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Dear Reader,

Welcome to the first issue of Cosmetic for 2013! I hope you find it both interesting and informative.

We have a variety of subjects covered in this issue. From posterior composites to white spot lesions, dentine hypersensitivity to resin-based dentistry, there should be something to interest everyone!

In addition we look back at one conference and forward to another. We review the British Academy of Cosmetic Dentistry’s ninth Annual Conference, which was held November 2012 in Manchester. This was a great event and I would recommend going in 2013.

We are also looking forward to the 10th Annual Clinical Innovations Conference. Organised by Healthcare Learning: Smile-on in association with The Dental Directory, this is the conference to attend for the latest thinking in the areas of restorative and aesthetic dentistry. Take a look at page 44 for more information.

As always, we welcome your feedback. Contact me – lisa@healthcare-learning.com – with your comments.

Until next time

Lisa Townshend

Group Editor

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Cover story - This image can be found in the article RED bonding: Predictable cementations of indirect aesthetic restorations by Irfan Ahmad, pages 18-30.
Two of the UK’s most respected education and academic organisations have joined forces to provide an innovative, technology driven MSc in Restorative and Aesthetic Dentistry. Smile-on, the UK’s pre-eminent healthcare education provider and the University of Manchester, one of the top twenty-five universities in the world, have had the prescience to collaborate in providing students with the best of everything – lecturers, online technology, live sessions and support.

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Bringing it all together – the

BACD Annual Conference 2012

22-24 November 2012, Manchester

Delegates from across the UK braved the flood warnings and torrential rain to attend the BACD’s 9th Annual Conference at the Manchester Central Convention Centre. Set over three days, the conference featured an outstanding line-up of national and international speakers including the likes of Dr Rafi Romano, Dr Basil Mizrahi, Dr Elliot Mechanic and Dr Michael Zybutz. The event also featured a trade show section, where delegates were able to visit stands featuring many of the industry’s most prominent names.

Building on the success of previous years, the BACD successfully raised the bar for its 9th Annual Conference, offering delegates a strong blend of cutting-edge education from some of the world’s leading speakers, combined with a trade exhibition, and excellent networking opportunities. At the climax of the event, on the evening of the second day delegates were invited to attend a special charity fundraising event at Manchester City Football Club, which featured a stadium tour followed by a Gala Dinner and evening entertainment. Dr Qureshi made a President’s Award that evening and dedicated it to one of the most influential clinicians of all time within minimally invasive dentistry, Dr Sverker Toreskog. Dr Chris Orr gave the acceptance speech on behalf of Dr Toreskog who is currently of ill health.

The incoming President of the BACD, Dr Julian Caplan was also welcomed into his position. Julian spent some time at the Annual dinner outlining his strategy for the year ahead within the BACD as well as entertaining the audience as a participant in Movember alongside other BACD board and com-
committee members who together raised more than £3,000.

_Changing perceptions_

Founded in 2003 by a group of dentists keen to share their knowledge and passion with others, the BACD has fast grown to become one of the most significant dental organisations in the UK today. At the heart of the BACD philosophy is an ethos centred on education, and a commitment to dispelling many of the myths surrounding cosmetic dentistry that still exist within the profession even now.

These objectives were made no more evident than in the conference’s opening ceremony, which included a welcome from outgoing President Dr Tif Qureshi. In his address, he reminded delegates of the BACD’s core mission to “Establish and promote core strong principles of minimally invasive cosmetic dentistry”, and showed how in the past year, the BACD had made great strides in this area, with particular progress working with many of the dental schools across the UK, as well as redeveloping the BACD website to wider platform and establishing a firm base for future growth.

Another area Dr Qureshi was keen to place focus on in his address was the BACD’s prestigious Accreditation programme. Designed to improve clinical skills across a range of different case types, Accreditation is one of the pillars of the BACD’s programme, and is a fantastic way for clinicians to gain recognition for the outstanding work that they do. Just as dentistry itself has changed a great deal over the course of the last decade, BACD Accreditation has also evolved to reflect this fact, and has fast become one of the most prestigious accolades a cosmetic dentist or technician can attain.

_Bringing it all together – the 9th Annual Conference_

Following on from an extremely well-received welcome from the President, delegates were treated to 15 minutes of a light and dance show before the conference programme began.

First on stage was the renowned Dr Rafi Romano, who presented on Current Innovations in Aesthetic Orthodontics. In a talk designed to be accessible to all GDPs, not just those with a particular interest or speciality in orthodontics, Dr Romano encouraged delegates to “think outside the box” and adopt a wider view to treatment planning. In a detailed yet thoroughly engaging presentation, he outlined a number of cases that he was able to solve using minimally invasive approaches that in some instances fly in the face of conventional thinking. A
keen proponent of technology Dr Romano described a number of different systems that he sees as the future of treatment planning, and also gave tips on some innovative approaches he regularly takes in his own work. These include placing orthodontic wires without brackets, and using a vacuum-forming machine to produce “home-made” tray retainers.

Following on from lunch in the Exchange Hall, delegates were treated to an afternoon hosted by Drs Anas Aloum and Mamaly Reshad on the subject of Which Ceramic Should I Use? In a talk designed to shed light on what can to many seem a complex and confusing field, the two speakers presented their own simplified solution which classes ceramics under two main headings, from which clinicians can select materials based on the specific case requirements. This investigation also then covered the important issue of selecting materials, and thicknesses to avoid underlying discoloration showing through. Though a fine balancing act at times, with some careful planning, and the selection of the right materials for the right cases, delegates came away from the lecture with an enhanced understanding of exactly what ceramic to use, and when.

_day two

With nine separate lectures to choose from on the second day at the BACD conference, delegates were hard pressed to choose precisely which of the many excellent lectures, they would attend. Among the many standout lectures to choose from were Smoothing Over the Cracks in Aesthetic Dentistry, Short Term Orthodontics for the General Dentist and Clinical Photography – Getting Started.

A particular highlight of day two was the two-part talk given by Dr Basil Mizrahi, who was speaking at the BACD conference for the very first time. In the first part of his talk he expanded upon the selection of ceramic crowns and outlined the best clinical approaches in order to achieve the long-term success of the restoration. He also paid particular attention to the selection of cementing material, and how cement also plays an important role in ceramic selection. Following a short break Dr Mizrahi then went on to address applications in more complex cases, with emphasis placed firmly on precision, and the steps and rationale needed to achieve this precision.

Following on from an extended lunch break that included the BACD Annual General Meeting, delegates were again treated to a wide selection of lectures covering a broad range of subjects. As well as the ever-popular Dr Elliot Mechanic, one of the highlights of the afternoon session was Aesthetics – It’s Not Just About The Teeth presented by Dr Michael Zybutz.

A specialist in periodontology, Michael Zybutz is one of the few periodontists to be fully accredited by the
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American Academy of Cosmetic Dentistry, and was actually the first ever speaker at the opening BACD meeting way back in 2003. In an engaging and detailed lecture, he highlighted the role of the attachment apparatus and soft tissues in dental aesthetics, and provided delegates with his own “check list” to help in aesthetic case assessment. This included an understanding of the gingival biotype and its impact on treatment planning, as well as the various types of smile that a clinician may encounter, and how these too, can also affect the way a dentist should plan a case.

_Succes by design_

Given the sheer number of high quality, world-class lectures on offer over the first two days of the BACD Annual Conference, the third and final day had a lot to deliver – and it did! Saturday 24th November featured as its main attraction a day-long course delivered by two of the biggest names in cosmetic dentistry: Dr David Garber and Dr Maurice Salama, of the world famous Goldstein Garber & Salama dental practice in Atlanta, Georgia – namely “Team Atlanta”.

In a talk entitled Success By Design: Integrating Biology, New Implant Design And Aesthetics In Simplified And Complex Therapy, Drs Garber and Salama spoke passionately about the importance of aesthetically excellent implant restorations. In a wide-ranging and comprehensive lecture the two experts detailed methods of preserving the restorative site, while also integrating evidence-based biological principles with treatment and implant designs to optimise aesthetic results. The talk also covered many of the different implant systems available, and covered topics such as what system to use, where and why, as well as an investigation of the different indications for immediate implant loading.

_Evolution of the smile_

With such an exciting world-class line-up of lecturers from some truly outstanding speakers, delegates left the BACD’s 9th Annual Conference feeling re-invigorated, re-energised and re-educated with current ideologies and techniques from the leaders of the dental profession. Not only this, but delegates were also treated to a range of exciting social events, designed to bring members together and forge new relationships that will last for many years to come. With such an outstanding conference held in Manchester in 2012, members are already looking forward to the next event!

_INFO_

The BACD’s 10th Annual Conference “The Evolution of the Smile” will take place 7-9 November 2013 at The Hilton London Metropole Hotel. For more information, and for all the latest news, visit www.bacd.com. For further information about the British Academy of Cosmetic Dentistry, call 0207 612 4166, fax 0207 182 7123, email suzy@bacd.com, or visit www.bacd.com. Images courtesy of REDAKIO.com. Photography and Video Productions.
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Success Strategies for the Aesthetic Dental Practice

Author: Jeremy Cooper

"Success Strategies for the Aesthetic Dental Practice" is a book that lives up to its name. It has brought together two inspirational people to share their formula for achieving this goal. It is unique in so many ways. Firstly, it brings a perspective not just from a hugely successful aesthetic dentist, Dr Linda Greenwall (pictured, right) but also from that of arguably the world’s number one in dental practice management, Cathy Jameson.

Furthermore, this book manages to (and excuse the pun) ‘bridge the gap’ between the two sides of the Atlantic. How many times have I heard comments along the lines of, "Well that might work in America but never over in the UK." So let’s get one thing straight from the outset, this book dispels that kind of negativity! Linda has an extremely successful Aesthetic Dental Practice in Hampstead, London, whilst Cathy not only continues to lecture across the globe in all aspects of practice management but also runs her own company, Jameson Management Inc.

As one would no doubt expect, the book is not just written in an eminently easy to read format but the chapters are organised so that one can easily refer back to particular subjects when they need to. This book can be used by all members of the team and will not have them drooping their eyelids when doing so! Each chapter is awash with tables, photographs, lists and most important of all a checklist or action plan at the end of each chapter. This allows one to easily put into practice what they have read.

Though the book is obviously focused on aesthetic dental practice and is full of ideas and information on subjects as diverse as whitening, photography, CAD/CAM systems, implants or veneers (laminates), etc, it can equally be applied to every aspect of general or specialist practice. Subjects covered on the business of dentistry, marketing, communication on the one hand leave one inspired to do more but equally ensure that one does not rest on one's laurels.

There are also invaluable contributions made by some of the leading names in dentistry from both sides of the water adding to appeal of this book. This book should be read by everyone from the oral surgeon, endodontist and periodontist to the newly qualified practitioner! If one follows the 'blueprint' of the text and actions the ideas contained within them, whether one is practising in ‘darkest’ Salford UK or Beverly Hills, California, USA one thing is guaranteed......... you too will be successful!
Posterior Composites in General Practice

Author: Trevor Bigg

For the majority of dentists, general practice has changed beyond recognition over the past decade. Minimal Invasive Dentistry, digital imaging and the computerisation of records, amongst many other changes, have altered the way dentists practise in their surgeries throughout the country.

But, although this is hardly ever mentioned, the greatest change that has occurred in the day-to-day running of a general practice has been the increasing use of composite filling materials in the restoration of posterior teeth.

Amalgam or Composite?

Dental amalgam has been the material of choice for restoring posterior teeth during the past 160 years. Despite repeated attempts to prove the dangers to the patient of using this material no significant link has been shown and, on July 28, 2009 the US Food and Drug Administration stated that unless the patient is allergic to mercury “the levels of mercury released by dental amalgam fillings are not high enough to cause harm in patients.”

So, if amalgam is considered safe for patients, the only reason for banning its use is due to the impact of dental amalgam on mercury in the environment. (although this is considered to be only 0.1 per cent of the worldwide burden) and the result of a recent study indicating that over one-third of an American’s mercury exposure is from tuna! Even though there are many other sources of mercury in the environment, the continued action from pressure groups in Europe led to the European Union (EU) commissioning the BIO Intelligence Service (BIOS) to review the potential for reducing mercury pollution from dental amalgam and batteries, as next to chlor-alkali production for batteries (to be phased out by 2020), dental amalgam will be the largest mercury use in the EU.

In June this year, a joint DoH and DEFRA meeting issued a statement that the UK should support the EU strategy to reduce the environmental impact of mercury, and should, subject to certain exemptions, support a ban on the use of dental amalgam from 2016. The exemptions, which would be reviewed after five years to identify if they were still required, would allow amalgam to be used under the following conditions:

1. Poor moisture control
2. Difficult cavity accessibility
3. Large cavities
4. Large interdental spaces to be bridged.
It is at this point that some readers may be thinking that the banning of amalgam is long overdue, but it must not be forgotten that amalgam, for all its faults, is a very forgiving material and even the EU is aware that there are situations in day-to-day practice when without its use the patient may be ill-served. Composite resin, on the other hand, is very much more ‘techniquesensitive’ and requires skill, experience and relatively expensive aids to enable satisfactory placement.

**Why should we place posterior composite restorations?**

After 2016, dentists in the EU will no longer be able to place amalgam restorations as a routine procedure. In the long term our patients may be better served by the placement of posterior composites as:

- The placement of posterior composites in Class II cavities is successful and predictable. Using composite and not amalgam increases the lifespan of the tooth.
- Composite is the ‘material of choice’ for initial posterior cavities. Amalgam should only be used in already heavily restored dentitions in older patients.

**Why is composite resin better than amalgam at increasing the lifespan of a tooth?**

- Less sound tooth needs removal during preparation
- Adhesive bonding means that non-retentive preparations can be used (Figs 1, 2, 3 & 4)
- Adhesive bonding improves the marginal seal and ingress of oral fluids and bacteria into the cavity, which is the commonest cause of pulpal damage and death
- It reinforces the remaining tooth structure
- It increases fracture resistance of the remaining tooth
- It can be used to repair or refurbish restorations without total replacement. 4

And not forgetting:

- It has an aesthetic tooth colour

However, composite is not ‘tooth-coloured amalgam’ and must be handled and placed differently.

**Who will teach how to place composite restorations?**

Older dentists had little teaching in the use of composite resin for posterior teeth at dental school. Only 13 years ago, Effective Health Care was able to report that composites are 1.7 to 3.5 times more expensive than amalgam with a five-year survival rate only half that of amalgam. 5

Over the past 10 years, techniques, materials and aids have improved so that Opdam’s study published in 2007 showed that survival rates for composite fillings at five and 10 years was greater than that for amalgam. 6

But although there has been a substantial increase in composite teaching at our dental schools over the past 10 years, recent research showed that erroneous techniques were still being taught. These included beveled enamel margins; causing a thin ‘flash’ which fractures later and the use of transparent matrix bands and wedges; based on the old idea that composite contracts towards the light. 7

**So can lectures and ‘hands-on’ courses help teach dentists good practical techniques?**

The majority of dentists attending a course on posterior composites are working for the NHS either fully or part-time. Unfortunately, too many courses are aimed at private practice, and a form of private practice that even a full-time UK private practitioner would not recognise. Experts from Europe describe how to place the perfect posterior restoration over a two-hour appointment and others spend a morning describing, in great detail, oc-
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Some Practical Tips

Imagine the scenario, one that occurs many times during the week: a patient attends with a fractured tooth and is booked in to a half-hour appointment. (Fig 5)

How can we fill that tooth with composite resin cheaply, quickly and effectively?

Moisture control:

Moisture control is essential, but a rubber dam is not mandatory!

Rubber dam is mandatory for root canal treatment and strongly advised in areas of difficult access and for certain procedures, such as the placement of posterior Resin Bonded Bridges. However, the financial cost of rubber dam precludes its use for routine restorative work in most NHS practices.

Does this affect the longevity of the subsequent restoration?

One study has shown that rubber dam incorrectly applied affected the proximal contact strengths of posterior composites leading to food impaction and periodontal problems. So rubber dam is no substitute for a good technique and it’s the quality of moisture control that is important, not how it is achieved. (Fig 6)

Matrix techniques:

On the advice of the Chief Dental Officer, all dentists should be using single-use, disposable matrix bands, as it is impossible to clean assembled conventional bands such as S iqveland adequately. So, rubber dam is no substitute for a good technique and it’s the quality of moisture control that is important, not how it is achieved. (Fig 6)

Bulk fillers:

Returning to the original scenario, already five to ten minutes of the half-hour appointment has been used. To enable the rapid placement of a composite restoration a new generation of flowable composites has been developed to use as a liner or bulk filler, such as SDR (Dentsply), Venus Bulk Fill (Heraeus) and Tetric EvoCeram Bulk Fill (Ivoclar Vivadent). These generally overcome the problem of light-activated composites shrinking while curing, by means of a polymerisation modulator that reduces shrinkage stress and force at the tooth-restoration interface. This shrinkage stress is one of the causes of post-operative sensitivity almost immediately after placement of the restoration and one study from Dentsply has shown elimination of post-operative sensitivity when a bulk filler is used.

Although the manufacturers state that it is possible to bulk fill using these materials in 4mm increments, anecdotal evidence suggests the following protocol:

1. Place a 0.5 mm liner at first, as the base of a thicker layer may be further than the maximum depth of 4mms when a matrix band has been fitted or a deep cavity is present. The initial thin layer is self-levelling as it flows into the irregularities of the cavity floor and may increase marginal adaptation in the gingival margin area. It also acts to stabilise the matrix band, preventing slippage if little tooth is left supra-gingivally. (Fig. 7)

2. Place a further layer of liner, or bulk fill if the cavity is deep, allowing a minimum of 2mm of conventional composite occlusally to improve wear resistance and appearance. Adaptation of the second layer of flowable or conventional composite is enhanced by the smooth surface left by the initial lining.
Finishing techniques:

Good finishing techniques reduce the failure rate caused by secondary caries in composite restorations:

- Trim using a copious quantity of water as coolant, as over-heating the composite encourages rapid shrinkage causing failing margins in time.
- Try not to use ‘coarse’ diamonds, as they can cause deep surface scratches and loss of filler particles.
- Direct the bur from the tooth to the filling to reduce iatrogenic damage.
- Remove ‘high-spots’ and contacts on the tooth-restoration junction.
- Do not ‘over-carve’ the surface, as deep fissures can make cleaning more difficult in some cases and could predispose towards fracture.
- Etch and wash the finished restoration and use the remaining bonding agent to re-seal the margins and repair surface micro-cracks (Fig 8).

Conclusion

Posterior composite restorations are ‘technique sensitive’ and do require training and experience if a good restoration is to be placed in the limited time available in general practice.

Materials research is slowly improving the outcome of these restorations and part of a dentist’s Continuing Professional Development should be in engaging in these advances so that a long lasting, functional and aesthetically pleasing restoration can be provided in a realistic time-scale, to the benefit of the dental health of our patients and the financial health of our practices.

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11. Clinical evaluation of Class I and Class II restorations. Burgess J and Muñoz C. (Contact Dentsply for further information)
**RED bonding: Predictable cementation of indirect aesthetic restorations**

Author: Irfan Ahmad

Dentistry 2006:34:252-259

**Fig. 1**

Most contemporary aesthetic dental treatment relies on resin-based aesthetic dentistry (RED). The essence of RED is achieving an efficacious bond to natural tooth substrate, be it enamel or dentine, for a long-lasting restoration. This is applicable to both direct and indirect aesthetic restorations.

Bonding to enamel is an established protocol, but bonding to dentine has proved more challenging and undergone considerable changes. However, the majority of current dentine bonding agents (DBA) is capable of efficacious bonding to dentine, but the method for achieving this goal is still debatable. Some authorities advocate self-etch DBA, while others prefer a total-etch approach, and further research will no doubt elucidate the validity of these methods.

Irrespective of the technique used, RED bonding is a quintessential requirement for success.
and durability of aesthetic dental restorations. It is worth noting that 50 per cent of clinical performance of dental cements is influenced by operator variables, including an exacting clinical technique together with mixing, dispensing and loading the cement. The remaining risk factors are tooth preparation design (ideal 12° convergence angle for adequate resistance form), material properties, location of tooth in the mouth and patient factors, such as oral hygiene.

**Interfaces**

The primary function of dental cement is retaining an indirect restoration on an intra-oral abutment, which can be natural tooth substrate or an artificial restorative material. The mechanisms by which cements achieve retention can broadly be termed “luting” or “bonding”. Luting is non-adhesive retention, and bonding implies a closer attachment of the cement to the restoration and tooth, which includes micromechanical and chemical adhesion.

The cementation mechanism of cements is classified as:

1. **non-adhesive or mechanical interlocking retention** by engaging tooth surface and restoration intaglio surface irregularities, measuring 20 to 100 μm (this mechanism is applicable to all dental cements);
2. **micromechanical “adhesion”** by engaging finer surface irregularities <2 μm created by etching, air abrasion, and usually in combination with a DBA by formation of a hybrid layer (0.5 to 10 μm);
3. **chemical (molecular) adhesion** by bipolar, Van der Waals forces and chemical bonds, which is the ideal that contemporary cements strive to achieve.

In order to understand the cementation mechanism, two interfaces between the cement and the tooth/restoration complex require consideration. On the tooth side, the substrate is dentine, enamel or cementum, and this is called the “cement–tooth interface”. On the opposing side is the artificial restoration, termed the **cement–restoration interface**.
clinical technique  Resin-based dentistry

Fig. 2  Defective amalgam restorations requiring replacement
Fig. 3  After removing the amalgam fillings, no attempt is made to extend the cavity to create undercuts, thereby maintaining the structural integrity of the tooth. Also, soft carious dentine is excavated, but hard, discoloured infected dentine is left in situ to preserve tooth substrate.

Fig. 4  An impression is taken for fabricating indirect ceramic inlays

“cement–restoration interface” (Fig 1). Some cements offer chemical adhesion at both interfaces. However, a vast number of interfaces are possible depending on the substrate on the tooth and restoration sides. These interfaces are the weakest link and account for adhesive failure. Cohesive failure is the breakdown of the cement or fracture of the tooth or the restoration.

A tight and secure seal is essential for preventing micro-leakage between the concealed interfaces beneath the bulk of the restoration and at the “open” margins exposed to the oral cavity. Furthermore, exposed margins are also vulnerable to occlusal stresses transmitted from the coronal part of the restoration to the cervical aspect, and the cement should be resilient to these forces in order to maintain a long-lasting hermetic seal.

Contemporary cements

At present, there is no single cement that can ubiquitously be used for all indirect restorations.

The choice of cement depends on the type of restoration, the restorative material and prevailing clinical scenarios. Judicial selection is imperative for efficacious cementation and longevity of a prosthesis. Contemporary permanent cements for definitive restorations are broadly categorised as resin-modified glass ionomers (RMGI) and resins (Table I). The latter are further divided into conventional resins (CR) and adhesive resins (AR). True AR are only those that contain the monomers MDP (10-methacryloxyloxydecyl dihydrogen phosphate) or 4-META (methacryloxy ethyl trimellitate anhydride), e.g. Maxcem Elite (Kerr), RelyX Unicem (3M ESPE), and Panavia 21, Panavia F2.0, Clearfil SA (Kuraray Dental).

Selecting a permanent cement

The choice of cement for an indirect prosthesis depends on the type of restoration, the restorative material from which the restoration is made, and the clinical situation. (Table II summarises the ideal choice of cement depending on the type of restoration and restorative material.)

Type of restoration

Indirect restorations are categorised as intracoronal or extra-coronal. In addition, the restoration can be retentive or non-retentive (Table III). Retentive restorations gain retention and resistance from of the geometry of the tooth preparation (e.g. crown preparation), and therefore adhesive cementation is not obligatory. Consequently, these restorations can be luted with traditional cements such as zinc phosphate or glass-ionomer varieties, which are less technique sensitive. Conversely, non-retentive restorations have limited retentive tooth preparation features and are predominantly, or totally reliant on RED bonding to the tooth substrate, e.g. Maryland/Rochette, fibre-reinforced fixed partial dentures (FPD), porcelain laminate veneers (PLV) and inlays/onlays.

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* Survey of 313 dentists who have used Traxodont at least once in their practice. / Clinical images courtesy of Shlomo Meleer DMD, Teaneck, NJ.
adhesive clinical techniques, placing a greater emphasis on preserving natural tooth substrate. Whereas in the past, preparation design was geometric and extensive (dictated by the properties of the restorative material), it is now amorphous and minimalist (dictated by the extent of disease; Figs 2–7).

Aesthetic restorations

Essentially, any restoration that achieves health and function can also be aesthetic. However, the term “aesthetic restorations” usually refers to tooth-coloured restorations or prostheses. Aesthetic restorations can be direct, using resin-based composites, or indirect, fabricated exclusively from a single ceramic material or with a strong substructure (ceramic or metal) that is subsequently veneered with a weaker overlying porcelain. This is the basis for the extremely successful porcelain-fused-to-metal (PFM) crowns and FPD.

The major disadvantage of PFM restorations is poor aesthetics at the cervical margins, presenting as greying owing to visibility of the metal substructure or “shine through” thin periodontal biotype gingivae. Therefore, a concerted effort has been made to seek alternatives, using dense, high strength ceramic cores to support aesthetic weaker porcelains. Although ceramics are capable of mimicking the appearance of natural teeth, they are plagued with fracturing in an aqueous and dynamic oral environment. Water imbibitions and occlusal stresses propagate crack formation of any exposed surface irregularities within the ceramic, leading to chipping or catastrophic fractures.

Furthermore, even if the surface is highly polished or glazed, the tenet for using ceramics in the oral cavity is that they must be supported by either the natural tooth substrate or an underlying high strength substructure.

Ceramics are inherently brittle materials (high modulus of elasticity) and therefore susceptible to fractures. Microscopic imperfections within the material are termed “Griffith flaws”, which grow into cracks and, if unimpeded, lead to catastrophic fracture of the ceramic. The cracks are propagated by the hostile oral environment: dynamics (occlusal forces) and humidity (stress corrosion). Furthermore, static fatigue is time dependent, which eventually results in breakage (Fig 8).

Many strengthening mechanisms are used for halting fracture propagation, including reinforcement and infiltration with glasses, and phase transformation toughening. Preventing fractures also depends on the clinical scenario, method of fabrication of the restoration, and the manufacturing technique and strengthening process of the ceramic.

In order for ceramics to survive in the oral cavity, they must be supported by either the natural tooth substrate or a substructure. Two types of ceramic restorations are possible: first, a unilayer restoration that is entirely composed of a single ceramic, gaining support through an adhesive bond to the underlying tooth substrate; and, second, a bi-layer restoration that has a supporting substructure for the aesthetic veneering porcelain (Figs 9–11). This substructure can be either metal or a dense, high strength...
Dental ceramics can arbitrarily be categorised as silica, alumina or zirconia based. Silica-based materials are weaker materials with a high glass content and excellent optical properties, making them the most aesthetic type of ceramic, eg feldspathic, leucite-reinforced, lithium disilicate and synthetic porcelains (Fig 12). Alumina and zirconia have reduced glass content, reduced translucency and poorer light transmission, making them less aesthetic but offering greater strength, eg alumina (flexural strength of 700 MPa) and zirconia (flexural strength of >1000 MPa). However, owing to their hardness and inferior optical properties, uni-layered alumina and zirconia restorations are impractical. Hence, these high strength ceramics are ideal for bilayer prostheses, acting as an underlying dense core for supporting weaker silica-based aesthetic porcelains for both single and multiple-unit FPDs.

**Clinical scenario**

The final aspect that determines the choice of cement is the clinical scenario. If the resistance and retention form of the tooth abutment is less than the ideal of 6° axial tapers (12° convergence angle), a resin cement is a prudent choice for reinforcing and improving the fracture strength of the abutment/cement/restoration complex.6 Similarly, when a remake of a restoration with poor marginal integrity is not immediately possible, it may be possible to seal open margins using resin cements.

Finally, if a dry environment is challenging, eg deep sub-gingival margins, RMGI is a better choice...
clinical technique  Resin-based dentistry

since it is less sensitive to moisture.

Bonding indirect aesthetic restorations

RED bonding indirect aesthetic restorations is demanding and technique sensitive. Failure to follow meticulous clinical protocols, or using inappropriate materials, is a recipe for disaster. Furthermore, aesthetic restorations are unique because they are often non-retentive, thin, delicate and fragile, requiring careful manipulation to prevent breakage during the cementation procedure (Fig. 13).

Choice of cement

The choice of permanent cement for definitive aesthetic restorations is either RMGI or resin. Although RMGIs offer chemical adhesion to dentine, they are unsuitable for aesthetic restorations owing to poor mechanical properties, inferior optical properties (profound opacity), making translucent silica-based ceramics appear dull, and a limited selection of shades, making accurate shade matching difficult. Furthermore, RMGIs undergo significant post-cementation dimensional changes that may fracture weaker uni-layer ceramic restorations. Therefore, the ideal cement for aesthetic restorations is a resin, which has superior mechanical, optical and physical properties (Table I). In addition, newer resin cements also offer low film thicknesses of 8 to 21 μm, comparable with that of RMGI, resulting in reduced micro-leakage. The disadvantages of resins are hydrolytic degradation, chromatic instability over time, post-operative sensitivity and requiring adherence to a stringent adhesive technique.

The next decision is choosing between AR and CR cement. The AR variety of resin cements is inappropriate for aesthetic restoration cementation owing to their limited shade availability and because the uncontrollable working time of dualcure setting causes difficulty cleaning excess set cement. Besides, many aesthetic restorations require minimal preparation and are usually finished within enamel. Since self-etch ARs do not require separate enamel etching with 37 per cent phosphoric acid, the higher pH primer in AR may not create an adequate enamel-etching pattern for efficacious bonding. For these reasons, a CR is therefore the ideal choice of cement for bonding tooth-coloured aesthetic restorations.

The CR cements are recommended for uni-layered, non-retentive, silica-based ceramics (lower flexural strength of 100 to 300 MPa), offering increased translucency, assuming the underlying tooth substrate is an acceptable colour. These ceramics are amenable to etching with hydrofluoric acid (HF) for enhanced mechanical retention, and when treated with silane (Figs 14a–c) create silica–silane chemical bonds at the cement–restoration interface. However, CR must be used in combination with a separate DBA, either a total-etch or self-etch system. Conventional resins have numerous shades and try-in pastes for precise shade matching. In addition, light-cured CR can be used for restorations with thicknesses of 1.5 to 2mm or thinner and dualcured CR for thicknesses of >2mm or opaque cores, thereby increasing their versatil-
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NX3 Nexus (Kerr) is a CR cement available in a large selection of tooth-coloured shades, enabling accurate shade matching. Its try-in pastes precisely correspond to the definitive cement shades, allowing colour assessment and alteration before final cementation. The defining features of NX3 are chromatic stability over time and compatibility with most seventh-generation DBAs.

A major concern with resin cements, especially associated with dual-cured resin cements, is ageing colour shift causing unsightly yellowing below translucent, aesthetic restorations. This is attributed to the amine-initiated setting reaction of the luting agents. To mitigate the latter, NX3 Nexus incorporates an amine-free re-doxx initiator system that guarantees chromatic stability over time.

It is also essential that the CR and DBA be compatible with each other. Compatibility is particularly an issue with self-etch DBA agents owing to the residual acidic inhibition layer that retards or impedes setting of dual- or dark-cured resin cements. NX3 has excellent bond compatibility with seventh-generation total-etch and self-etch DBAs without requiring an activator for dual-cured adhesives. This simplifies clinical protocols and ensures predictable bonding at the cement–tooth interface, and in combination with a DBA has a shear bond strength (SBS) of approximately 34 MPa for dentine and 30 MPa for enamel. At the cement–restoration interface, NX3 chemically adheres to most restorative materials, including resin-based composites, porcelain CAD/CAM blocks, alumina, zirconia and cast metal, achieving a maximum SBS of over 30 MPa. Finally, NX3 offers the choice of light or dual curing, allowing restorations with reduced light penetration, i.e. thicker than 2mm or highly opaque (eg alumina or zirconia cores), to be predictably cemented.

**Dentine bonding agent**

Achieving RED bonding with CR cements requires use of a DBA. The adhesion mechanism of resin cements and DBA at the cement–tooth interface is both micromechanical, by forming a hybrid layer, and chemical, by bonding with calcium ions from the hydroxyapatite of the tooth substrate. In order to resist the polymerisation stresses of the overlying resin cement, the bond strength of the DBA should be greater than 25 MPa.

OptiBond XTR (Kerr) is the latest self-etch, universally compatible DBA for direct and indirect restorations. The XTR is a retro-step to the sixth-generation bonding agents, eliminating many of the drawbacks of existing single-component seventh-generation DBAs. Compared with seventh-generation DBAs, XTR does not require selective etching of enamel margins owing to its profound etching pattern on both cut (prismatic) and uncut (apprismatic) enamel (Figs 15 & 16) and is fully compatible with all dual- and self-cured resin-based composites and cements. It has an SBS greater than most self-etch systems of approximately 30 MPa. Another problem with selfetch DBA is inadequate penetration of...
the adhesive into the dentine tubules following etching, which results in post-operative sensitivity and large film thicknesses. XTR overcomes this by penetrating deeper into dentine tubules, reducing the film thickness to less than 5μm, SBS to dentine of 37 MPa, and post-operative sensitivity (Figs 17a&b). Finally, XTR can be used with any CR cement for bonding indirect aesthetic restorations, and in combination with Nexus NX3 achieves dentine bond strengths of nearly of 42 MPa.

Cementation protocols

As mentioned previously, nearly half of all risk factors relating to successful cementation depends on operator factors, which leaves little latitude for errors. The cementation protocol can be divided into three distinct processes: pretreatment of the intaglio or fitting surface of the restoration, pre-treatment of the intra-oral abutment, and clinical steps for cementation.

1. Pre-treatment of intaglio surface

The conditioning of the intaglio surface depends on the restorative material and the choice of cement (RMGI, CR, AR). The preferred method for silica-based restoration is chemical conditioning, using HF acid (4–10 per cent for three minutes), followed by application of warm silane or DBA, which increases the SBS between ceramics and the dentine substrate at the cement–restoration interface.11 However, prolonged etching with HF acid can excessively dissolve the glass filler particles in the ceramic, making the surface smooth and negating the etching process. In addition, gross alteration to glass particles also compromises the strength of the ceramic.

Hydrofluoric and phosphoric acids cannot be used to etch metal, alumina or zirconia, but may be used for cleansing to ensure a contamination free intaglio surface. The surface roughness or micro-irregularities of high strength dense ceramics must be created during the manufacturing process. Air abrasion of zirconia and alumina fitting surfaces prior to cementation is controversial. To date, there is no long-term data to verify this practice, and air abrasion of zirconia can cause transformation change from the tetragonal to the monoclinic phase, weakening and reducing the life expectancy of the restoration.12 Other chemical agents include alloy primers or tin plating for some casting alloys.

Another benefit of using OptiBond XTR is that the adhesive liquid contains an adhesive monomer that provides true chemical adhesion for most restorative materials at the cement–restoration interface (Figs 18a–c). Therefore, application of silane, or other alloy primers, to the fitting surface is superfluous.

2. Pre-treatment of intra-oral abutment

Pre-conditioning of the intra-oral abutment is begun by removing the temporary restoration and provisional cement, which is accomplished mechanically using hand instruments, air abrasion, pumice paste or ultrasonic devices. Complete removal of the provisional cement is
Fig. 35. The left central incisor is facially inclined and overlapping the lateral incisor.

Fig. 36. Diagnostic wax-up to simulate pseudo-realignment of the left central incisor so that it is in line with the maxillary arch.

Fig. 37. Transparent vacuum stent fabricated from a plaster cast of the diagnostic wax-up for intra-oral composite mock-up for gaining patient acceptance of the proposed aesthetics, and for making chairside temporary acrylic restorations.

The next stage is isolation, either with a rubber dam or intra-sulcular gingival retraction cords. A dry environment is essential for resin-based cements. A rubber dam is the ideal choice for cementing inlays in posterior teeth but may be unsuitable for anterior teeth because the retaining metal clamps can potentially traumatise the gingival margin, leading to recession, especially for anterior teeth with thin periodontal biotypes. A gingival retraction cord, dry or impregnated with an astringent, not only allows visualisation of the abutment margins, but also acts as a physical barrier to avoid excess cement entering the delicate gingival sulcus. However, the use of a retraction cord may be inappropriate around implant abutments because it may lacerate the friable epithelial attachment.

Fig. 38. Minimally invasive PLV preparations on the central incisors finished within enamel with distinct finish lines, by a healthy periodontium.

Fig. 39. Chairside-fabricated acrylic temporary veneers using the vacuum stent of the wax-up.

Fig. 40. Two silica-based ceramic PLV for the central incisors.

Tooth abutment pre-treatment depends on the type of cement being used. If RMGI is employed, no further conditioning is usually necessary, whether the abutment is dentine, enamel or artificial restorative material, e.g., a composite, amalgam, cast-metal and ceramic core or titanium, alumina or zirconia implant abutments. For CR cements, where the abutment is natural tooth substrate, pre-treatment involves application of a DBA, i.e., self-etch or total-etch. If an artificial abutment is present, the conditioning depends on the restorative material of the abutment, e.g., for composite and amalgam core build-ups, the pre-treatment is air abrasion followed by etching with phosphoric acid.

3. Clinical procedure

After pre-treatment of the intaglio surfaces and intra-oral abutments, the next stage is dispensing the chosen cement. One of the major factors that reduces cement strength is introduction of air into the cement, e.g., 10 per cent porosity can reduce strength by 55 per cent. Porosity is related to the method of mixing, polymerisation shrinkage during the setting reaction, and disintegration of the cement owing to fatigue and thermo-cycling. For this reason, auto-mixing dispensers and pre-capsulated cartridges are ideal for a smooth, reduced porosity mix.

Depending on the restoration, the cement is dispensed onto either the fitting surface or intraoral abutment, and the restoration correctly located and seated with pressure, with or without an ultrasonic insertion technique for high viscosity cements. Excess cement is immediately wiped off, and floss is used to clear the interproximal areas. If a retraction cord is placed beforehand, this is now removed together with excess cement and the restoration firmly held in place during light-curing from all aspects with an appropriate light intensity and duration (20 seconds for halogen lights and 10 seconds for LED lights of 800 mW/cm²).
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After setting, a #12 blade is used to trim set excess cement. The occlusion is checked and adjusted accordingly. Finally, minor adjustments and margins are polished with silicone tips, interproximal diamond strips, and the sulcus irrigated with chlorhexidine solution to wash out remnants of set cement and to promote gingival health.

To illustrate the above three processes of cementation, two case studies are presented in Figures 19 to 32 (cementation of a ceramic inlay) and Figures 33 to 45 (PLVs).

**Conclusion**

Cementation is the penultimate clinical procedure, besides review and maintenance, for the provision of indirect restorations. Fitting indirect restorations requires adherence to stringent clinical procedures for ensuring success and longevity. Achieving these objectives involves understanding the mechanism of adhesion, the benefits and limitations of contemporary cements, and selecting the most appropriate cement depending on the type of restoration, the restorative material and the prevailing clinical situation. For aesthetic tooth-coloured restorations, the ideal choice is RED bonding with CR cements.

It is observed in the dental literature that all-ceramic restoration survival rates are now approaching those of metal-ceramic prostheses. However, providing metal-ceramic units is relatively technique insensitive, unlike all-ceramic prostheses, which are highly technique sensitive. Forgetting this basic difference in clinical practice is costly, frustrating and embarrassing, and although clinical judgement may be forgiven, the patient may not be so forgiving.

Editorial note: A complete list of references is available from the publisher.
All dental practices have patients with dentine hypersensitivity. Many patients avoid dental treatment because of their hypersensitivity. Surprisingly, most practices do not have a systematic approach for diagnosing and treating this condition. This is simply because it seems too complicated. There is a multitude of products. What works? Why does it work? Many practitioners have had poor success in the past with sensitivity treatments and are reluctant to try again. Today’s products are effective and easy to use. The following discussion will attempt to bring simplicity and clarity to the subject of diagnosis and treatment of dentine hypersensitivity.

Definition

Dentine hypersensitivity is defined as a short sharp pain arising from exposed dentine in response to:

- thermal change
- evaporation of air
- tactile stimulus
- osmotic pressure
- chemical stimulus

and cannot be ascribed to any defect or pathology.1

The three essential components of dentine hypersensitivity are (Fig. 1):2

1. exposed dentine surfaces
2. open tubule orifices on the exposed dentine surfaces
3. patent tubules leading to vital pulp

Dentine hypersensitivity has been reported to affect up to 57 per cent of the general population.3-10 It occurs most frequently in patients of 30 to 40 years of age.11 All teeth are susceptible but canines and premolars are the most affected.12,13

A 2002 international survey of 11,000 adults revealed that only half of the affected individuals had talked to their dentist about their sensitivity and only half of this group actually received treatment recommendations.14 Many patients do not wish to burden the dentist with this problem, or they may feel that it may not be taken seriously.

Mechanism of action

The most widely accepted theory for the mechanism that causes dentine hypersensitivity is the hydrodynamic theory first proposed by Brännström in 1963.15 When dentinal tubules in vital teeth are

Fig. 1. The essential components of dentine hypersensitivity are exposed dentine surfaces with open patent tubules leading to a vital pulp. (Image courtesy of GSK)
Table I  Treatment of dentine hypersensitivity

Fig. 2  Fluid shifts in the dentinal tubules activate pain receptors to cause pain (Courtesy of GSK)

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>Benefits and indications</th>
<th>Delivery</th>
<th>Product examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluorides</td>
<td>Some efficacy. Stannous fluoride best. For mild sensitivity where patient also has gingivitis.</td>
<td>Toothpaste/at home</td>
<td>Crest Pro-Health (Procter &amp; Gamble)</td>
</tr>
<tr>
<td>Fluoride varnishes</td>
<td>Some efficacy. For mild sensitivity where patient also requires anti-caries effect.</td>
<td>Varnish/in office</td>
<td>Vanish 5 % Sodium Fluoride</td>
</tr>
<tr>
<td>Tissue fixatives</td>
<td>Strong efficacy. Place away from gingiva.</td>
<td>Liquid/in office</td>
<td>GLUMA Desensitizer (Heraeus)</td>
</tr>
<tr>
<td>(glutaraldehyde or HEMA)</td>
<td>Strong efficacy. Fast onset. Lasting.</td>
<td>Liquid/in office</td>
<td>Super Seal (Phoenix Dental)</td>
</tr>
<tr>
<td>Oxalates</td>
<td>Strong efficacy. Cumulative onset. Remineraliser.</td>
<td>Toothpaste/at home</td>
<td>Sensodyne Repair and Protect (GiaxoSmithKline)</td>
</tr>
<tr>
<td>Novamin</td>
<td>Strong efficacy. Cumulative onset. Remineraliser.</td>
<td>Extra paste/at home</td>
<td>MI Paste (GC Europe)</td>
</tr>
<tr>
<td>Recaldent</td>
<td>Strong efficacy. Fast onset. Lasting.</td>
<td>Paste/in office</td>
<td>Sensitive Pro-Relief (Colgate)</td>
</tr>
<tr>
<td>Pro-Argin Technology</td>
<td>Strong efficacy. Fast onset. Lasting.</td>
<td>Toothpaste/at home</td>
<td>Sensodyne (GiaxoSmithKline)</td>
</tr>
<tr>
<td>5 %potassium nitrate</td>
<td>Strong efficacy. Cumulative onset. Best treatment for whitening sensitivity.</td>
<td>Toothpaste/in tray/at home</td>
<td>Sensodyne (GiaxoSmithKline)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gel/at home</td>
<td>Sensodyne (GiaxoSmithKline)</td>
</tr>
</tbody>
</table>

It is important to use specific clinical descriptors with the patient (like brief, sharp, localised) to differentiate dentine hypersensitivity from pulpal pain (which is prolonged, dull, aching, poorly localised and longer lasting).2

Risk factors for dentine hypersensitivity include16:
- periodontal disease
- gingival recession
- para-function (abfractions)
- acidic diet
- xerostomia
- bleaching

These factors predispose the patient to the essential components of dentine hypersensitivity: exposed, open and patent dentinal tubules leading to vital pulp. There may also be passage of fluids through the enamel. The enamel may be thought of as a semi-permeable membrane that allows passage of fluids and small molecules through the organic defects between the enamel crystals. With time, the organic channels become plugged owing to the formation of organic biofilm. When this occurs, the bidirectional flow of
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Fluoride varnishes may be used for sensitivity relief. In healthy patients, saliva is normally very effective in reducing dentine hypersensitivity. Saliva provides calcium and phosphate, which over time occlude open dentine tubules. Pro-Argin Technology was developed based on this role that saliva plays in naturally reducing hypersensitivity. The Pro-Argin formula contains arginine, an amino acid found in saliva. The positively charged arginine binds to the negatively charged dentine surface. This attracts a calcium-rich fluoride varnishes

Fluoride application is believed to work through a reaction between the fluoride ion and ionised calcium in the tubular fluid. This reaction forms an insoluble calcium fluoride precipitate in the tubule. Different fluoride varnishes show differing efficacies. Stannous fluoride is more effective than sodium fluoride in the concentrations used for toothpaste formulations (Figs 3a & b).

Occlusion of dentinal tubules

Fluorides

Fluoride varnishes may be used for sensitivity relief but are chiefly indicated for caries control and remineralisation. The desensitisation effect is transient, since the material is abraded soon after placement. Many applications may be necessary for increased efficacy. It is thought that the benefit comes from the physical blockage of the tubules by the varnish base rather than the fluoride itself.18

Treatment

The first line of treatment for dentine hypersensitivity is of course prevention. All of the predisposing factors must be dealt with first. This may not be an easy task. Periodontal disease, recession, occlusal forces and diet present many challenges. The treatment of sensitivity is much simpler in comparison.

If we review the mechanism of action of dentine hypersensitivity, it is easy to understand the wide range of products available for treatment. The product must either block the movement of fluid in the tubules or stop the transmission of the pain response to the pulp. For added simplification, it is important to focus on the active ingredient, and not on the multitude of products (Table I).

Products are available for in-office or at-home application. Treatment should not be restricted to one option only. This is not a one-size-fits-all solution. Different treatments may be tried and modified based on the patient’s response.

The first group of products works by occluding the open tubules and decreasing pulpal fluid flow. This group includes fluorides, fluoride varnishes, tissue fixatives, oxalates, remineralising agents and Pro-Argin Technology. The second group of products works by depolarising the nerve so that it cannot transmit the pain response.

Oxalates

Desensitisers containing metallic salts, predominantly oxalates, form insoluble chemical precipitates in the peri-tubular dentine. No acid etch or light curing is needed. They cause no irritation of the gingival tissue. One example is Super Seal (Phoenix Dental). Super Seal forms a complex with the calcium-rich zone of the peritubular dentine to create a crystal plug. This effectively shuts down dentine sensitivity almost entirely (Fig. 4).

Remineralising pastes

Remineralising pastes are used in the office or at home to restore the minerals that have leached out of patients’ teeth owing to caries, diet, etc. These pastes have the added advantage of reducing sensitivity through tubule occlusion. Two active ingredients have been shown to be the most effective for this purpose:

1. Novamin (calcium sodium phosphosilicate bioactive glass) and amorphous calcium phosphate: Novamin-containing toothpastes have been shown to reduce dentine hypersensitivity significantly, with continued home use.20, 21 The effect is cumulative up to about six weeks and then stabilises.
2. ACP: ACP forms a protective mineral barrier of hydroxyapatite that occludes the exposed dentinal tubules (Figs. 5a & b).22 ACP is most effective in the form called Recaldent (casein phosphopeptideamorphous calcium phosphate) in which the casein portion (derived from milk) binds the ACP to the tooth surface, where it can do its job. Recaldent-containing pastes are placed on the affected areas after regular brushing.

Pro-Argin Technology

In healthy patients, saliva is normally very effective in reducing dentine hypersensitivity. Saliva provides calcium and phosphate, which over time occlude open dentine tubules. Pro-Argin Technology was developed based on this role that saliva plays in naturally reducing hypersensitivity. The Pro-Argin formula contains arginine, an amino acid found in saliva. The positively charged arginine binds to the negatively charged dentine surface. This attracts a calcium-rich ions...
layer from the saliva to infiltrate and block the dentinal tubules (Fig 8).16

This technology is available for in-office application, through a paste that is delivered by prophylaxis cup. There is also toothpaste for at-home use. The in-office paste has been found to provide immediate and lasting relief of hypersensitivity for four weeks when it is applied as the final polishing step of a professional cleaning.20 It has also been found to decrease dental prophylaxis discomfort when used prior to the procedure.26

_Depolarisation of the nerve

The second major group of desensitisation products works by depolarising the nerve that transmits the pain response. After the nerve has been depolarised, it cannot re-polarise and this diminishes its excitability. The ingredient that produces this effect is potassium nitrate.27 According to the FDA, for a potassium nitrate toothpaste to claim to be desensitising, it must contain five per cent of the ingredient. Potassium nitrate penetrates the enamel and dentine to travel to the pulp and exerts a calming effect on the nerve. This effect can be thought of as a anaesthetic-like.28

Potassium nitrate products are ideal for whitening sensitivity. Whitening sensitivity occurs due to the easy passage of peroxide through the enamel (a semi-permeable membrane) and dentine to the pulp. Desensitisation products that work by occluding the dentinal tubules are ineffective in preventing the passage of the tiny peroxide molecule, which can travel in the interstitial spaces between the tubules.28

Potassium nitrate can be delivered in several effective ways to counteract whitening sensitivity:

1. Pre-brushing with five per cent potassium nitrate toothpaste for two weeks pre-whitening and during whitening: It takes approximately two weeks for the potassium nitrate to be at peak desensitisation efficacy.29
2. Whitening tray delivery of a potassium nitrate toothpaste for ten to 30 minutes during whitening treatment: This appears to be very effective for more acute sensitivity.24 It is preferable to use a toothpaste without sodium lauryl sulphate, which is the primary ingredient in most toothpastes, and creates the effect of foaming. Sodium lauryl sulphate has been associated with increased gingival irritation, especially on prolonged contact.
3. Syringe delivery of potassium nitrate and fluoride: The material is applied as needed for specific areas of sensitivity.
4. Potassium nitrate incorporation into the whitening gel itself: Bleaching efficacy does not appear to be affected by this addition.20

_Conclusion

Treatment of dentine hypersensitivity is a simple, clear process. It starts with a differential diagnosis, ruling out other possible aetiologies like caries, pulpite, cracks, marginal leakage, etc. Next, an attempt is made to eliminate predisposing factors such as periodontal disease, para-function, acidic diet and xerostomia.

At the same time, the patient is evaluated with respect to the potpourri of potential desensitisation ingredients and the products that contain them. It is essential for the dental practitioner to be familiar with these ingredients, their mechanisms of action, benefits and indications. Some patients may require more than one type of treatment. The treatment is fine-tuned until a successful solution is found. There is no longer a reason for any patient to endure dentine hypersensitivity. Simple answers have been found to this long-time problem, and the dentist has gained a patient for life._

Editorial note: A complete list of references is available from the publisher.

_author bio

Dr Fay Goldstep has been a featured speaker in the ADA Seminar Series, and has lectured at the American Dental Association, Yankee, American Academy of Cosmetic Dentistry, Academy of General Dentistry, and the Big Apple dental conferences. She has lectured nationally and internationally on Conservative dentistry, innovations in hygiene, dentist health issues, magnification and office design. She has served on the teaching faculties of the postgraduate programmes in Aesthetic Dentistry at SUNY Buffalo, University of Florida, University of Minnesota and University of Missouri-Kansas City. She has been a contributing author to three textbooks and has published more than 20 articles. She is a Fellow of the American College of Dentists, International Academy for Dental-Facial Esthetics and Academy of Dentistry International. She sits on the editorial boards of the Oral Health Journal (healing/preventive dentistry) and Dental Tribune US Edition. She has been listed as one of the leaders in continuing education by Dentistry Today since 2002. Dr Goldstep is a consultant to a number of dental companies and maintains a private practice in Toronto, Canada.
The problem of white spot lesions

A new method for remineralisation post-orthodontic treatment

Author_Dr Derek Mahony

Demineralised white spot lesions occur frequently after orthodontic treatment. Some teeth are more prone to demineralisation, typically the maxillary lateral incisors and the mandibular canine teeth. The disto-gingival area of the labial enamel surface is the area most commonly affected (Fig 1). In the first few weeks after removal of the fixed appliances, there is a reduction in white spot lesion size and appearance, possibly due to the action of saliva (Fig 2).

Various treatment methods have been proposed to assist the process of remineralisation. It is important to note that fluoride should not be used in high concentration, as it tends to prevent demineralisation and can lead to further unsightly staining. Low concentrations of fluoride, however, may assist remineralisation, such as those found in casein calcium phosphate materials. Additionally, stimulation of salivary flow by chewing sugar-free gum is helpful.

This article will describe a revolutionary approach to the cosmetic treatment of white spot lesions (Fig 3). With Icon, a micro-invasive technology from German manufacturer DMG, demineralised enamel can be filled and reinforced without drilling or anaesthesia (Figs 4 & 5).
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Stopping caries early – without drilling – use Icon.

One of the reasons that earlier approaches to the treatment of white spot lesions have fallen short is that fluoride therapy is not always effective in the advanced stages, and the use of restorative fillings usually sacrifices significant amounts of healthy tooth structure. Instead of adopting a wait and see approach, Icon has been shown to arrest the progress of early enamel lesions up to the first third of dentine in one simple procedure (Fig 6), without unnecessary loss of healthy tooth structure.

In the procedure described here, the surface area of the white spot lesion is eroded with a 15 per cent HCl gel, which opens the pore system of the lesion. This is then dried with ethanol, followed by the application of Icon onto the lesion with the application aid. The extremely high penetration coefficient enables it to penetrate into the lesion pores. Excess material is then removed, and the material is lightcured. The total treatment time should be about 15 minutes (Fig 7).

The cosmetic treatment of cariogenic white spots in one visit can be very appealing, especially to young patients and their parents (Figs 8a&b). No drilling or anaesthesia is required and those patients who have already demonstrated poor compliance with their brushing can be treated earlier. I would recommend that clinicians try the Icon product when attempting to remineralise white spot lesions post-orthodontic treatment. This is not just minimally invasive dentistry; it is micro-invasive dentistry.

Dr Derek Mahony is a world-renowned specialist orthodontist, who has spoken to thousands of practitioners about the benefits of interceptive orthodontic treatment. Early in his career, Dr Mahony learned from leading clinicians the dramatic effect functional appliance therapy can afford patients in orthodontic treatment. He has combined the fixed and functional appliance approach ever since. His lectures are based on the positive impact such a combined treatment approach has had on his orthodontic results and the benefits this philosophy provides from a practice management perspective. Dr Mahony is a contributing editor to the Journal of Clinical Paediatric Dentistry, International Orthodontic Journal and Spanish Journal of Dentofacial Orthopaedics. He can be contacted at info@derekmahony.com.
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Stopping caries early – without drilling – use Icon.
Lithium disilicate -
An effective solution for aesthetically demanding indications

Author: Dr Igor Ristic

At a time when dentists and patients are both seeking more conservative restoration, as well as maximum transformation regarding individual teeth and whole-mouth restoration, lithium disilicate ceramic material represents a truly unique material and is almost certainly the next big thing in aesthetic dentistry!

Owing to its high resistance to fracture (400 MPa), optical properties similar to natural tooth structure and the ability to be pressed very thinly in particular, such material has a unique potential for the manufacture of minimally invasive restorations like ultrathin crowns and veneers.

Now, skilled dental technicians can press lithium disilicate restorations as thin as 0.3mm with excellent aesthetic results. If we add to that experience and knowledge of the material, such restorations could be considered perfect in terms of appearance, durability and ability to blend with the existing intact teeth.

Unfortunately, when the press ceramic was launched it caused some scepticism and reluctance within the profession, primarily owing to the high biological cost of such restorations, since healthy tooth structure was reduced by up to 2mm, which eventually led to overly aggressive preparation. Preparation of the lower incisors according to the manufacturer's instructions was often on the verge of devitalising the tooth.

Owing to its special properties, Lithium Disilicate (IPS e.max Press, Ivoclar Vivadent) has completely
allows for extremely conservative preparation. IPS e.max Press is an aesthetic ceramic system based on lithium disilicate, with a high resistance to fracture, that can be cemented with adhesive technique or self-etch composite cements—such techniques are better known in the literature as “conventional”. Full-contour restorations can be created and characterised with staining or layered with IPS e.max Ceram ceramic.

Case report

The patient presented to our practice with a simple request: “I don’t like the stains on my teeth and I would like to correct the rotated tooth #22 to look like #12”.

The examination established that teeth #11 and 21 had stains most likely caused by fluorosis, visible under a partially delaminated composite layer, which was previously added by another dentist in an attempt to mask the discoloration. Tooth #22 was rotated with a huge mesial composite filling (Figs 1 & 2). A seemingly nice and relatively harmonious smile, upon further inspection, revealed a number of composite fillings on the proximal palatal side of the central incisors, which limited the possibility of restoration with veneers on these teeth.

After consultation with the laboratory and ceramist, we decided to use IPS e.max Press to produce crowns for teeth #11 and 21, with preparation as conservative as possible, and a thin, V-shaped vestibular palatal veneer on tooth #22, which was to simultaneously be rotated to correct and compensate for the missing natural tooth structure restored with composite. There was a need for preparation only on the labio-distal tooth surface after removing the mesial composite fillings. A veneer was made for tooth #12.

After reviewing the composite fillings on the centrals, the teeth were prepared palatally with a supragingival finish line and minimal removal of the tooth structure. Teeth #12 and 22 were very conservatively prepared, owing to the characteristics of e.max Press materials the advantages and characteristics of e.max Press materials.

Temporary restorations were fabricated from composite material and cemented with the spot-etch technique, in order to allow the fit of the definitive restoration. Impression taking was done with one stage putty/wash technique using highly accurate Flexitime Putty and Flexitime Correct Flow materials (both Heraeus; Fig 4b).

The surface of the prepared teeth was healthy, with natural colour and no discolouration, which allowed us to use the highly translucent IPS e.max Press HT BL1
to use the highly translucent IPS e.max Press HT BL1 ingot (Fig. 6). The copings were pressed from lithium disilicate material and fired in a special furnace.

Given that there was a demand for the highest level of aesthetics in this case, the ceramist decided that all four restorations were to be made using the cut-back technique on pressed copings and veneers in order to achieve a high degree of individualisation using the Incisal materials of the IPS e.max Ceram range.

Once received from the laboratory, the restorations were treated with hydrofluoric acid gel and a silane agent. The restorations were tried in before glazing and then cemented after the final check (Fig 10). For adhesion, we used the resin cement Variolink II (Ivoclar Vivadent) in a transparent colour without a catalyst, taking advantage of light only polymerisation.

The perfectly fitting crowns and veneers, even prior to cementation, indicated that we had met all the preconditions for a successful future adaptation of the restorations to the soft tissue (Fig 11).

Conclusion

The aesthetic result and the optical properties of the overall restoration have demonstrated that when it is necessary to combine veneers and crowns at a minimal cost to the natural tooth structure, the best choice is the IPS e.max Press system, owing to its superb clinical performance, physical properties and reliability. With that knowledge, the treatment team is relieved of the dilemma of whether different thicknesses of the final restorations will yield a different aesthetic result.

The whole system has a much broader philosophy, that no matter what the base is (zirconia, metal substructure, pressed core), it does not affect the final result—a predictable aesthetic reconstruction of different core materials in a single arch.

Acknowledgement

I would like to acknowledge Andreja Protić for the fabrication of the ceramic restorations, laboratory photographs and material for this article.

Author bio

Dr Igors Ristic, after graduating in 1996, searched for the new frontiers and emerging trends in aesthetic dentistry and implantology. In 2001, he established his private practice, the Centre for Aesthetic Dentistry and Implantology in Belgrade, Serbia. He loves teaching treatment planning and various clinical procedures nationally and internationally, through lectures, hands-on training and workshops with a focus on all-ceramic and implant restorative procedures. He is a certified member of the European Society of Cosmetic Dentistry board and an affiliate member of the International Academy for Dental-Facial Esthetics. He can be contacted at igor@iristic.com.
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The Dentistry Show
1st-2nd March 2013
NEC, Birmingham

British Lingual Orthodontic Society Spring Conference
16th March 2013
Four Seasons, Canary Wharf, London

British Dental Conference and Exhibition
25th-27th April 2013
ExCel, London

Clinical Innovations Conference
17th-18th May 2013
Millennium Gloucester Hotel, London

INTERNATIONAL COSMETIC EVENTS 2013

International Dental Show
12–16 March 2013
Cologne, Germany

AACD Annual Meeting
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Seattle, USA

EAED Spring Meeting
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AAED Annual Meeting
7–10 August 2013
Washington, USA

FDI Annual World Dental Congress
28–31 August 2013
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Saturday 2nd March – Paulo Malo
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The plans and equipment for the 90 square metre practice were provided by The Dental Directory. “I have used The Dental Directory for six years now, and I am very happy with the service they provide,” says Mr Todorovic.

Fully equipping both surgeries via The Dental Directory, Mr Todorovic opted for KaVo 1058 dental units on which he specified upgrades to both paint and upholstery to fit with the colour scheme of the practice.

For more information, contact The Dental Directory Equipment Department on 0800 585 585, or visit www.dental-directory.co.uk.

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BACD:

BACD announces its 10th annual conference

The British Academy of Cosmetic Dentistry (BACD) is dedicated to creating a friendly environment where members can come together to share in their passion for their profession and the learning opportunities the BACD provides.

Hitesh Panchal is principal dentist at Dental at MediaCityUK. He says: “My first real ‘taste’ of the BACD came when I attended the Annual Conference a few years back. I remember thinking to myself just how refreshing it was to meet likeminded people all hugely passionate about cosmetic dentistry. The conference really is a fantastic way of meeting different people and networking. It’s also been a great way of gaining new friends within the profession, learning different techniques and swapping tips.

“What I love about the BACD is just how open and friendly everyone is. By speaking to colleagues in the BACD I’ve even managed to gain a number of really useful contacts that have helped me set up my new practice in Salford Quays. Without the BACD it’s fair to say I wouldn’t be the dentist I am today!”

This year’s BACD Annual Conference will be held at the MCCC in Manchester on 22nd–24th November. For further information about the British Academy of Cosmetic Dentistry, call 0207 612 4166, fax 0207 182 7123, email suzy@bacd.com or visit www.bacd.com
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