distribution of the load, and to reduce any micromovement during the healing phase.

Avoiding micromovement is paramount if immediately loaded implants are to osseointegrate, so the patient has to keep to a soft diet for at least six weeks, progressively introducing soft chewing after this period elapses.

It is well documented that an edentulous maxilla can be immediately loaded and restored with a fixed prosthesis using as few as four implants placed in strategic positions. The 'All-on- four' technique that was first described by Malo et al (2003) advocates the placement of two vertical implants in the anterior region and two more implants placed mesial to the sinus in a 30-45° angulation.

When implant placement in the posterior maxilla is not possible in a conventional way due to sinus pneumatization, this technique offers a very effective way of using the existing bone in the premaxilla to anchor the implants while still reducing distal cantilevers.

Scientific literature also supports that tilted implants have similar success to axially placed implants when they are splinted (Aparicio et al, 2001). Thus, tilted implants in the premaxilla present a very safe and predictable outcome to sinus augmentations.

An essential advantage of computer-assisted techniques is the precision with which the implants are placed. This accuracy can be measured by comparing the 3D planning with the final surgical position and angulation of the implants (Widmann and Bale, 2006).

It has been demonstrated that computer-assisted implant placement is more precise than manual insertion (Brief et al 2005). However, it is also necessary to have a minimum safety margin of 1mm from important anatomical structures, since some error can be accumulated from the transfer of the radiologic images to the 3D software, and the positioning of the surgical guide. Despite this, it is the opinion of this author that computer-assisted surgery should be considered the safest way of placing implants, since it is the technique least influenced by human error.

One study showed that an experienced surgeon can have an average of 6.1mm deviation when drilling an osteotomy manually, compared to an average of 0.5mm when using computer guided surgery (Schermeier et al, 2001).

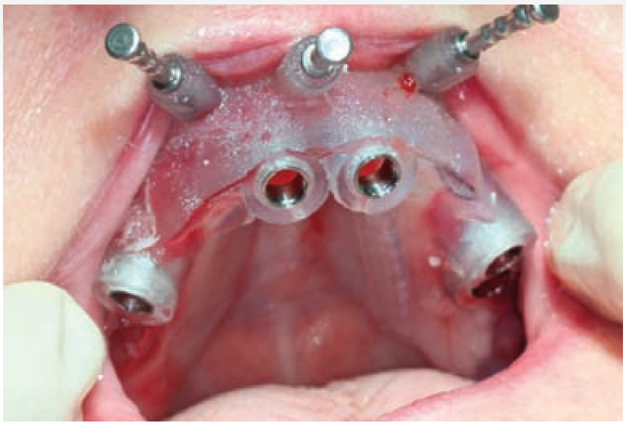


Figure 8: Surgical guide in place, fixed to the maxilla with three pins.

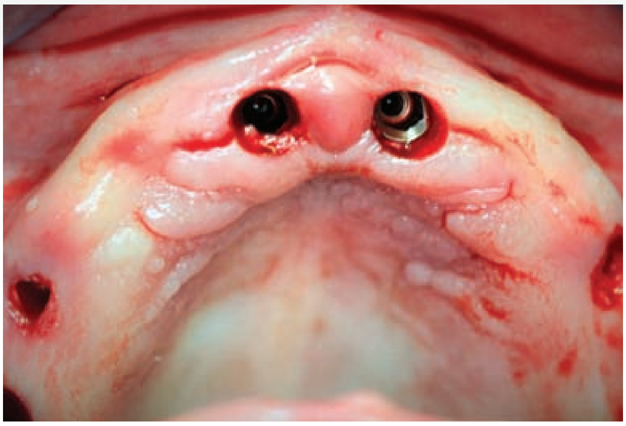


Figure 9: Implants placed without raising a flap.

Figure 10: Postoperative CBCT showing final implant position.

Another study compared implant selection and planning between conventional radiographs and 3D software, and the length of the implants was increased in 77.7% of the cases when using the 3D software (Siebegger et al, 2001).

Longer, wider implants increase the contact surface between the implant and the bone, which is a very important factor in immediate load protocols, where functional load of these implants happens before actual osseointegration occurs (Sanna et al, 2007).

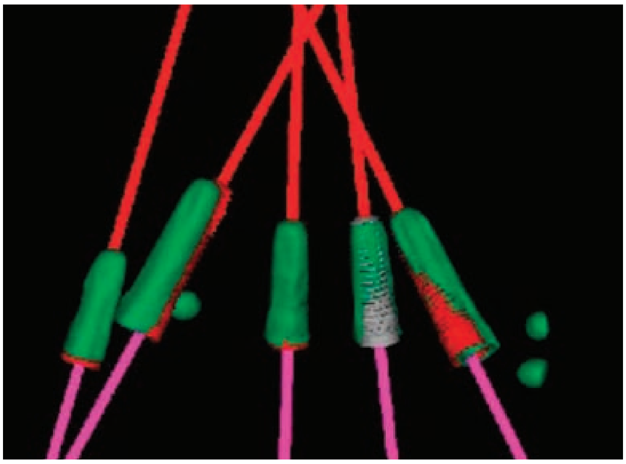


Figure 11: Comparison between final implant position (green) and 3D planning (red and grey).

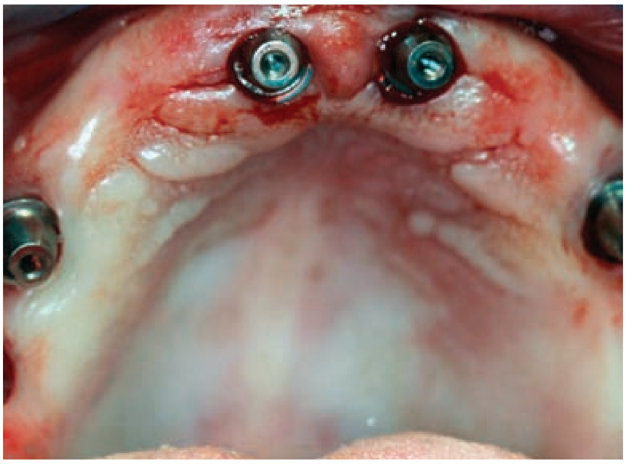


Figure 12: Multiunit abutments connected.

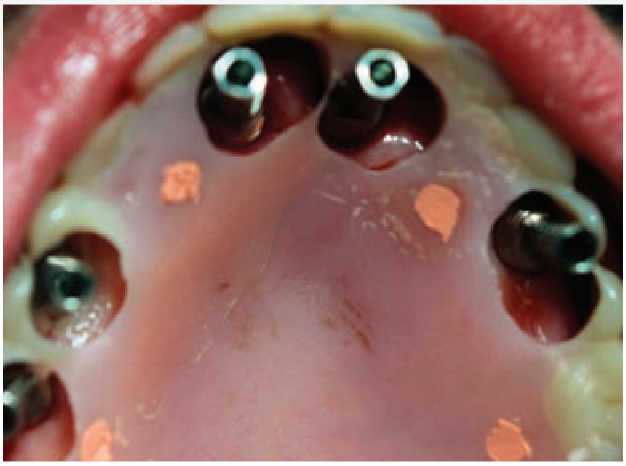


Figure 13: Transforming the complete denture into a screw retained provisional fixed prosthesis, using direct pick up technique.

Figure 14: Immediate postoperative – showing provisional restoration.

In order to achieve an accurate transfer of implant position from the virtual platform to the oral cavity – and therefore achieve successful guided surgery – a strict protocol must be adhered to. The clinician should ensure that all steps, from the scanning of the patient to the surgical placement of the implants, are carried out meticulously. The scan appliance must be perfectly adapted and thoroughly assessed – relining it intraorally if necessary – before taking the CBCT.

From here, the accuracy of the procedure is determined by the surgeon's ability and proficiency with the technology, the precision the surgical guide is made with, the compatibility and tolerance of the surgical drills and transfers and the correct fitting and fixing of the surgical drill.

It must be stressed that the stability and position of the surgical guide has to be checked during all steps of the implant surgery.

Conclusions

By reducing the number of surgeries to one, implementing immediate load protocols, and decreasing patient morbidity and complications with a minimally invasiveness philosophy, both the clinician and patient can benefit from more predictable and safer implant dentistry.

Three dimensional images help the implant surgeon plan the number, location, diameter and length of the implants. The surgical stent guides the surgery, enabling the correct and precise placement of the implants to be able to load them with a fixed restoration at the same surgical session

References

Aparicio C, Perales P, Rangert B (2001) Tilted implants as an alternative to maxillary sinus grafting: A clinical, radiologic, and periotest study. Clin Implant Dent Relat Res 3(1): 39-49

Boffano P, Forouzanfar T (2014) Current concepts on complications associated with sinus augmentation procedures. J Craniofac Surg 25(2): e210-2

Brief J, Edinger D, Hassfeld S, Eggers G (2005) Accuracy of image-guided implantology. Clin Oral Impl Res 16: 495-501

Cannizzaro G, Torchio C, Leone M (2008) Immediate versus early loading of flapless-placed implants supporting maxillary full-arch prostheses: a randomized controlled clinical trial. Eur J Oral Implantol 1: 127-39

Dudley J (2015) Implants for the ageing population. Aust Dent J 60 Suppl 1: 28-43

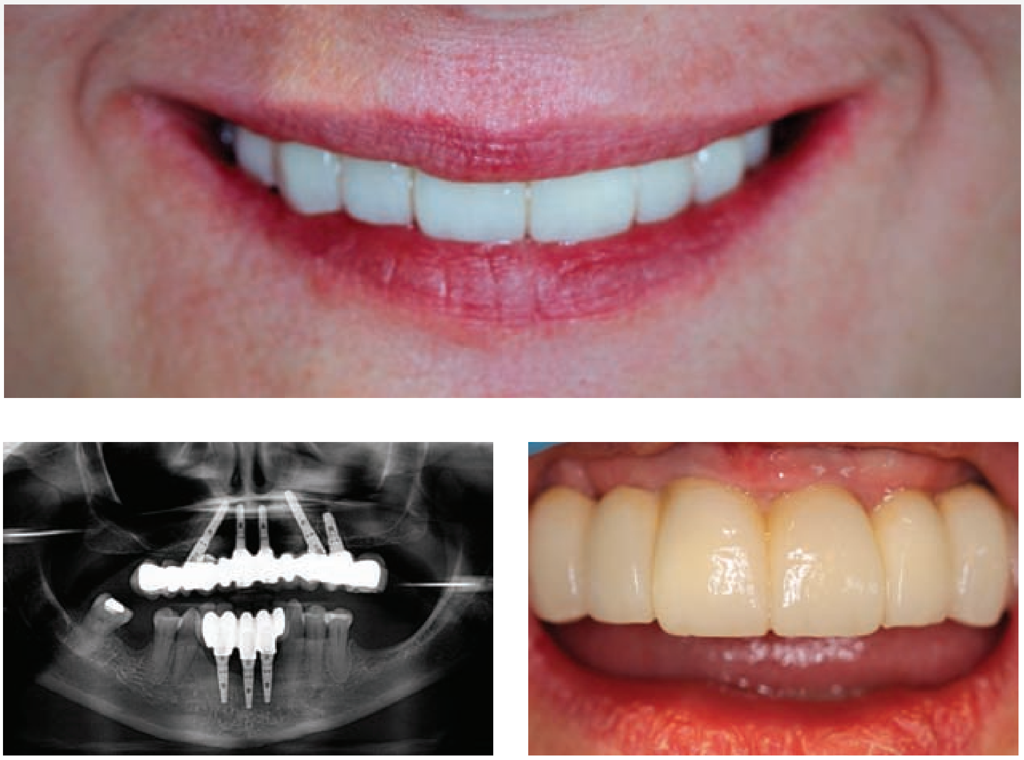
Faverani LP, Ramalho-Ferreira G, dos Santos PH, Rocha EP, García Junior IR, Pastori CM, Assuncao WG (2014) Surgical techniques for maxillary bone grafting - literature review. Rev Col Barss Cir 41(1): 61-7

Ganz SD (2015) Three-dimensional imaging and guided surgery for dental implants. Dent Clin North Am 59(2): 265-90

Malo P, Araujo M, López A (2007) The use of computer-guided flapless implant surgery and four implant placed in immediate function to support a fixed denture: preliminary results after a mean follow-up period of thirteen months. J Prosthet Dent 97: S26-S34

Malo P, Rangert B, Nobre M (2003) "All -on -Four" immediate-function concept with Branemark system implants for completely edentulous mandibles: a retrospective study. Clin Implant Dent Relat Res 5(suppl 1): 2-9

Marchack CB (2007) CAD/CAM-guided implant surgery



Figures 15-17: The final metal-ceramic screw retained prosthesis.

and fabrication of an immediately loaded prosthesis for a partially edentulous patient. J Prosthet Dent 97: 389-94

Mora, MA, Chenin DL, Arce RM (2014) Software tools and surgical guides in dental - implant - guided surgery. Dent Clin North Am 58(3): 597-626

Salama H, Rose LF, Salama M, Beos NJ (1995) Immediate loading of bilaterally splinted titanium root form implants in fixed prosthodontics: A technique reexamined. Two case reports. Int J Periodontics Restorative Dent 15(4): 344-61

Sanna AM, Molly L, Van Steenberghe D (2007) Immediately loaded CAD-CAM manufactured fixed complete dentures using flapless implant placement procedures: a cohort study of consecutive patients. J Prosthet Dent 97: 331-9

Schermeier O, Hildebrand D, Lueth T, Hein A, Szymanksy D, Bier J (2001) Accuracy of an image-guided system for oral implantology. In: Lemke HU, Vannier MW, Inamura K, Farman AG (eds). Computer- Assisted Radiology and Surgery, vol 1281; International Congress Series. New York: Elsevier 748-52

Shahlaie M, Gantes B, Schulz E, Riggs M, Crigger M (2003) Bone density assessments of dental implant sites: 1. Quantitative computed tomography. Int J Oral Maxillofac Implants 18: 224-31

Siebegger M, Schneider BT, Mischkowski RA, Lazar F, Krug B, Klesper B, Zoller JE (2001) Use of an image-guided navigation system in dental implant surgery in anatomically complex operation sites. J Cranio- Maxillofac Surg 29: 276-81

Sorní M, Guarinós J, García O, Peñarrocha M (2005) Implant rehabilitation of the atrophic upper jaw: a review of the literature since 1999. Med Oral Patol Oral Cir Bucal 10 Suppl 1: E45-56

Tarnow D, Emtiaz S, Classi A (1997) Immediate loading of threaded implants at stage 1 surgery in edentulous arches: ten consecutive case reports with 1 -to 5-year data. Int J Oral Maxillofac Implants 12: 319-24

Van Steenberghe D, Glauser R, Blomback U, Andersson M, Schutyser F, Pettersson A, Wendelhag I (2005) A computed tomographic scan-derived customized surgical template and fixed prosthesis for flapless surgery and immediate loading of implants in fully edentulous maxillae: a prospective multicenter study. Clin Implant Dent Relat Res 7 Suppl 1: S111-S120

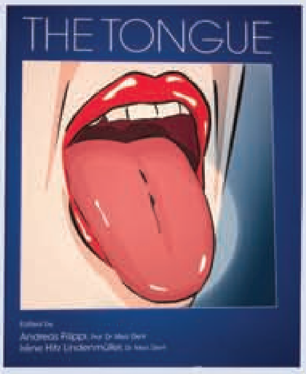
Widmann G, Bale RJ (2006) Accuracy in computer-aided implant surgery. A review. Int J Oral Maxillofac Implants. 1: 305-13

Reprinted by ADT June 2018

QUINTESSENCE
INTERNATIONAL
PUBLISHING GROUP

The Tongue

Andreas Filippi and Irène Hitz Lindenmüller

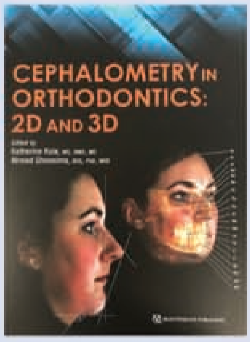


As the largest organ in the oral cavity, the tongue not only plays a primary role in masticatory and speech function—it is also a significant indicator of health, demonstrating signs of both oral pathologies and diseases that can affect the entire body. Because no health care provider gets the opportunity 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

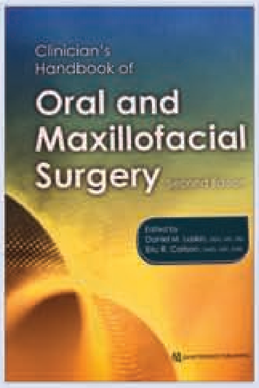


Cephalometrics has been used for decades to diagnose orthodontic problems and evaluate treatment. However, the shift from 2D to 3D radiography has left some orthodontists unsure about how to use this method effectively. This book defines and depicts all cephalometric landmarks on a skull or spine in 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.

Q-5120868 | 208pp 338 illus | **$173.09**

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.

Q-5120870 | 624pp 374 illus | **$427.76**

*Prices may vary when purchased in New Zealand

Treating white discolouration on upper front teeth: a case report

Richard Field[1]

Initial Consultation

A 27-year-old female presented requesting an improvement to her smile with reference to the white discolouration to her upper front teeth (Figures 1-2). She had an unremarkable medical history.

On extraoral examination there was:

- No apparent decay
- Temporomandibular joint non-clicking
- No pain on loading or palpitation.

Oral examination showed:

- Good general dental health
- Moderate fluorosis affecting the upper incisors
- The fluorosis was markedly worse on the upper centrals, where there was a marked white opacity
- Molar-incisal hypoplasia was ruled out due to absence of lesions on the first permanent molars (Denis, 2013).

Treatment options discussed

Enamel is the most highly mineralised tissue in the body, 96% hydroxyapatite and 4% organic fluids. In white lesions part of the mineral phase is replaced by organic fluids, however, the surface layer is constantly being re-mineralised by the saliva. This means that, histologically, white spots are characterised by hypo-mineralised subsurface enamel with a relatively intact surface layer.

As the structure of the white lesions is less mineralised and less organised than healthy enamel this causes a change in the lesions' optical properties (refractive index). Light entering the lesions is reflected back to the eye much brighter than light entering healthy enamel, giving the lesions a bright white appearance. Historically, treating white lesions in a minimally invasive way has been particularly difficult, with some practitioners advocating the extended use of minimal intervention paste, with varying success rates.

Often, if the lesions were to be covered completely, patients underwent aggressive restorative treatment plans. Recent advancements in dental technology now allows the masking of the white spots by modifying the optical properties of the white lesions through resin infiltration. Resin infiltration is a technique where the overlying mineralised layer is removed with hydrochloric acid, allowing a low viscosity resin with a similar refractive index to natural enamel to be infiltrated into the more porous and hypomineralised white lesions (Paris and Meyer-Lueckel, 2009). As the resin has a refractive index close to that of healthy enamel, once infiltrated it allows the lesions to

Dr Richard Field
Private Practice,
Bristol & London, UK.

www.drfield.co.uk

Figures 1: Initial presentation.

Figures 2: Close-up view of central incisors.

mimic the translucent properties of healthy enamel more effectively, restoring natural translucence.

It was discussed with the patient that it would be best to first approach her teeth with a minimally invasive treatment plan using a combination of home tooth whitening and, if necessary, resin infiltration. If she was not satisfied with the results then other treatment could be explored; such as resin or ceramic veneers.

The patient was advised that, before resin of superficial enamel removed infiltration, she should carry out a course of home tooth whitening. This would reduce the contrast between the white lesions and her natural tooth colour. In some cases, this is enough to achieve the aesthetic demands of the patient without resorting to further treatment with resin infiltration, as the reduction in contrast between the white lesions and natural tooth colour can make the white lesions less noticeable.

The patient was satisfied with her current tooth colour, so it was decided to go ahead with the resin infiltration treatment without home tooth whitening.

It was explained to the patient that resin infiltration would still be possible, however, the results with resin infiltration alone would not be as predictable due to the relatively dark shade of her natural teeth. It was discussed that if she wished for the best possible resolution it may be necessary to remove a thin layer of superficial enamel with a bur, in order for the resin to be able to reach the full depth of the white lesions. This would result in shallow labial defects following infiltration, which would need to be restored with thin layers of composite resin. The patient was happy with this proposed approach.

Protocol

As Icon treatment requires working with a strong acid it is important to isolate the soft tissue from the area you will be working on. Isolation was achieved from upper first molar to upper first molar with a heavy gauge non latex dental dam (Unodent) with wedgits distal to the canines as this negates the need for local anaesthetic (Figure 3).

The areas to be treated were coated with Icon Etch, which is a 15% hydrochloric acid gel, for two minutes before being washed off to leave the typical post acid etch frosted appearance (Figures 4-5).

Following rinsing and drying, the lesions were then 'previewed' using the Icon-Dry ethanol solution provided (Figure 6).

Icon-Dry has a refractive index significantly nearer to that of healthy enamel than air. Because of this, after it has been applied and allowed to penetrate the lesions for 30-40 seconds and whilst it is still wet, it enables you to preview the effect of resin infiltration on the white spot lesions. This preview allows the operator to see if the lesions have been sufficiently penetrated to thoroughly mask the white lesions. If the lesions are still visible during the application of the Icon-Dry further etch cycles are needed, if the lesions disappear it is safe to proceed to infiltration.

Initially, the process of etch, rinse and application of Icon-Dry was carried out three times with no resolution of the white lesions on the centrals (Figure 6). This was discussed with the patient and permission was granted to remove a thin layer of superficial enamel in order to access the white lesions to depth. A red band rugby ball bur was used to remove approx. 0.2-0.3mm of superficial enamel (Figure 7).

Figure 3: Teeth isolated with dental dam.

Figure 4: Icon Etch applied for two minutes.

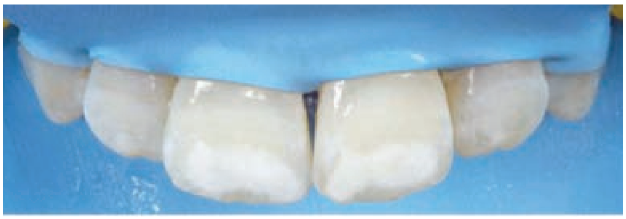


Figure 5: Post acid etch frosted appearance.

Figure 6: 'Preview' using Icon-Dry ethanol solution.

Figure 7: Approx. 0.2-0.3mm of superficial enamel removed.

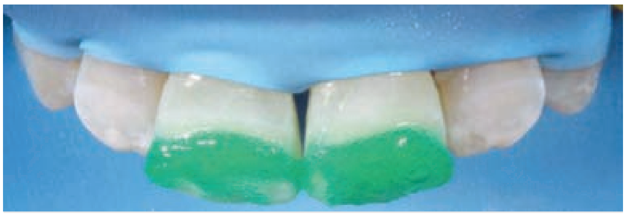


Figure 8: Further application of Icon Etch.

The process of etch, rinse and application of Icon-Dry was repeated two more times (Figure 8), until the majority of the white lesions were no longer visible following preview with the Icon-Dry ethanol solution (Figure 9).

Once satisfied with the preview stage, the teeth were dried to a frosty post-etch appearance with a further application of the Icon-Dry ethanol solution being allowed to evaporate over 60 seconds (Figure 10). The operating light was then switched off to prevent premature curing of the Icon resin and the hydrophobic Icon resin was then applied to the teeth. The resin was then left to infiltrate for three minutes and excess resin was then removed from the labial surface using a cotton wool roll. Pre cure, contacts were then flossed to prevent the teeth being bonded together. Each lesion was then light-cured for 40 seconds. This resin application process was then repeated one more time.

Immediately post cure, the Icon treatment leaves the teeth slightly rough due to excess resin being present on the surface of the teeth (Figure 11). The defect caused by the removal of superficial enamel is also still present.

According to the literature it is possible to bond to freshly cured Icon resin without further conditioning, as it exhibits its own oxygen inhibition layer (Wiegand et al, 2011). In the author's experience there is sometimes a problem with delamination around the margins of any composite resin added, which causes a problem during polishing and finishing. The literature suggests that the bond can be further strengthened though the addition of a bonding resin prior to composite addition.

A thin layer of FL bottle 2 (Kerr) was painted over the defects and cured before the addition of a thin layer of achromatic composite (3M Espe, Filtek Supreme XTE White enamel), which was cured for 40 seconds before being cured again for a further 40 seconds under a glycerine barrier. This final cure under the glycerine barrier serves to remove the sticky oxygen inhibition layer that can clog finishing and polishing instruments making them less effective (Park and Lee, 2011) (Figures 12-13).

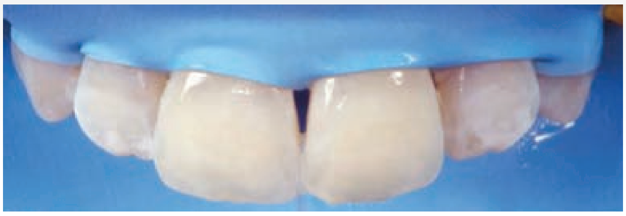


Figure 9: Final Icon-Dry 'preview'.


Figure 10: Teeth are allowed to dry.

The teeth were polished with the Astropol system (Ivoclar Vivadent) until the surface of the composite resin was smooth and any excess Icon resin had been removed. This excess resin requires removal to prevent staining.

Results

The patient was reviewed one month later and final review photos were taken (Figures 14-15). The patient was thrilled with the huge improvement that the treatment had made to her smile. This was particularly significant as she had previously been told that nothing could be done and had reluctantly accepted that she may need veneers at some stage. She was so happy that she was able to get the result she wanted in such a conservative and biologically respectful way.

References

Denis M, Atlan A, Venat E, Tirlet G, Attal JP (2013) White defects on enamel: Diagnosis and anatomopathology: Two essential factors for proper treatment (part 1). Int Orthod 11 (2): 139-65


Figure 11: Icon resin applied and cured.

Park H, Lee I (2011) Effect of glycerin on the surface hardness of composites

Paris S, Meyer-Lueckel H (2009) Masking of labial enamel white spot lesions by resin infiltration-a clinical report. Quintessence international volume 40, number 9

Wiegand A, Stawarczyk B, Kolakovic M, Hammerle CH, Attin T, Schmidlin PR (2011) Adhesive performance of a caries infiltrant on sound and demineralised enamel. Journal of Dentistry 39: 117-121.

Reprinted with permission by Private Dentistry October 2018

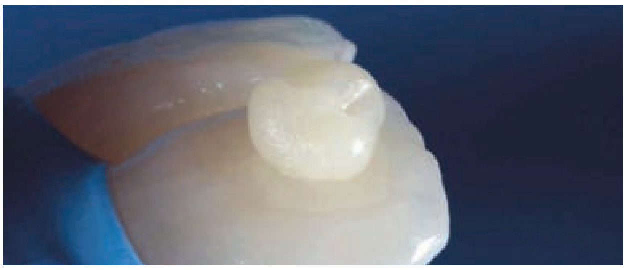


Figure 12: Addition of a layer of composite.

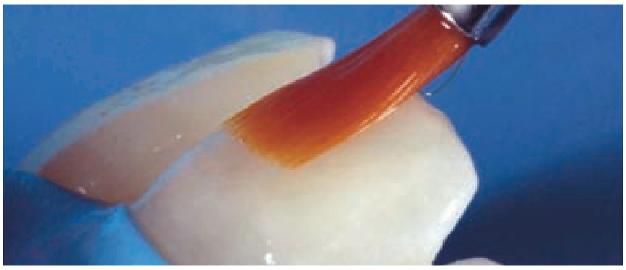


Figure 13: Applying the glycerine barrier.


Figure 14: Review at one month.


Figure 15: Review at one month, full-mouth view.

All ceramic restorations on discoloured preps

Stefan M. Roozen[1]

Lithium disilicate offers us exceptional possibilities for the fabrication of natural looking dentures.

In addition to its high degree of stability, the ability of this material to transmit light is what makes it so valuable. The ceramic shoulder on conventional metal ceramic crowns is a good example of the enormous aesthetic gains that can be obtained by increasing light transmission. For example, lithium disilicate exhibits positive cosmetic results, even when applied monolithically, as is done with fully anatomical restorations, particularly in the posterior region.

GC Initial LiSi veneering ceramic is optimal for refining or veneering in the anterior region. The cutback technique offers a good combination of stability and high aesthetic value for this. The crown's fully anatomical design, pressed with MT (Medium Translucency), slight vestibular reduction, lustre pastes and minimal GC Initial LiSi veneering ceramic overlays, is highly efficient. The use of these variants allows the underlying tooth substance to remain a cosmetic part of the crown without being covered by a light-blocking framework. However, the stumps must not be strongly discoloured.

Medium Opacity (MO) frameworks are generally used to compensate for dark substrates. However, this opaque compact must be covered with veneering ceramics and cannot be fully contoured.

The following case study describes the procedure for an all ceramic restoration with GC Initial LiSi Press (a lithium disilicate glass ceramic) on a strongly discoloured prep.

The initial situation

The young patient complained about the aesthetically unpleasant appearance of her Zr crown 21. The previous restoration did not match the shape and colour, and the cervical area in particular seems too opaque. A common phenomenon with zirconia is the unnatural emission of the material into the marginal gingiva.

In this case, the degree to which the gingiva in the cervical areas of the natural teeth exhibited a reddish radiation was particularly visible. Little consideration was given to this effect with the previous restoration.

[1] MDT Stefan M. Roozen
Zell am See, Austria

Figure 1: The previous Zr crown on 21.

Figure 2: The dark prep became visible after the crown was removed.

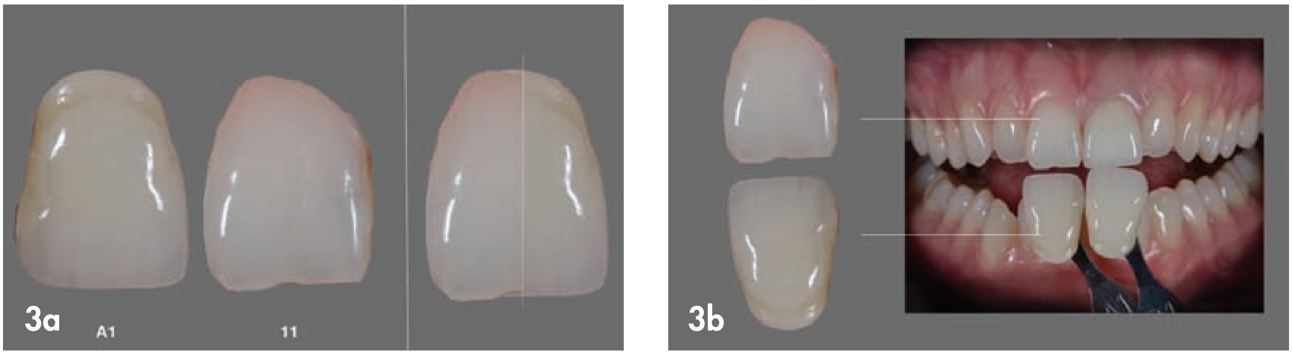


Figure 3a: Red colouration in the cervical area of natural tooth 11 (compare with colour pattern A1).

Fabrication of the framework

The crown was removed, prepared once again and moulded. After the model was created, the wax cap was fabricated using CAD/CAM.

The object was pinned according to procedure. Additional air channels were installed to prevent air compression in the marginal area and, therefore, potential inaccuracies in the subsequent pressing result. The surface was sprayed with SR Liquid and then invested with LiSi PressVest (fig 5). After a setting time of approximately 20 minutes, the muffle was placed in the preheating oven. The higher the temperature to which the phosphate-bonded investment is heated, the

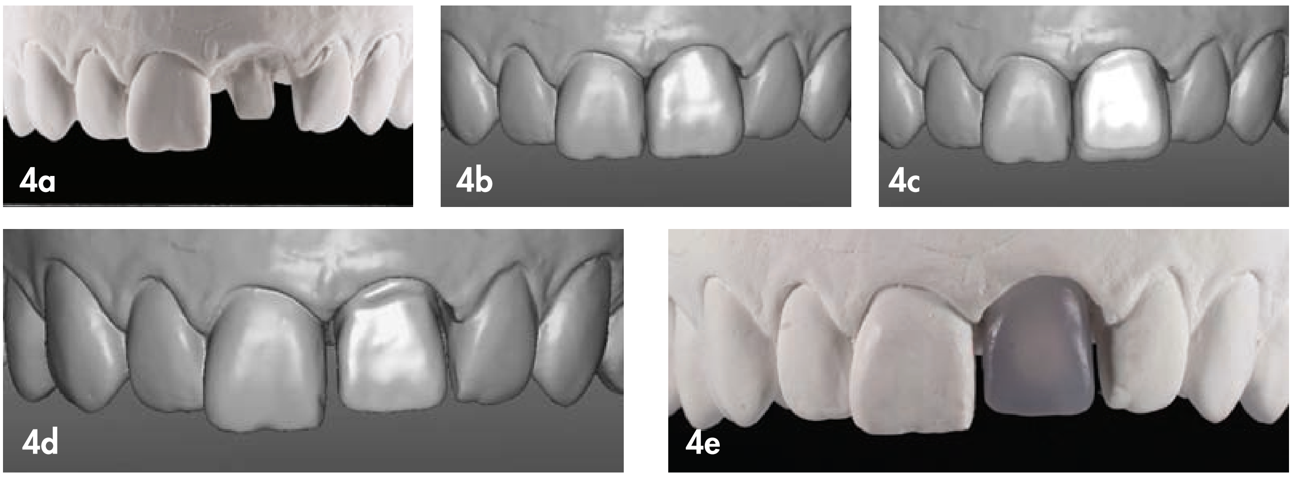


Figure 4: Production of the wax cap with CAD/CAM.

Figure 5: The prepared wax object for investing with LiSi PressVest (according to the method of Toshio Morimoto, Osaka).

Figure 6: GC Initial LiSi Press, with a flexural strength of > 500 MPa.

higher the compressive strength it develops. Therefore, the initial oven temperature was 900°C and was lowered to 850°C after the muffle was inserted.

It is important to install the investment using the fast heating process, as this leads to a relatively constant expansion. This is because, among other things, conventional slow heating leads first to expansion (cristobalite transformation at approx. 250°C) and then to contraction (due to the decomposition of ammonium phosphate at approx. 350°C). The repeated expansion and contraction of the material thus promotes the formation of small cracks.

The shade selected for the pressing material was ingot MO0; this selection was based on the contrast between the black discolouration of the stump and the light target colour. This is perfect for the layering technique with high fluorescence and a high brightness value. It has an excellent covering capacity due to its relatively high opacity.

After pressing and cooling, the object was blasted with glass beads. GC Initial LiSi Press has almost no reaction layer; therefore, the need for acidification is eliminated. The result is a very homogeneous surface with an excellent fit (fig. 7& 9).

The ability of this material to reproduce a natural fluorescence is unique and adding extra fluorescence is not a prerequisite as it is the case with other frame materials. This yields restorations that are true to the natural model, wherein the fluorescence comes from deep inside the restoration (fig 8).

Wash firing

GC Initial Lustre Pastes NF were applied to the bare, white cap to adjust its base colour (fig 12). For this purpose, we used L-N, a light lustre coating with L-A; in the incisal area, we used a mixture of L-5 and L-7. The redness in the cervical area was increased with LP-M2 to mimic the previously described radiation into the surrounding gingiva. It was important to allow only a slight hint of the actual colour, and not with too much intensity (fig 13). After firing in the oven, Glaze Liquid was applied once again and sprinkled with an FD-91 make-up brush. The excesses were blown off by mouth

Figure 7: The pressing gives a homogeneous result, and barely any reaction layer is formed.

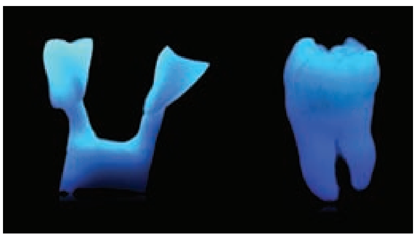
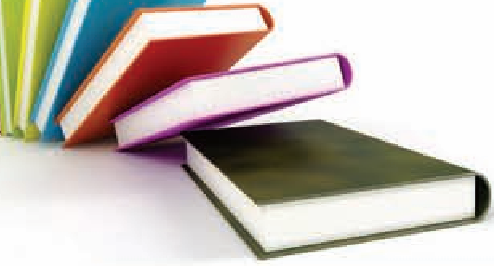


Figure 8: The MO0 ingot exhibits very good fluorescence.

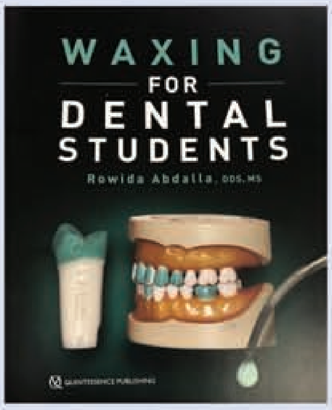
Figure 9: Perfect edge fit of the pressed cap.



QUINTESSENCE
INTERNATIONAL
PUBLISHING GROUP

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.

Q- 5120854 | 88pp 388 illus | **$88.60**

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.

This book approaches clear aligner treatment from a diagnosis and treatment-planning perspective, discussing time-tested orthodontic principles like biomechanics and anchorage and demonstrating how to apply them to orthodontic cases using these appliances.

Each chapter explains how to use clear aligners to treat a given malocclusion and teaches clinicians how to program a suitable treatment plan using available software, how to design the digital tooth movements to match the treatment goals, and finally how execute the treatment clinically and finish the case well. This clinical handbook will prepare orthodontists and dental students to exceed patient expectations with the most esthetic orthodontic appliance currently available.

Q- 5120858 | 320pp 1,344 illus | **$333.05**

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.

Readers are guided through the process of using digital tools at every stage of treatment, from developing the treatment plan to surgical execution. The authors detail the specifications of guided surgical procedures, review the latest 3D radiology options and software currently available, and present full case studies with stunning photographs. As implant dentistry relies more and more on digital technology, clinicians owe it to their patients to educate themselves on the most current tools available, and this book is the perfect place to start.

Q- 5120855 | 392pp 1,270 illus | **$302.50**

*Prices may vary when purchased in New Zealand

Figure 10: We were able to cover the dark tooth prep with a cap thickness of approx. 0.9mm.

Figure 11: The natural white framework on the working model.

Figure 12: Colouring and adjusting the colour with GC Initial Lustre Pastes NF.

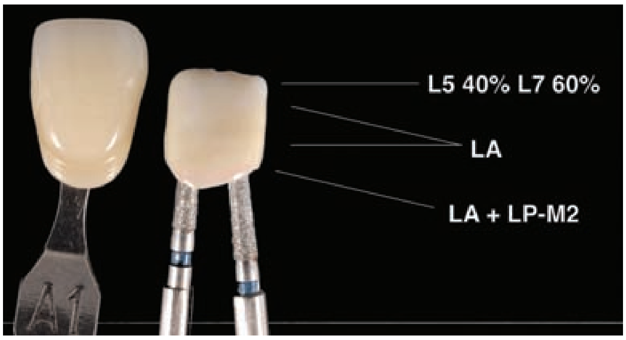


Figure 13: Lustre with L-A: more depth effect was created in the incisal area with "violet"; the red value in the cervical area was increased by adding the LP-M2 (gum).

and burned. The result was a very dynamically active framework with established colour and a scattering of light on the surface (fig 15).

Ceramic layering

We then proceeded to veneering using GC Initial LiSi veneering ceramic. INside Primary Dentin was used to achieve a relative chromatic effect from deep within the restoration. In this case, an additional 20% of Bleach Dentin was mixed into the IN-44 to increase its brightness slightly. The incisal third was processed with Fluo Dentin FD-91. This was followed by dentin that was mixed with neutral Transpa towards the incisal area to increase the depth effect. A mixture of E-58 and TN was applied to the incisal plate. This

Figure 14: Thin sprinkling of ceramic powder.

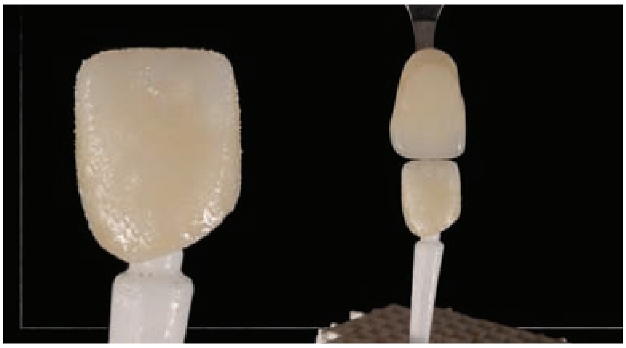


Figure 15: The result after firing exhibited a dynamic surface with a nice colour.


SCHEIN ONLINE
ORDERING ONLINE
HAS NEVER BEEN EASIER!
SCHEIN ONLINE is continually evolving to create an effortless experience for you.
• Over 25,000 products with images and videos
• Track and trace orders
• Personalised ordering templates
• Pay invoices online
• View order history
• Industry news and product updates
• Latest events and education
HENRY SCHEIN® | HALAS
Rely on Us
www.henryschein.com.au

was wetted with a little staining liquid to enable the precise placement of the mamelon on it with FD-91. CL-F was thinly layered on the finished internal structure in order to mimic the sclerotic dentin layer. Bluish mesial and distal bands were applied with EOP-3. A subtle horizontal band was applied with EOP-2 to create more brightness. Cervical CT-21 and CT-22. The final shape was fully covered with Enamel E-58 and 25% EOP-2. Finally, to mimic the halo effect, a little more EO-15 was applied incisally. The layering was over-contoured accordingly to compensate for the sinter shrinkage.

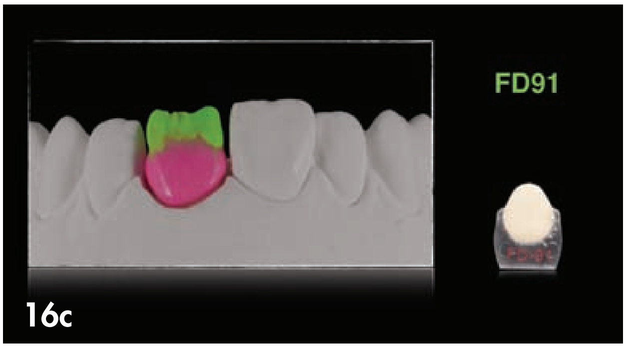
Special care had to be taken with the accuracy of the subsequent firing, as the firing window for lithium disilicate is very narrow. In general, no attempt was made to perform repeated firing cycles in order to obtain the best brilliance, colour and translucency.

The final shaping was followed by a soft, short glaze firing in which the surface pores were closed.

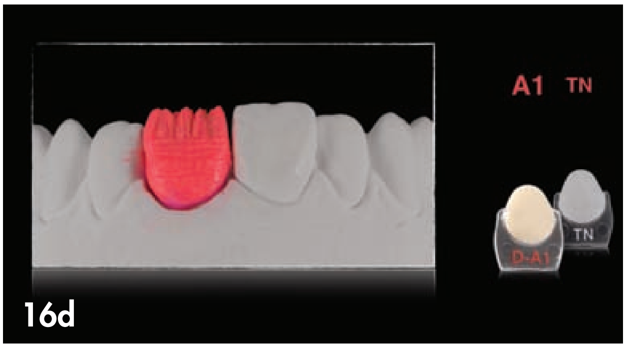
The degree of gloss was determined directly on the patient during the try-in of the crown and produced by mechanical

16a

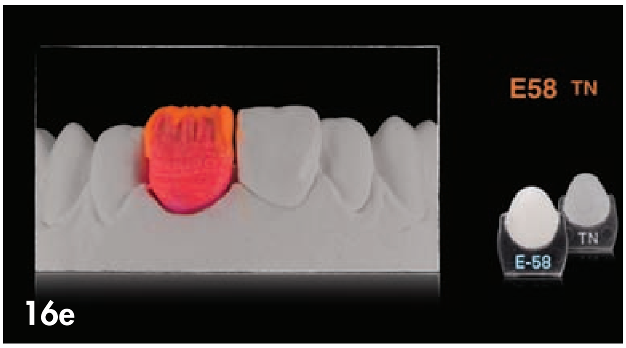
16b



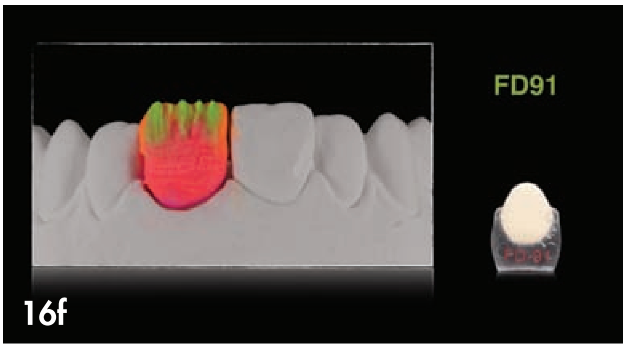
16c



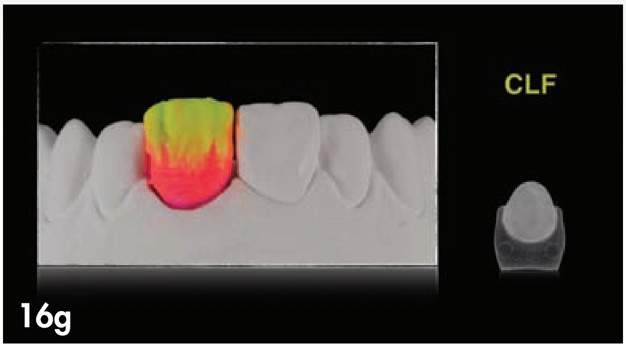
16d

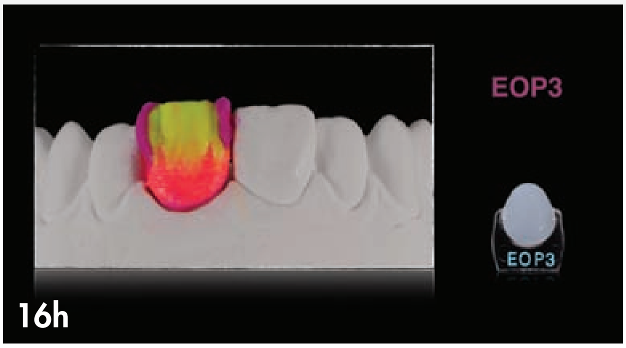


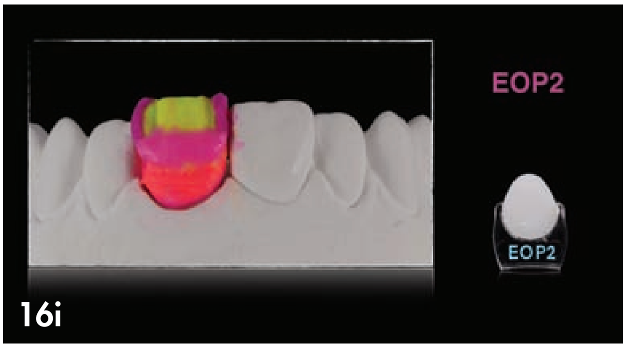
16e

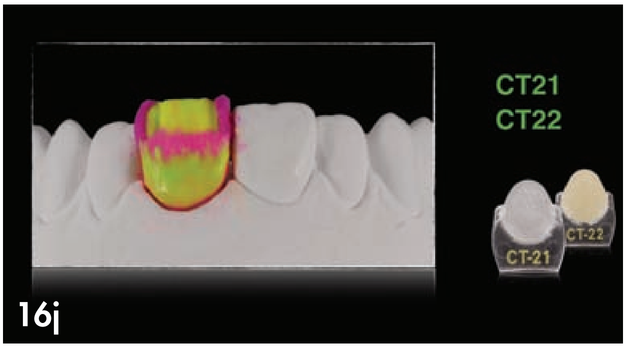


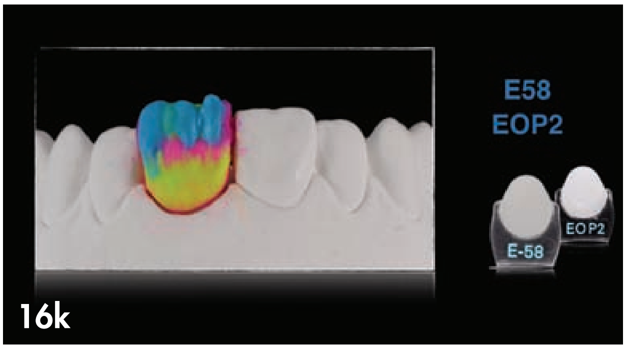
16f

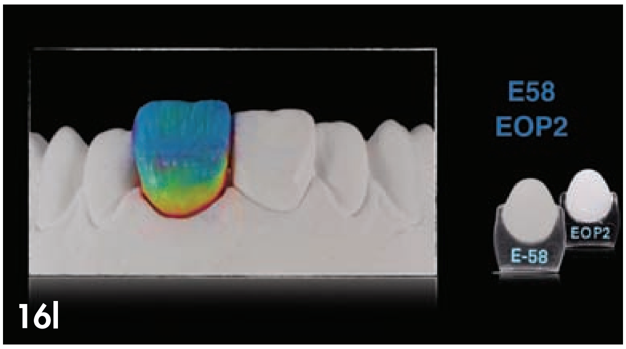












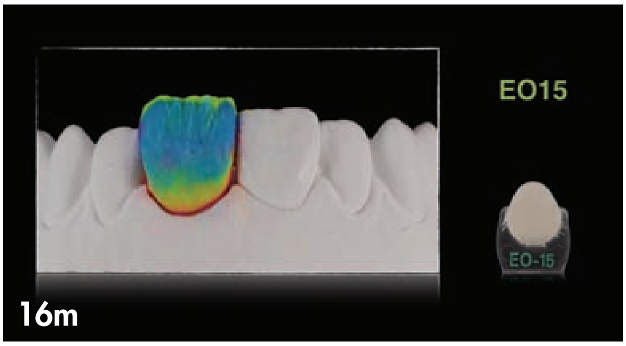
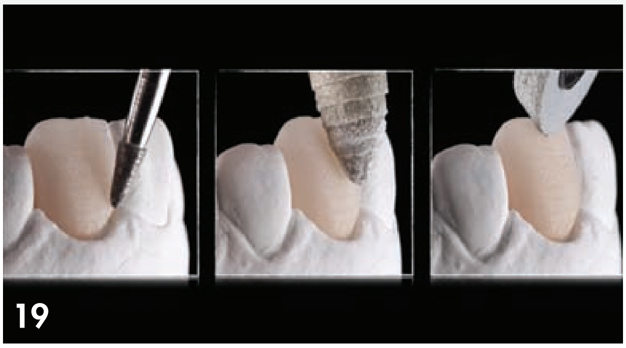


Figure 16: The steps for layering with GC Initial LiSi veneering ceramic.

Figure 17: The result after firing.


18


19

Figures 18-19: Fitting and surface finishing.


21


22

Figures 21-22: The final result in the mouth.

polishing. This additionally solidified the surface and created a natural silk matte effect (fig 18-19-20).

Results and conclusion

After an evaluation and performance check of the restoration in the patient's mouth, some fine-tuning was performed and the crown prepared according to the protocol for cementation. Cementation completed the work process, the goal of which had always been to leave no visible traces of the effort and to achieve a good integration into the natural environment.

Despite the difficult initial situation, the right choice of materials made it possible to meet the patient's high aesthetic standards. The material components were perfectly matched to each other and thus offered a high degree of safety and efficiency in production.

The vitality and natural-looking fluorescence of GC Initital LiSi Press is outstanding. The flow of light through the entire crown into the sulcus area is also appreciable. This lightens it up and prevents grey shadows. The crown appears life-like and natural (fig. 21 & 22).

Reprinted from GC Connect 10

ZIRC

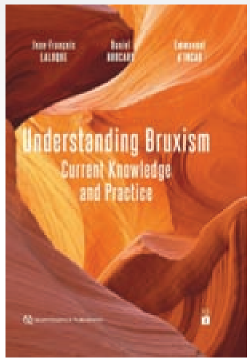
CAD/CAM BLOCK LOCKER

- Includes 6 Internal Organizers & 6 Block Dividers
- Choose from 7 different colours for Internal Organizers, N, E, J, T, U, Q, and S
- Fits all CAD/CAM milling blocks
- Sleek, powder-coated finish for modern look
- Provides a professional platform to present and discuss same-day restoration
- Use online customization tags to create organization by shade and translucency
- Small 13kg for 288 blocks - 49.5x40.6x23.5cm or
- Large 22kg for 48 packs - 63.5x67.6x23.5cm
- Drawer accommodates accessories, such as burs & lubricant

QUINTESSENCE

UNDERSTANDING BRUXISM: CURRENT KNOWLEDGE AND PRACTICE

Jean-François Laluque,
Daniel Brocard &
Emmanuel d'Incau



Bruxism is a common parafunction, and over the last 15 years the profession has become aware of just how destructive it can be to the masticatory structures when left untreated. However, because it is still seen as a multifaceted phenomenon that is difficult to treat, many practitioners assume that it is incurable. This book answers these doubts and concerns by outlining the various etiologies and aggravating factors of bruxism, distinguishing the different types of bruxism, and demonstrating how to complete a differential diagnosis. Then, in keeping with the latest evidence, the authors promote a more conservative approach to treatment and outline which treatment strategies to use in different situations.

Q-5120857 184pp 179 illus

ZIRC

AIRWAY ARMOR

Provides aspiration and ingestion prevention. Give yourself peace of mind and your patients the protection they deserve. Airway Armor™ has multiple benefits in comparison to using a dental dam. This includes easy placement, durability, patient comfort and full mouth accessibility.

- 3 convenient sizes (small, medium, large)
- Single-use
- Ideal uses include: Extractions, Implants, Direct and Indirect Restorations, Crown and Bridge, Orthodontics, Pediatric Procedures

SWIRLIT

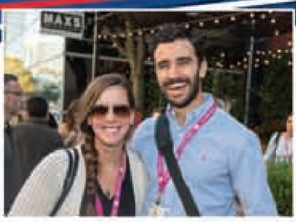
FRESH MOUTH HEALTH SHOT DRINK

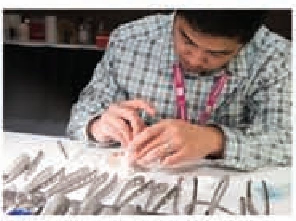
Developed by a dentist to freshen your whole mouth.
Sip, swirl & swallow to get an instant clean mouth feel, soothe your stomach & combat bad breath.

0% Sugar
0% Titanium Oxide
0% Alcohol
pH Neutral

#theoceaniseverybodysbusiness and Swirlit is working to improve ocean health and develop key partnerships with the aim to promote recycling, reduce waste and protect our oceans.
Box of 6 x 200ml Bottles


Be a part
of something
extraordinary.

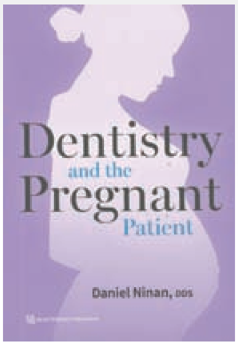




QUINTESSENCE

DENTISTRY AND THE PREGNANT PATIENT

Daniel Ninan



To err on the side of caution, some dentists may hesitate to perform necessary procedures on pregnant patients. However, good oral health is essential to a healthy pregnancy and can help reduce prenatal complications, including preterm delivery and fetal loss. This book serves as an easy-to-use guide to help dentists of all specialties provide safe, effective care for their patients during pregnancy. The book is broken down into chapters on general treatment guidelines, pregnancy-related conditions in each organ system that may impact care, and the safety of the use of common dental drugs, including anaesthetics, during pregnancy. With over 50 quick-reference charts and tables and a breakdown of treatment recommendations by trimester, this book is a must-have for any dental office.

Q- 5120853 160pp

ZIRC

PINK PETAL

Simply slide Pink Petal onto your saliva ejector to provide continuous, comfortable, hands-free suction with no additional attachments required. By placing buccal side, the Pink Petal confidently holds the saliva ejector right where you need it – the back corner of the patients mouth.

- Easy placement
- Patient comfort
- Single-use
- 50 per pack
- Ideal for ultrasonic scaling and sealants!

EMS

THE AIRFLOW® PLUS POWDER

The AIRFLOW® PLUS powder is the first high-tech powder that removes Biofilm and young calculus in a minimally-invasive way from all types of surfaces:

- Enamel
- Dentine
- Soft tissue
- Restorations
- Orthodontic appliances
- Implant surfaces

The PLUS powder has the solution.
The Erythritol based molecule provides a unique indication for both supra-gingival and sub-gingival use.

ERYTHRITOL – THE BIG PLUS IN PROPHYLAXIS TODAY
With a granule-metric size of only 14µm, the AIR-FLOW® PLUS powder represents the most finely grained particle in the world of dentistry. The benefit of this type of powder is a selective minimally-abrasive spray: the ability to efficiently remove Biofilm whilst leaving soft and hard tissues unharmed.

QUINTESSENCE

BIOAESTHETICS IN ORAL REHABILITATION: SCIENCE, ART, AND CREATIVITY

Loris Prosper

This book describes a methodology for creating biomimetic restorations that harmonize with the remaining natural teeth. The authors analyze the methodology for each phase of work, including the diagnosis and treatment planning, the stages of preparation and fabrication, and the cementation of the definitive restoration. All the essential components are covered, including occlusal analysis, soft tissue management, color selection, implant considerations, and guidelines for home maintenance.

The merits of a multidisciplinary approach are shown within the functional esthetic paradigm in which the prosthodontist, surgeon, orthodontist, and dental technician work as a close-knit team to ensure a predictable and reproducible result.

Q-5120856 896pp 3,349 illus

All products available from: HENRY SCHEIN • Tel: 1300 65 88 22 • www.henryschein.com.au

CERASMART™

GC's force absorbing hybrid ceramic blocks

The genius behind GC's force absorbing hybrid ceramic is the development of a unique technology to manufacture a block with high density of ultrafine glass particles. Uniform dispersion (very short inter-particle distance) of individually silanated and bonded particles is key to delivering CERASMART's™ exceptional strength, polish retention and wear resistance.

CERASMART™ is easy to finish and retains its beautiful high gloss over time

Due to the dynamic proprietary nano ceramic matrix, and its complete homogeneous nature, CERASMART™ is a true self-polishing material. Not only does it stay polished longer, but it is proven to gain lustre even after being roughened.* This unique hybrid ceramic is unsurpassed with its high gloss value, unique self-polishing capability, and its unmatched aesthetics.

Dr Anthony Mak (Australia), Brad Grobler (New Zealand)

Milled CERASMART™ | CERASMART™ after polishing | CERASMART™ finished with Optiglaze™ color

CERASMART™

CERASMART™ for CEREC and PlanMill, refill of 5 blocks

Sizes 12, 14, 14L.

HT shades (A1, A2, A3, A3.5, B1) & LT shades (A1, A2, A3, A3.5, B1). Bleach shade (BL).

* Akiyama S, Akatsuka R, Sasaki K. Evaluation of Gloss-retention and Self-polishing Property of CAD/CAM Composite Block. J Dent Res 2015;94(Spec Issue A):3650.