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DENTAL ASSOCIATION OF MALTA

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Editorial

By Dr David Muscat

Dear colleagues,

It has been rather busy over the last months. We had a wonderful Christmas party at The Hilton on 21st December and this was well attended especially by the younger members and this is encouraging. We raised €468 at our charity raffle for Inspire. We would like to thank Bart Enterprises, Cherubino Ltd, VJ Salomone, Page Technology, GSK, Alf Gera and Sons, Hilton, Collis Williams, Metropolis Ltd, Chemimart, Kin and Pro Health for supplying presents for the raffle.

Our AGM was held at the Federation Gzira on 5th February. This was well attended. There were minor changes made to our statute. Various issues such as the sewage regulations, CBCT course, Medical Devices regulations as well as the issue of non-EU dentists registration were discussed.

Between 24-27th February the DAM, in conjunction with the Radiological Board of Malta and the International Atomic Energy Agency, organised two certified CBCT courses which were kindly sponsored and supported not only financially but logistically and with IT support by Bart Enterprise and Suratek Ltd.

In fact this is probably a European first where a Dental Association, the RPB and the IAEA have worked together towards such an excellent CBCT certified course. Dentists working in Malta did not have to go overseas for this course.

This was quite difficult to organise logistically but the event was again a great success. Two cycles of dentists with 20 in each group were organised. There was a lot of work done behind the scenes namely by Drs Dougall, Manche, Bartolo and Vella. Dr Manche was present on all four days to ensure that all went smoothly. The event was presented by Drs Jimmy Makdissi, Ruben Pauwels and Joe Cremona. The course was fully subscribed. It was extremely well organised and of a very high standard.

On 28th February Bart Enterprises organised a course on hygiene, maintenance and sterilisation which was attended mainly by DSAs. This was presented by W and H hygiene adviser Christian Stempf, member of the European Committee for Normalisation.

There was a concurrent hands-on course organised by Geistlich on their new biomaterial products. This was also a Bart Enterprises event.

On the 29th February there was a meeting of the ITI Study group. At the time of writing this editorial, a Maillefer event was organised for 4th March at Radisson St Julians and the launch of Clear Correct in Malta on 18th March at the Corinthia Marina Resort, both events by Bart Enterprises.

The DAM is currently working on the next Mediterranean Dental Conference.

The cover photo is of the 'Ghajn Tuffieha Tower' and is by Dr Josef Awad.

Best regards,

David

Dr David Muscat B.D.S. (LON)
Editor / Secretary, P.R.O. D.A.M.



Presentation of funds collected at Christmas Raffle to Claire Galea from Inspire.



Participants of the CBCT Event at the Hilton



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Are your patients' dentures truly clean?

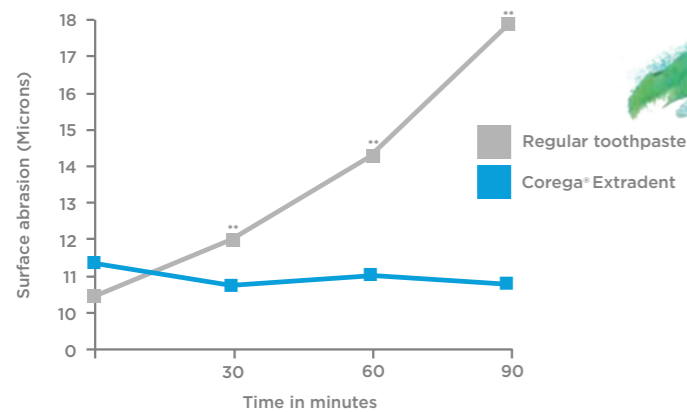
Even visibly clean dentures can have hidden dangers.

The denture surface contains pores in which microorganisms can multiply and thrive.¹ Up to **80%** of patients use toothpaste to clean their dentures.^{2,3} As dentures are approximately **10x** softer than enamel,⁴ the abrasive nature of toothpaste can create scratches, which may lead to increased microbial colonisation,⁵ resulting in gum irritation or denture malodour for your patients. These inadequate cleaning methods can cause the appearance of your specially made and well-fitting dentures to deteriorate and affect your patients' denture wearing experience and satisfaction.

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Brushing with Corega 3 Minutes was associated with significant ($p < 0.005$) reduction in depth of abrasion compared with a regular toothpaste⁷



Examiner blind, randomised three-period crossover study done on 26 subjects simulating brushing for 90 minutes using toothpaste (Crest cavity protection RDA-95) and Corega denture cleanser on an acrylic denture prototype. Surface changes observed at baseline, 30, 60 and 90 minutes. Abrasion was assessed using surface profilometer. ** $p < 0.005$.

* When used as directed; ⁺ *in vitro* single species biofilm after 5 minutes soak

References: 1. Glass RT *et al. J Prosthet Dent.* 2010;103(6):384-389; 2. Marchini L *et al. Gerodontology.* 2004;21:226-228; 3. Barbosa L *et al. Gerodontology.* 2008; 25:99-106; 4. GSK Data on File; Literature review. August 2013; 5. Charman KM *et al. Lett Appl Microbiol.* 2009;48(4):472-477; 6. GSK Data on File; Lux R. 2012; 7. GSK Data on File; L2630368. October 2006.

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THE DENTAL ASSOCIATION OF MALTA Administrative Report for the year 2019

By Dr David Muscat, Hon. Secretary - DAM

The Dental Association had its last AGM on 13 February 2019.

ST APOLLONIA EVENT

On 18/02/2019 we had the St Apollonia event which was celebrated at the Carmelite Monastery in Mdina followed by lunch at Palazzo Depiro. Professor George Camilleri presented a donation of manuscripts related to Professor Mangion and the Dental Profession of Malta by Stuart Geddes to the DAM.

LENTEN TALKS

On 7/04/2019 Dr Lino Said organised Lenten talks at St Peters church at the Benedictine Monastery in Mdina.

MEDITERRANEAN DENTAL CONFERENCE

The DAM organised a two day Mediterranean Dental Conference at The Hilton on 27/28 September 2019 which was a great success. We had lecturers of a great calibre such as Drs Subir Banerji, Apollonius Allen, Matthias Mahrng, David Andrew, Simon Atkins, Jonas Lorenz, Minas Leventis, Rebecca Rominsche. The DAM also garnered the support of local and international sponsors. We hope to hold a similar conference every two years.

WINE TASTING EVENT

On 26/10/2019 a wine tasting for charity was organised at Tal Markiz Winery by Dr Lino Said and €1,200 was raised for Inspire.

CHRISTMAS PARTY

The Christmas party was held at the Hilton on 21st December 2019 and

again was well attended especially by the young dentists. The raffle we held raised €468 which will be given to the charity Inspire.

DAM ACTIVITIES

The DAM has been involved in talks regarding the phasing down of amalgam, and Dr Edward Fenech has been active in this regard.

Dr Chris Satariano attends all the meetings of the Federation. Dr Audrey Camilleri attends the CED meetings abroad and briefs us on EU developments. Dr Nik Dougall is our IT support person and Dr Manche holds us all to account. Dr Adam Bartolo and Dr David Vella have been active in negotiating the forthcoming CBCT two day courses which the Radiation Protection Board organised in conjunction with the DAM. They were also active in negotiations regarding the sewage discharge permit.

Dr Ann Degaetano strives to provide us all with CPD and is the person who is always working behind the scenes to provide quality and value in our events.

Dr David Muscat produces the Dental Probe Journal.

Dr Adam Bartolo also holds the DAM Lifesaving Courses and he is helped by Drs Nik Dougall and Noel Manche.

We look forward to another productive year. 🍷



International Relations Officer Report 2020

By Dr Audrey Camilleri, IRO – DAM

As representative of Dental Association of Malta I attended a CED meeting in Vienna in May 2019 and I also attended the one day CED meeting in Brussels in November 2019

These are the updates on important topics that affect our profession

1. EDUCATION AND PROFESSIONAL QUALIFICATIONS

The working group:

- Reported on the strategy around the call for an immediate update of the Annex V.3/5.3.1. of PQD;
- Informed about the joint paper with FEDCAR;
- Updated on the list of dental professions in European Skills, Competences, Qualifications and Occupations (ESCO);
- Informed about the One Health Event;
- Introduced the new focus of the WG: Future of Oral Health – Workforce Challenges.

2. PATIENT SAFETY, INFECTION CONTROL AND WASTE MANAGEMENT

The working group:

- Presented the CED Resolution on the use of Nitrous Oxide Inhalation Sedation – Update;
- Updated on the WG work on the patient safety;
- Introduced the new focus for the WG on environmental sustainability in dentistry.

3. BTF INTERNAL MARKET

The working group:

- Informed that the BTF worked on the update of the Resolution on Corporate Dentistry which was meant to reflect different national systems regarding supervision over provision of dental care and corporate dentistry.
- They explained that CED Members were asked to provide an overview of the legal situation on corporate dentistry which would allow to get an overview of the situation in different countries.
- They presented some examples of misleading advertising collected and encouraged the Members to provide examples from their own countries;
- Reminded that the Proportionality Test Directive is to be transposed into national legislation by 30 July 2020 and assured that the CED will follow the issue closely;
- Informed that the CED is in the process of joining the EESC Liaison Group. Membership would be politically useful, particularly for the adoption of a common definition of liberal professions in Europe on the basis of the CED Charter.

4. WORKING GROUP DENTAL MATERIALS AND MEDICAL DEVICES

- They informed about progress to date and concerns regarding the implementation of the Medical Devices Regulation i.e. eligibility of Class I devices for the grace period;

- A questionnaire will be sent to investigate in which countries dentists are considered manufacturers;
- They informed on dental amalgam developments and asked CED members to share updates on National Action Plans for phasing down of amalgam;
- They explained that on tooth whitening products, certain non-dental companies in certain Member States are using over the counter whitening, however there is nothing new in this sphere.
- They mentioned that the inhalable form of titanium dioxide has been classified as carcinogen 2 and unless there is an objection from the EU institutions it will enter into force.
- They informed that the WG has updated the CED Resolution on Dental Amalgam to reflect political developments and newest scientific evidence.

CED POSITION

There is an issue related to the inconsistency in the interpretation of the provision on exemption of certain devices/materials from the obligation of an implant card.

Namely, during the process of formulation of MDR, we were explicitly informed that all devices/materials that are fixed to the bone (such as dental implant) are not exempted from the obligation of an implant card.

As per Article 18, the exemption concerns sutures, staples, dental fillings, dental braces, tooth crowns, screws, wedges, plates, wires, pins, clips and connectors.

However, the Swedish Drug Agency decided that dental implants are exempted from the implant card obligation as they are composed of a screw and a tooth crown (which are exempted as per Article 18).

Note that the Commission does not hold any specific privilege in relation to interpretation of EU law and that the qualification issues in relation to products relies primarily with Member States.

Therefore, in order to promote harmonised view on this issue, CED requested the point on the status of dental implants to be added to the agenda of the Commission's expert group composed of competent authorities to obtain a concise written opinion. CED has no official position and they aim to have a unified understanding of this provision among EU member states

CED POSITION RE MEDICAL DEVICES REGULATION AND CHAIRSIDE CAD/CAM PROCEDURES: RIGHT OF DENTISTS NOT TO BE DEFINED AS MANUFACTURERS

- All devices manufactured or marketed in the Union or used to provide diagnostic or therapeutic

services to persons established in the Union, should comply with the provisions of the EU MDR.

- Dentists are manufacturers when they fulfil the definition of "manufacturer" in Article 2 (30) of the MDR. The definition is fulfilled when they manufacture or fully refurbish devices and market those devices under their name or trademark.
- However, dentists are not considered manufacturers (as defined in Article 2 (30) of the MDR), when they manufacture, modify and use devices in their clinic (health institution), provided that they comply with the provisions of Article 5.5 of the MDR.

Putting into service of the CAD/CAM devices that they manufacture should not be considered as making available on the market or placing on the market, in accordance with Article 5.4 of the MDR. 🇺🇦





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1. Arai T, et al. Nihon Shishubyo Gakkai Kaishi 1999; 41(4):450-60 ; 2. Saito T, et al. Arch Oral Biol 1997; 42(8):539-45 ; 3. Gallob JT, et al. J Clin Periodontol 2015; 42:740-7 ; 4. Sadeghi N, et al. J Agr Sci Tech 2009; 11:633-8 ; 5. Chaturvedula VSP, et al. Int J Res Chem Environ 2011; 1(1):1-18 ; 6. Flanagan D. Inside dentistry 2006; 2(9) ; 7. Rajan S, et al. J Orofacial Res 2013; 3(1):38-41 ; 8. Narayan T, et al. IOSR-JDMS 2014; 13(8):29-34.

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THE GOLD STANDARD: IPS e.max Press – one material for virtually all indications?

Posterior occlusal veneers in the dental practice

An article by Dr Diether Reusch and Jan Strüder, Westerburg, Germany

The book titled “Porcelain Laminate Veneers” by David A. Garber, Ronald E. Goldstein and Ronald A. Feinmann has had a great influence on the prosthetic and restorative methods developed by the authors. Based on the resounding success of the adhesive technique, a minimally invasive approach evolved for the reconstruction of teeth.

In 1990 “Westerburger Kontakte”, a private postgraduate dental training institute, offered the first course on ceramic crowns, inlays and veneers. Today, as was the case almost 30 years ago, it is still considered quite an amazing feat that ceramics can be used in the same way as gold alloys. A study conducted by A. Krummel, A. Garling, M. Sasse and M. Kern at the Christian-Albrechts-Universitaet Kiel (University of Kiel) showed that occlusal veneers in the posterior region with a minimum thickness of 0.3 to 0.6 mm offer a very promising treatment solution.

In our dental practice, we restore posterior teeth with occlusal veneers or partial crowns. These restorations measuring 0.5 to 7.0 mm in thickness are made of monolithic IPS Empress or LS₂ and they are cemented with the adhesive technique. In anterior teeth, we use adhesively bonded monolithic 360° veneers, partial crowns or laminate veneers measuring 0.3 to 0.5 mm in thickness. In contrast to gold, which deforms quite easily and metal-ceramic

solutions, which can fracture, most all-ceramic materials are virtually indestructible. Therefore, these materials fulfil exceptionally high standards in terms of the static and the dynamic occlusion.

DIAGNOSIS AND TREATMENT PLANNING

As a result of parafunctional habits and biocorrosion the front teeth of our 23-year-old patient showed considerable attrition. The palatal enamel in the upper jaw had been completely worn away (Figs 1 and 2). Hardly any of the occlusal enamel remained on the posterior teeth.

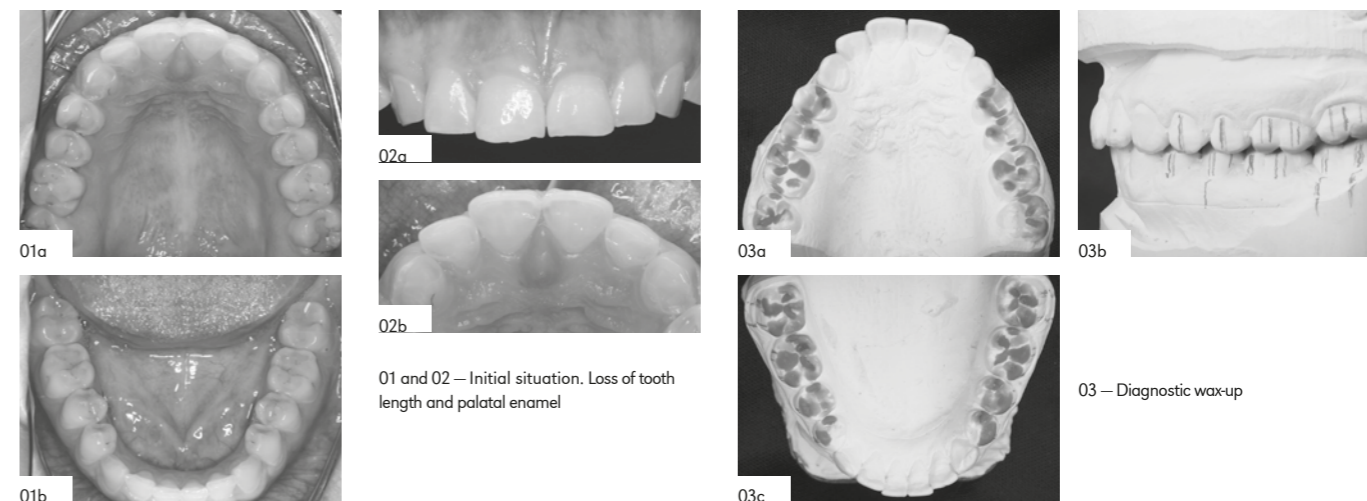
FUNCTIONAL ANALYSIS, WAX-UP AND PREPARATION PLANNING

The upper jaw model was articulated according to skull-related orientation principles. The joint-related orientation was used for the lower jaw. The lower jaw movements were recorded in order to program the articulator. A diagnostic wax-up was produced on the duplicate models (Fig. 3). The aim was to raise the vertical height to the

level required for the reconstruction of the front teeth (“logical” tooth shape). The length of the anterior teeth was established with a mock-up, which was used to test the phonetic, functional and esthetic parameters. As far as the lateral movements were concerned, our objective was to achieve immediate disclusion of the posterior teeth.

Any interfering cusps were relocated. As a guide for the appropriate functional preparation, the dental technician marked the original location of the working cusps (red lines) and the non-supporting cusps (green lines) on the buccal surface of the teeth. Markings were made on the gingiva of the model to indicate the new position of the cusps and spaces. A mould of the duplicate wax-ups was made using a thermoforming process. A temporary composite resin was filled in the moulds, which were placed on the teeth. Once the material had set, the moulds were removed.

Continues on page 10.

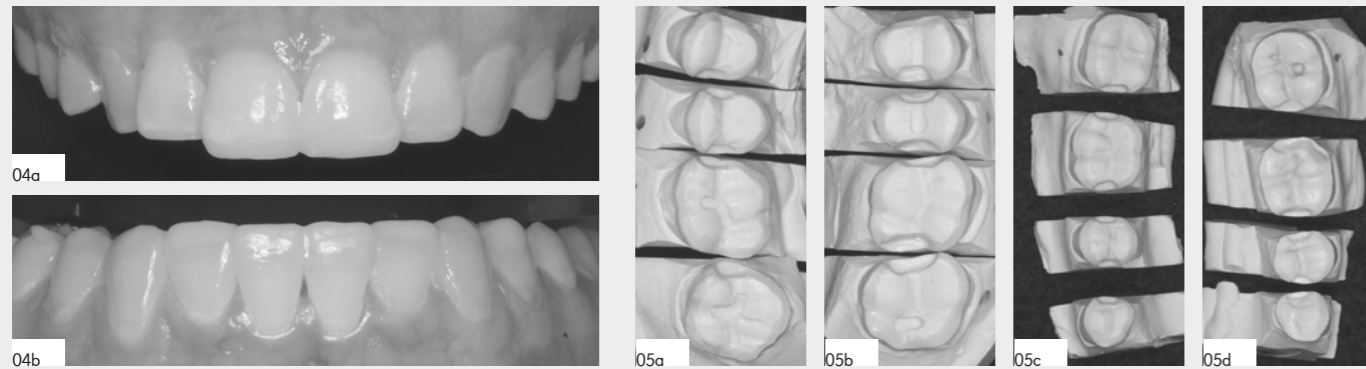


01 and 02 – Initial situation. Loss of tooth length and palatal enamel

03 – Diagnostic wax-up

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– one material for virtually all indications?



04 – Mock-up made of provisional composite resin

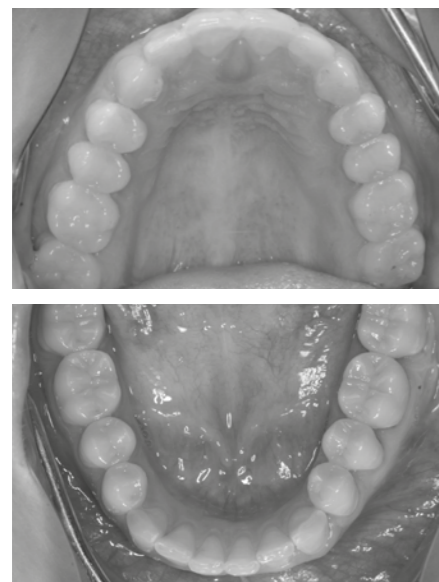
05 – Models of prepared posterior teeth

Continues from page 9.

Together with the patient we were then able to evaluate the planned changes in terms of phonetics, function and esthetics (Fig. 4) before the teeth were actually prepared.

1ST TREATMENT PHASE: TEMPORARY UPPER POSTERIOR RESTORATION AND PERMANENT LOWER POSTERIOR RESTORATION

The posterior teeth in the upper and lower jaw were prepared, and the



06 – Upper and lower anterior teeth: lengthened with composite resin; upper posterior teeth with provisional restorations; lower posterior teeth with permanent partial crowns (characterized)

models (Fig. 5) were mounted in the articulator on the basis of the obtained facebow and centric relation data. The support pin was adjusted in accordance with the planned vertical dimension. The lower posterior teeth were waxed up with the help of an occlusal plane plate. Next, the wax crowns were invested and reproduced with ceramic. The crowns were placed using an adhesive cementation technique (self-etch technique, Adhese® Universal, Variolink® and Monobond® Etch & Prime).

We placed an indirect temporary restoration made of composite resin in the upper posterior jaw. The unprepared anterior teeth were provisionally treated with an adhesively bonded composite resin mock-up (Fig. 6).

The upper dental arch was slightly expanded towards the buccal aspect and the anterior teeth were lengthened. The restorations featured the vertical dimension and cusp positions that were determined by means of the mock-up. Small adjustments were made in the upper temporary restoration by means of splint therapy.

2ND TREATMENT PHASE: PERMANENT UPPER AND LOWER ANTERIOR RESTORATIONS

Preparation and fabrication of the temporary restorations

The upper and lower anterior teeth were prepared on the basis of minimally invasive principles (Figs 7 and 8).

Step 1: A “dual-grit” diamond was used to mark the depth to which the incisal edge needed to be removed through the adhesively bonded mock-up (generally 1.0 to 1.5 mm).

Step 2: A special grinder was used to apply 0.5 mm horizontal depth markings on the facial surface of the teeth through the mock-up. The grooves were marked with an insoluble fine liner.

Step 3: The incisal edges were removed. For this purpose, the “dual-grit” diamond was inclined towards the palatal aspect at an angle of about 30°.

Step 4: The proximal parts of the teeth were removed with a “dual-grit” diamond (0.3 mm) or a flame-shaped bur (014).

Step 5: The mock-up was removed and the labial enamel was cut away until the markings were no longer visible. The cervical areas of the teeth were prepared along the gingival margin. The palatal preparation depth was between 0.3 and 0.5 mm. In the areas where the enamel loss on the palatal surface extended beyond the

tubercle, we prepared the teeth for a 360° veneer. This was done to prevent palatal fractures from occurring.

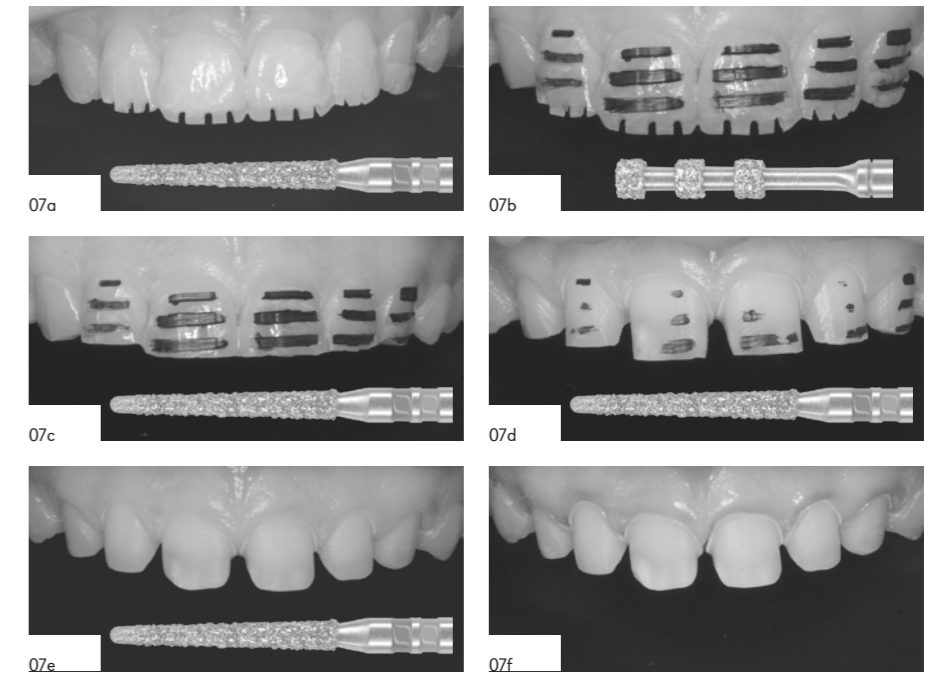
Step 6: Before we finely contoured the margins, we placed a #000 retraction cord. The teeth were prepared with a red contra-angle handpiece at reduced speed (40,000 rpm) up to the level of the retracted gingiva. This preparation step can be done with air cooling.

A silicone matrix, which was produced on the basis of the diagnostic wax-up, was filled with hydrocolloid. Alternatively, the thermoforming method could have been used to make a mould of the wax-up, which would have been filled with silicone impression material. This enabled us to check whether or not we had removed enough of the tooth structure (Fig. 9). If the hydrocolloid is less than 0.3 mm thick, the tooth structure that needs to be further reduced is marked with a wax pencil.

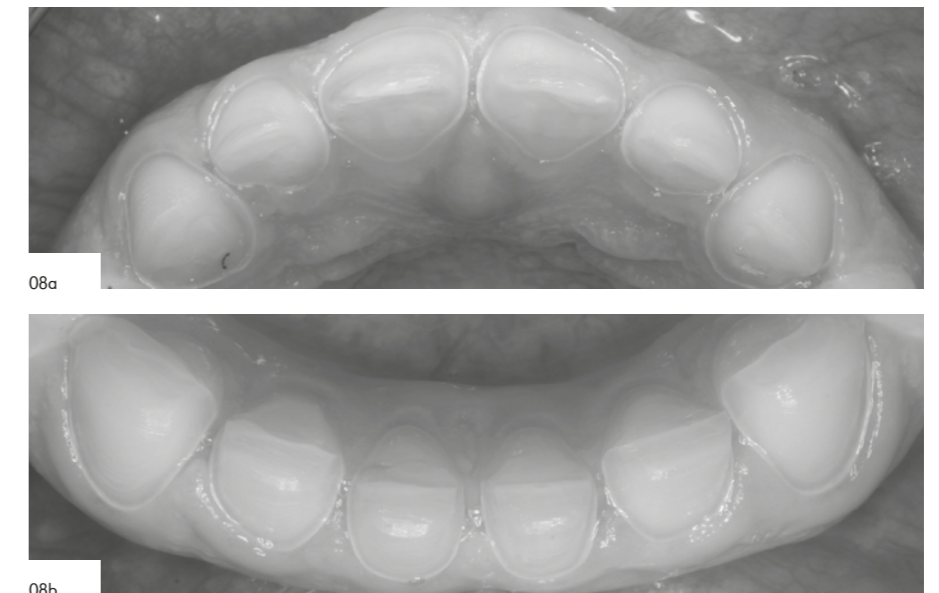
After this impression step, a model was produced with a fast-setting stone (Whip Mix Snap-Stone) in order to check the prepared surfaces. The silicone matrix (diagnostic wax-up) was given to a specialized dental assistant who fabricated the indirect provisional restorations.

Preparation of the lower front teeth and fabrication of the model

The lower front teeth were prepared and checked in the same way as the upper front teeth. The preparation depth was not to exceed 0.3 mm. Before the impressions were taken, a #0 cord (soaked with ViscoStat Clear, Ultradent) was placed over the #000 cord. It was removed shortly before the impression material was inserted. The #000 cord keeps the sulcus open and dry during the impression taking process. We took an overall impression and two partial impressions for the reconstruction of the individual teeth. The articulator was programmed with all the necessary movement data of the lower jaw.



07 – The individual minimally invasive preparation steps in the upper anterior teeth



08 – Completed preparation of the upper and lower anterior teeth (partial preparation)

Wax-up for the examination of the phonetics, function and esthetics

The dental technician produced a wax-up of the front teeth using an esthetic wax. This allowed the dental technician, the dentist and the patient to jointly examine the phonetic, functional and esthetic properties of the restoration (Fig. 10). The adjustments were made with the consent of the patient. Subsequently, the wax-up was invested and then the restoration was pressed.

Determination of the tooth colour and fabrication of the crowns

The final appearance of very thin veneers and crowns is considerably

dependent on the colour of the remaining tooth structure. Therefore, the colour of every single prepared tooth was determined. Furthermore, the dental technician produced individual dies with the corresponding shade in the dental lab (IPS Natural Die Material).

The lab-fabricated crowns were characterized before they were tried in. This allowed the phonetic, functional and esthetic properties of the teeth to be checked and documented by means of photographs taken with a smartphone.

Continues on page 12.

THE GOLD STANDARD: IPS e.max Press – one material for virtually all indications?

Continues from page 11.

After the necessary adjustments had been made, the restorations were glaze fired. The completed restorations (360° veneers/partial crowns) measured between 0.3 and 0.5 mm in thickness (Fig. 11).

Adhesive cementation

If possible, a rubber dam should be used to establish a dry working field for the adhesive cementation technique. Alternatively, a #00 retraction cord should be placed in the sulcus before the cementation procedure in order to make the preparation margin easily accessible (Fig. 12). In the present case, the neighbouring teeth were isolated with Teflon tape. We usually place the crowns in pairs. In this case, after etching with 37 % phosphoric acid, the entire preparation was shown to be located in the enamel tooth structure. Dentin was visible in individual areas, where it had been exposed due to the parafunctional habits of the patient.

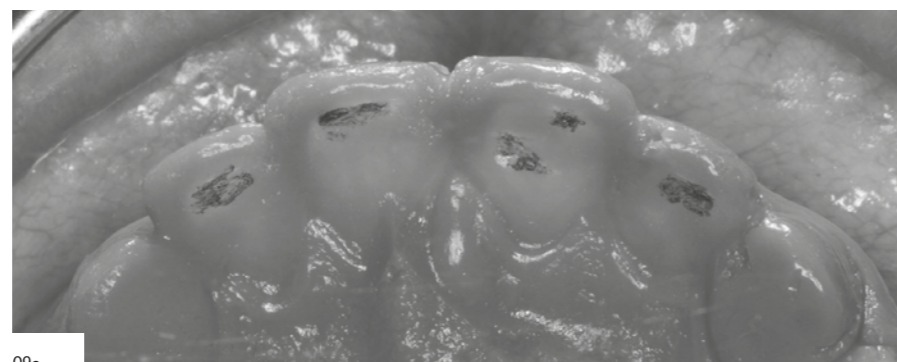
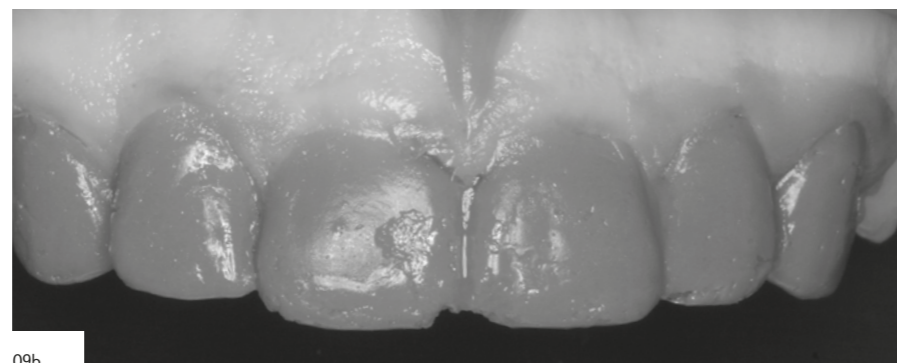
The upper and lower front teeth as well as the lower posterior teeth were permanently restored. A few minor adjustments still needed to be made on the occlusal surfaces of the temporary upper restoration.

3RD TREATMENT PHASE: PERMANENT UPPER POSTERIOR RESTORATION

We removed the indirect restorations in the upper posterior region and took impressions of both jaws. A centric jaw relation record was made using thermoplastic sticks (GC Bite Compound, GC). The upper jaw model was positioned in the articulator on the basis of an arbitrary facebow record. With the help of the two thermoplastic bite records, the lower jaw model was mounted in the articulator in a joint-related orientation.

Application of ReFu wax

We fabricated the upper partial crowns with ReFu wax (Reference Function



09 – Examination of the prepared teeth using hydrocolloid

wax, Keydent). Initially, this wax was very hard. As a result, we were able to check the contact points after the placement of the crowns with the help of Shimstock contact foil. In the oral environment, the wax became softer. We asked our patient to make certain forceful movements, some of which simulated parafunctions (Fig. 13). If a cusp interfered, this was shown on the chewing surface and the necessary adjustments could be made. Subsequently, the waxed-up models were invested and the monolithic partial crowns were fabricated using lithium disilicate (IPS e.max Press) in the press

technique. The restorations were characterized and glazed (Fig. 14). No adjustments were necessary after the restorations had been adhesively bonded. The thickness of the posterior partial crowns measured about 0.5 mm on average.

Adhesive cementation

A rubber dam was placed and the neighbouring teeth were protected with Teflon tape. Then the posterior partial crowns were seated in pairs on the prepared upper teeth using the adhesive cementation technique (Fig. 15).

Continues on page 14.

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THE GOLD STANDARD: IPS e.max Press – one material for virtually all indications?

Continues from page 12.

After the restorations had been cemented in the patient's mouth, we checked the dynamic occlusion with the help of Occlusal Indicator Wax (Kerr) (Fig. 16). The wax did not show any premature occlusal contacts.

Brux Checker foil

The patient was given a Brux Checker foil and instructed to use it for two nights (Fig. 17). This allowed us to make sure and record that the restorations were free from any interference during sleep and bruxing. In most cases, no subsequent grinding adjustments are necessary.

SUMMARY

Minimally invasive restorations measuring 0.3 to 0.6 mm in thickness placed with the adhesive technique have shown to be a reliable treatment option in our practice. We have been working with the described method since 1993. Particularly in young patients showing a substantial loss of enamel, we know of no other comparable long-lasting and minimally invasive treatment approach.



10a



10b



10c

10 – Wax-up for the examination of the phonetics, function and esthetics



11a



11b



11c

11 – Try-in of the restoration after the stains firing cycle



12a



12b

12 – Adhesive cementation of the restorations in the upper anterior jaw

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- Biocompatible
- Biomimetic
- Minimally invasive
- Extremely strong
- Long-lasting; hardly any failures after 25 years
- Excellent conversion of wax-ups into ceramic crowns
- Easy to use
- Easy to colour
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- One material for virtually every indication

NOTE: Ivoclar Vivadent does not recommend that IPS e.max Press and IPS e.max CAD are used in patients with bruxism. Nevertheless, our experience has shown that if all the functional and parafunctional aspects are properly considered, no complications are to be expected in bruxers.

Continues on page 16.



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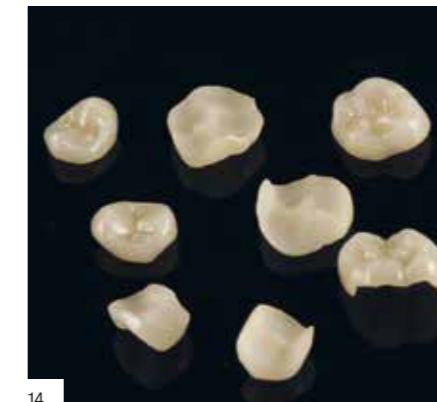


13a



13b

13 – Examination of the static and dynamic occlusion with ReFu wax



14

14 – The pressed ceramic restorations prior to placement



15a

15b

15 – Ceramic partial crowns seated with the adhesive technique



16a



16b

16 – Examination of the dynamic occlusion using an occlusal indicator wax



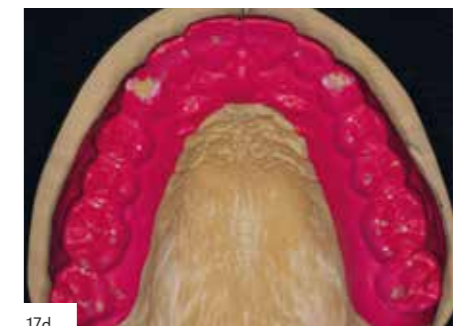
17a



17b



17c



17d

17 – Brux Checker foil (left: initial situation; right: after the restorative treatment)

THE GOLD STANDARD: IPS e.max Press – one material for virtually all indications?

Continues from page 15.

HOW DURABLE ARE IPS E.MAX PRESS AND IPS E.MAX CAD RESTORATIONS?

In a study by K. A. Malament, IPS e.max® CAD/Press performed the best out of all the dental glass-ceramics tested, with a survival rate of 99.75 % over a period of just more than ten years.

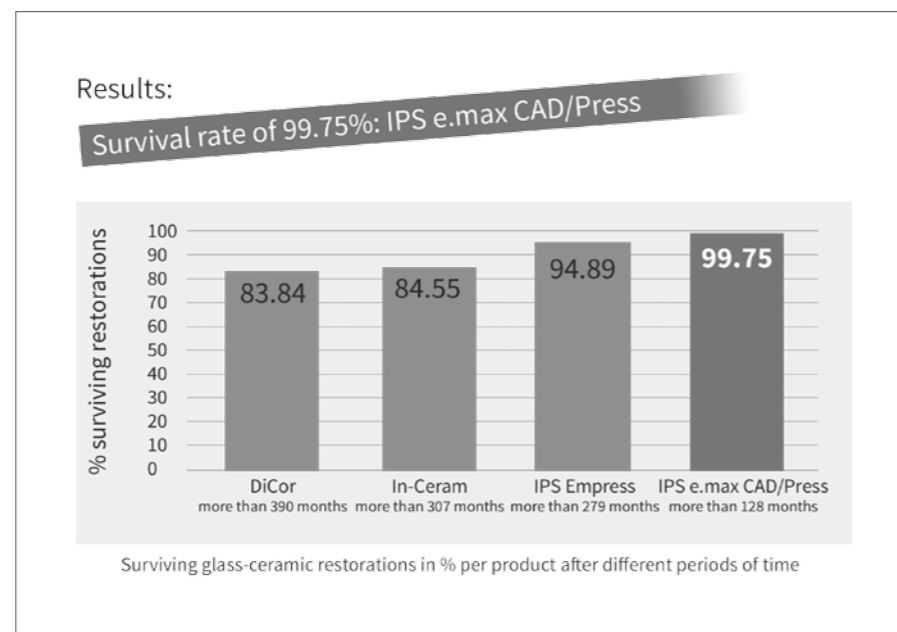
Within the framework of this study, 6000 all-ceramic restorations have been placed since 1983. Four different types of ceramics have been evaluated

- Dicor/Dentsply Sirona (n = 1504)
- In-Ceram/Vita (n = 330)
- IPS Empress (n = 2133)
- IPS e.max Press or CAD (n = 2364)

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Source: IPS e.max, Scientific Report, Vol. 03/2001-2017

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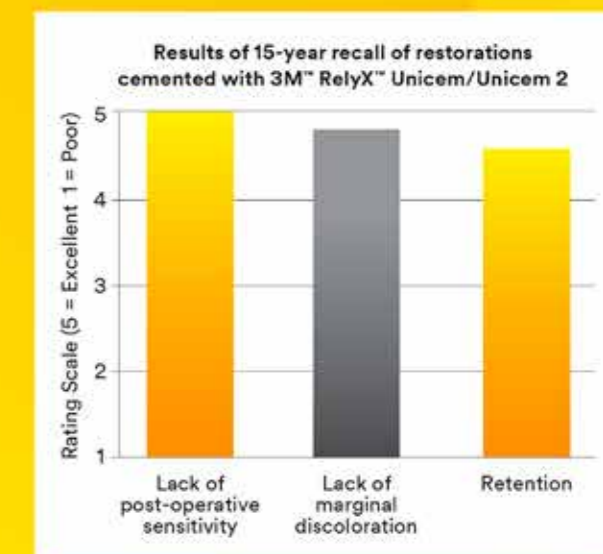


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CROWN LENGTHENING PROCEDURE REVISITED

Dr Fahad Zafar

BDS, MSc (Perio), MSc (Implant dentistry)
CCST European Federation of Periodontology

Dr Giacomo Gualini

DDS, MSc (Perio), MSc (Implant dentistry)

Dr Nicola Scotti

DDS, PhD (Restorative dentistry)

In our daily practice we come across many clinical situations where the carious lesion has reached the sub gingival area or the tooth is broken to the level where enough tooth structure is not available for restorations. In these clinical situations crown lengthening procedure is indicated.

UNDERSTANDING THE TERM BIOLOGICAL WIDTH & ITS RELATIONSHIP WITH RESTORATIVE MARGIN

To understand this problem first we have understand the anatomy of the dento gingival complex. The term biological width which was first coined by Dr D. Walter Cohen in 1962 at the University of Pennsylvania. But recently the term was changed to 'Supracrestal tissue attachment'

Biologic width describes the combined heights of the connective

tissue and epithelial attachments to a tooth. The dimensions of the attachment were described in 1961 by Garguilo on cadavers.

His pioneered work showed the connective tissue attachment having an average height of 1 mm, and the epithelial attachment also having an average height of 1 mm, leading to the 2 mm dimension often quoted in the literature for biologic width. In addition, he found the average facial sulcus depth to be 1 mm, leading to a total average gingival height above bone of 3 mm on the facial.

In 1994, Vacek did further cadaver studies on biologic width that helped give some insight into the clinical findings many of us had seen.

He found that biologic width was relatively similar on all the teeth in the same individual from incisors to molars, and also around each tooth.

He also found the average biologic width to be 2mm as the Garguilo group did. What Vacek found that was clinically important that biologic width varied between individuals, with some having biologic widths as small as 0.75mm, and others as tall as 4mm, but statistically the majority followed the 2mm average.

The primary significance of biologic width or supracrestal tissue attachment to the clinician is its importance relative to the position of restorative margins, and its impact on post-surgical tissue position.

We know that if a restorative margin is placed too deep below tissue, it invades the biologic width, and that will lead to inflammation in the dentogingival complex. The chronic inflammation the dentogingival complex in turn leads to loss of attachment. Clinically this attachment loss would result in periodontal pocket formation in the inter proximal area and gingival recession on the facial surfaces.

The first option to consider when placing a restorative margin is to decide if the margin can be left supra

or equigingival, or must be placed subgingival. If the margin can be placed supra or equigingival, the concerns over biologic width don't exist - assuming the gingiva is healthy and mature.

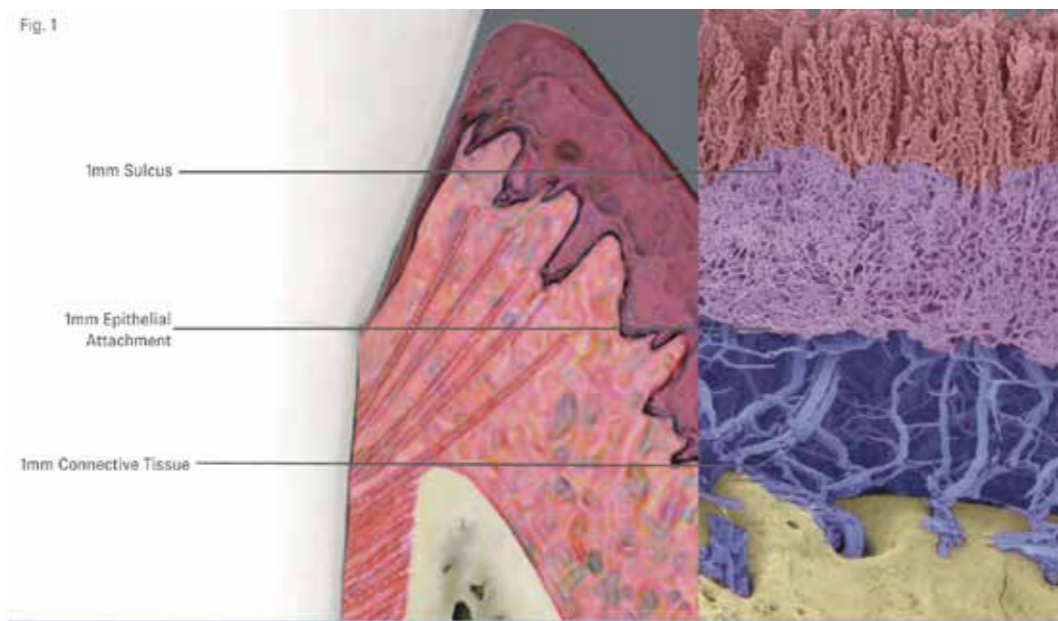
Today, if the tooth colour is acceptable and there is no structural reason to extend below tissue (such as caries, cervical erosion, old restorations or a need to extend for ferrule), the use of a translucent material, such as Lithium Disilicate, can get an esthetically acceptable result without the need to go below tissue.

There are times, however, when it is necessary to place margins below tissue, specifically if structural issues exist, the tooth is extremely discolored or you need to use a more opaque restoration such as zirconia or metal ceramics.

In these instances, a subgingival margin is necessary and the concern of going too far below tissue and violating the attachment exists. As described by Gargiulo 1961 biologic width is same for every patient (i.e. 2 mm), the solution to margin placement is simple: place the margin 2.5mm from bone.

This would be far enough away from bone that it didn't violate the attachment, but also leave the margin sub gingival, as the facial gingival margin is normally at least 3 mm above bone.

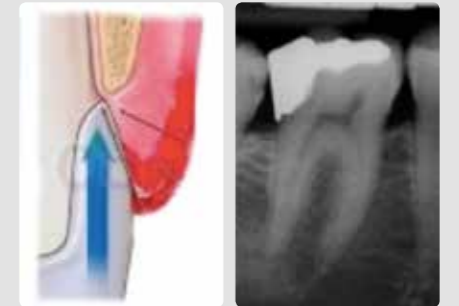
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Dimensions of Biological width

BIOLOGIC WIDTH

Invasion



Inflammation

BIOLOGIC WIDTH

Inflammation



Loss of attachment

CROWN LENGTHENING PROCEDURE REVISITED

Continues from page 19.

CROWN LENGTHENING PROCEDURE FOR CONSERVATIVE DENTISTRY

There are two reasons why we go for functional Crown lengthening procedure.

- 1: Gain access to the sub gingival defects without violating the Biological width.
- 2: To gain tooth structure for indirect restorations(i.e. Ferrule effect)

To gain access to the sub gingival caries or sub gingival fracture crown lengthening is indicated. It can be quite confusing when deciding what kind of surgical approach should be followed.

To make it a simple clinical decision a decisional tree has been formulated after reviewing the literature.

When coming across a clinical situation where the decay is extended sub gingival area a vertical bitewing radiograph should be taken to access the extent of sub gingival caries.

Now a days, with digital X-rays we can easily measure the distance between the crestal bone and the extent of carious lesions.

Many studies in the literature have outlined the minimum distance which should be maintained from the alveolar bone crest and it should be at least 3 mm (Inber et al. 1977, Bragger et al 1992) Other studies have advocated even up to 5mm (Rosenberg et al.1980, Van der Velden et al. 1982). Clinical experience

has shown that not respecting this 3mm of the distance have led to overhang formation which intern leads to gingival inflammation, quantitative and qualitative plaque alterations, pocket formation and loss of attachment.

When assessing the vertical bitewing radiographs the first thing to assess is whether biological width is respected or not. If the answer yes than the second thing to consider whether isolation is possible or not.

If Isolation is possible a Deep margin elevation technique described by Veneziani et al. 2012 can be applied successfully. If the isolation is not possible only soft tissue removal would be required for successful isolation and subsequent restoration. If the distance between future restoration margin is not less than 3mm



The pre requisite for deep margin elevation technique are Isolation, curved circumferential matrix and matrix in a matrix technique.

a crown lengthening surgery with bone removal should be done to recreate healthy dentogingival complex.

CROWN LENGTHENING PROCEDURE FOR PROSTHETIC DENTISTRY

There are two reasons why we go for functional Crown lengthening procedure for prosthetic restorations.

- 1: Gain access to the sub gingival defects without violating the Biological width.
- 2: To gain tooth structure for indirect restorations(i.e. Ferrule effect)

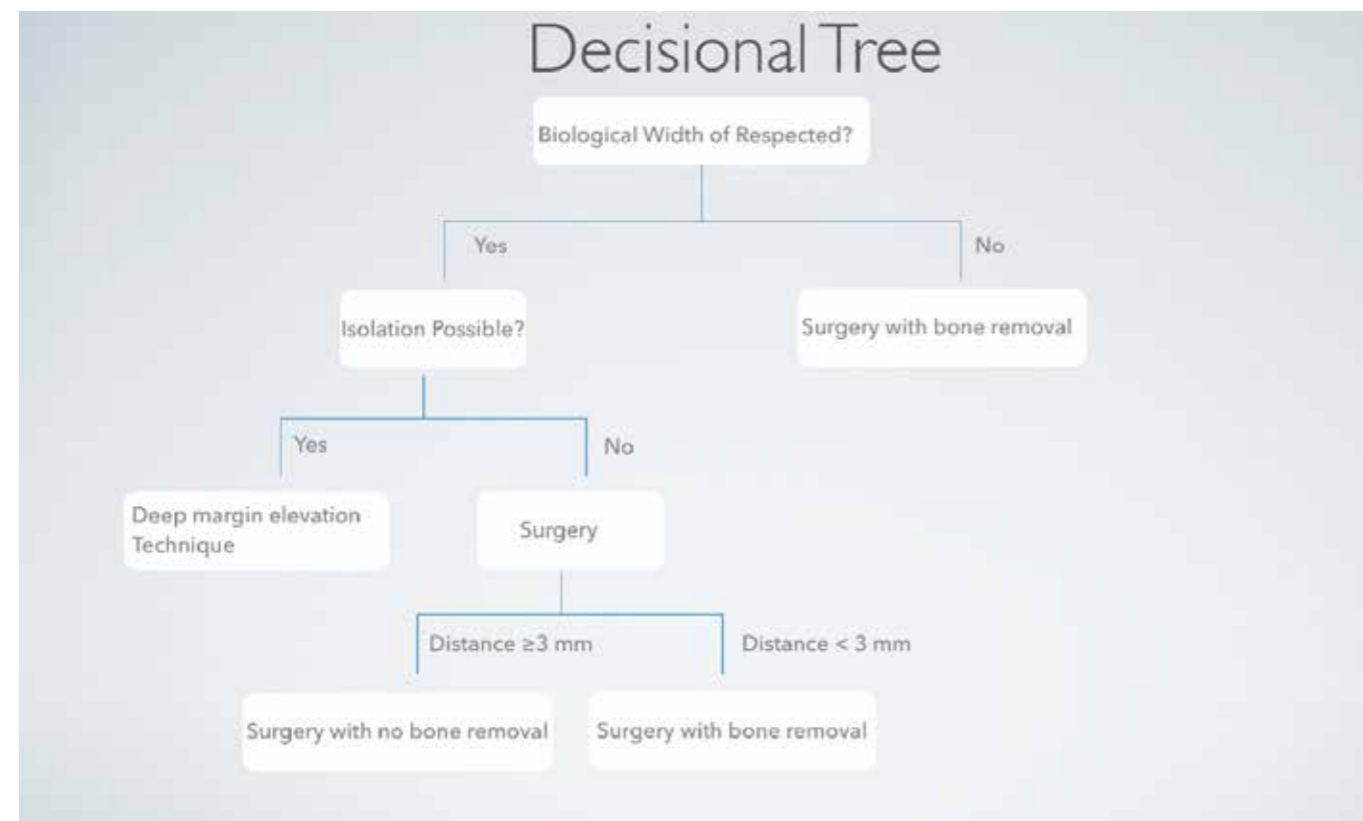
Crown lengthening procedure for prosthetic rehabilitations require at least of 5mm of tooth structure above the crystal bone. Which includes 3mm of for supracrestal tissue attachment and 2 mm for ferrule effect.



In case the distance of restorative margin to supracrestal bone is ≥ 3 mm and isolation is not possible, soft tissue removal is acceptable treatment



In this case crown lengthening procedure with bone removal is required to restore the tooth.



Continues on page 22.



CROWN LENGTHENING PROCEDURE REVISITED

Continues from page 21.

TIMING OF DEFINITIVE PROSTHETIC CROWN

The timing for the final prosthetic crown is very important after crown lengthening procedure. As final gingival tissue is an ongoing process which takes months to complete. In the literature the term creeping attachment has been explained the reason of this healing behaviour. A followup of 12 months should that creeping attachment continues up to 9 to 12 months but significant healing process takes place in first 6 months. Understanding healing process is important in restoring anterior dentition where crown margin has to be in accurate position to have predictable aesthetic outcome.



Follow ups

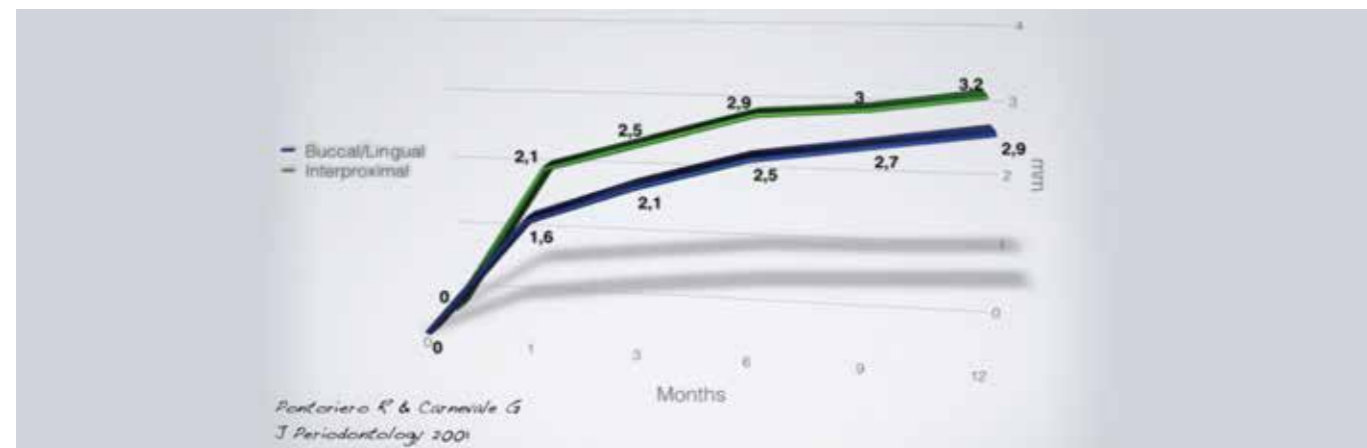
- When the tissue regrowth finishes?
- When the gingival margin level is stable?

Follow ups

Stable tissue level

Pontorero 2001	12 months
Lanning 2003	6 months
Deas 2004	6 months
Schmidt 2013	2-6 months

Posterior: 3-6 months
Anterior: 9-12 months



FULLY DOCUMENTED CLINICAL CASES

CASE 1:
Patient A presented to our practice for the treatment of irreversible pulpitis of the tooth 16. Root canal treatment was performed and patient was awaiting final restoration of the tooth.

But while patient awaiting the final restoration patient had a fracture of the palatal wall of the tooth 1.6. Fracture was analysed and it was a sub gingival fracture.

So a crown lengthening procedure was performed to regain tooth structure for a definite restoration. There was no break in the coronal seal after the fracture.

A paramarginal incision was used in this case buccally and palatally. On the palatal aspect of the 1.7 there were pseudo pockets were present and they were also addressed in the surgical procedure. Flaps were raised and bone remodelling was performed and a distance of 3 mm was achieved from the supra crestal bone.

Continues on page 24.



Paramarginal incision including the distal wedge



Full thickness mucoperiosteal flaps were raised



CROWN LENGTHENING PROCEDURE REVISITED

Continues from page 23.



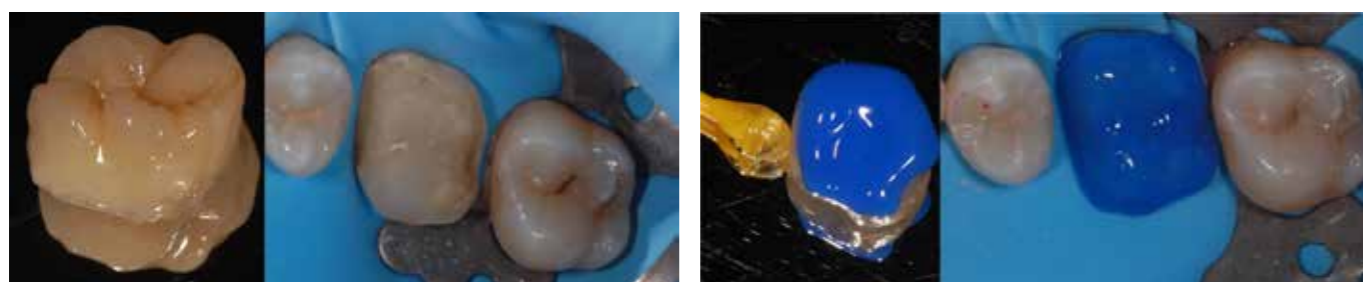
Bone remodelling was performed to achieve 3mm of distance from the alveolar crest.



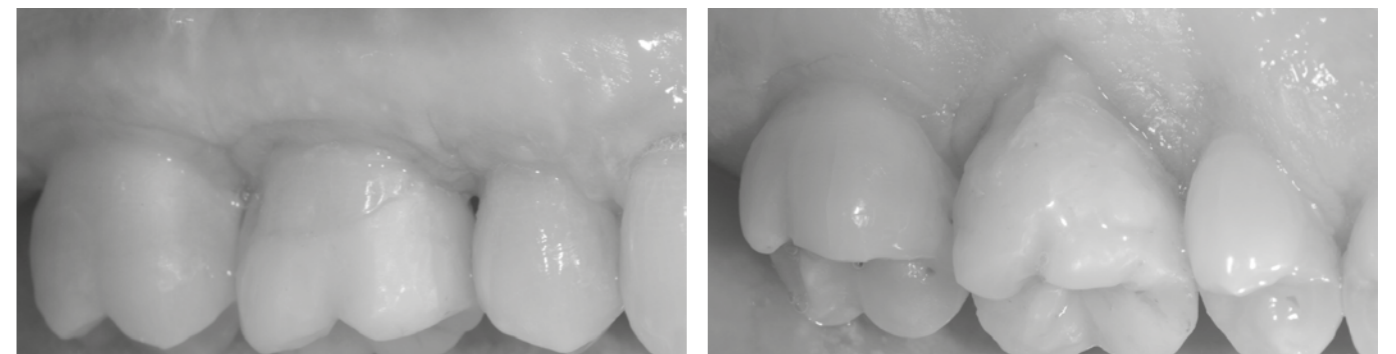
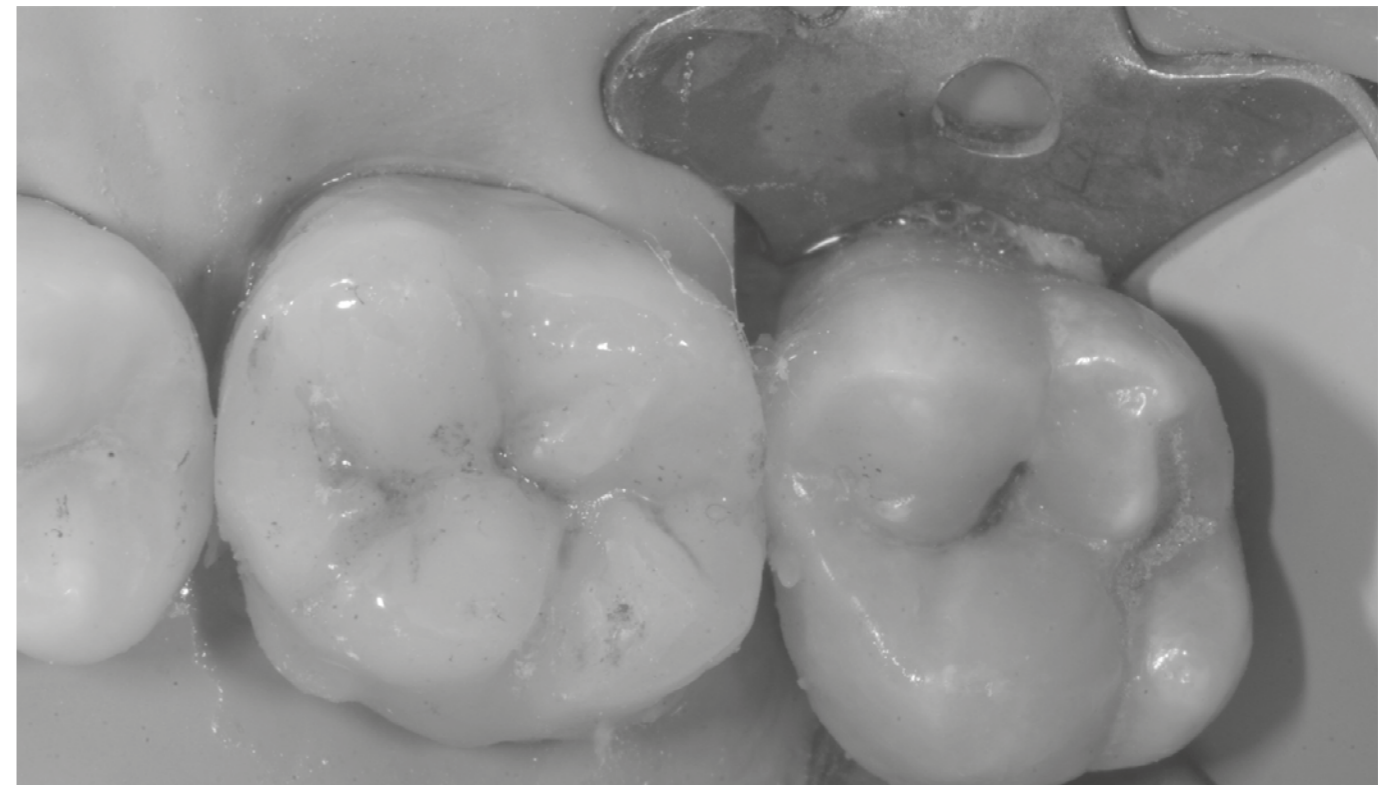
The margins of the flap suture exactly at the new bone margin.



Healing at 1 month.



After 8 months making sure that soft tissue healing complete a permanent restoration was fabricated.



Healthy soft tissue healing can be appreciated by papilla filled interdental area

CASE 2:

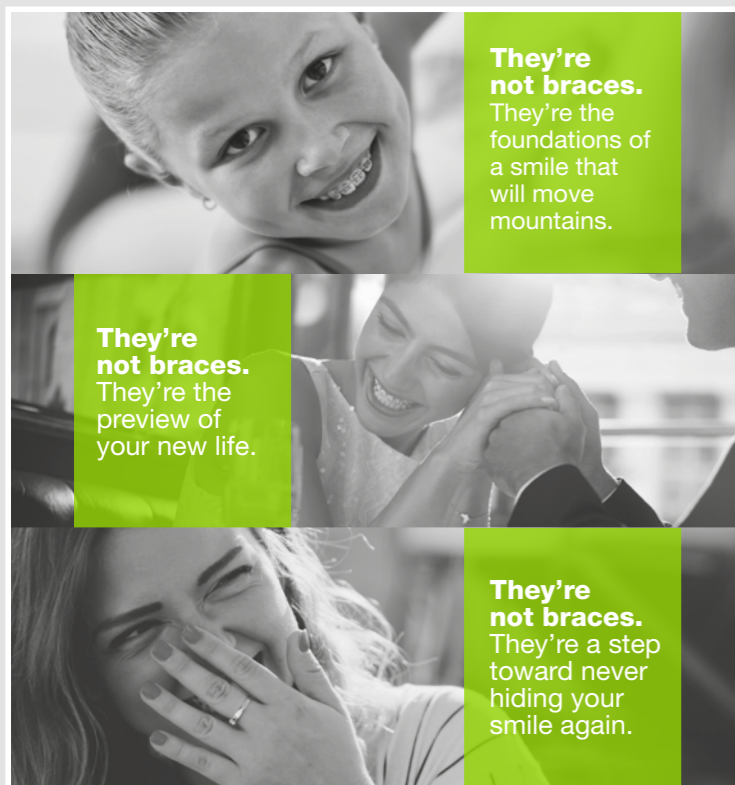
Patient A presented to our practice for Patient presented with broken tooth. Tooth was evaluated for restorative treatment. A crown lengthening procedure was performed and single

visit root canal treatment was performed. Posts were cemented for the coronal buildup of the tooth. One week after surgery and restorative treatment, an impression was taken for

the fabrication of a provisional crown and finally after 6 months of healing a definite crown was cemented.

Continues on page 28.





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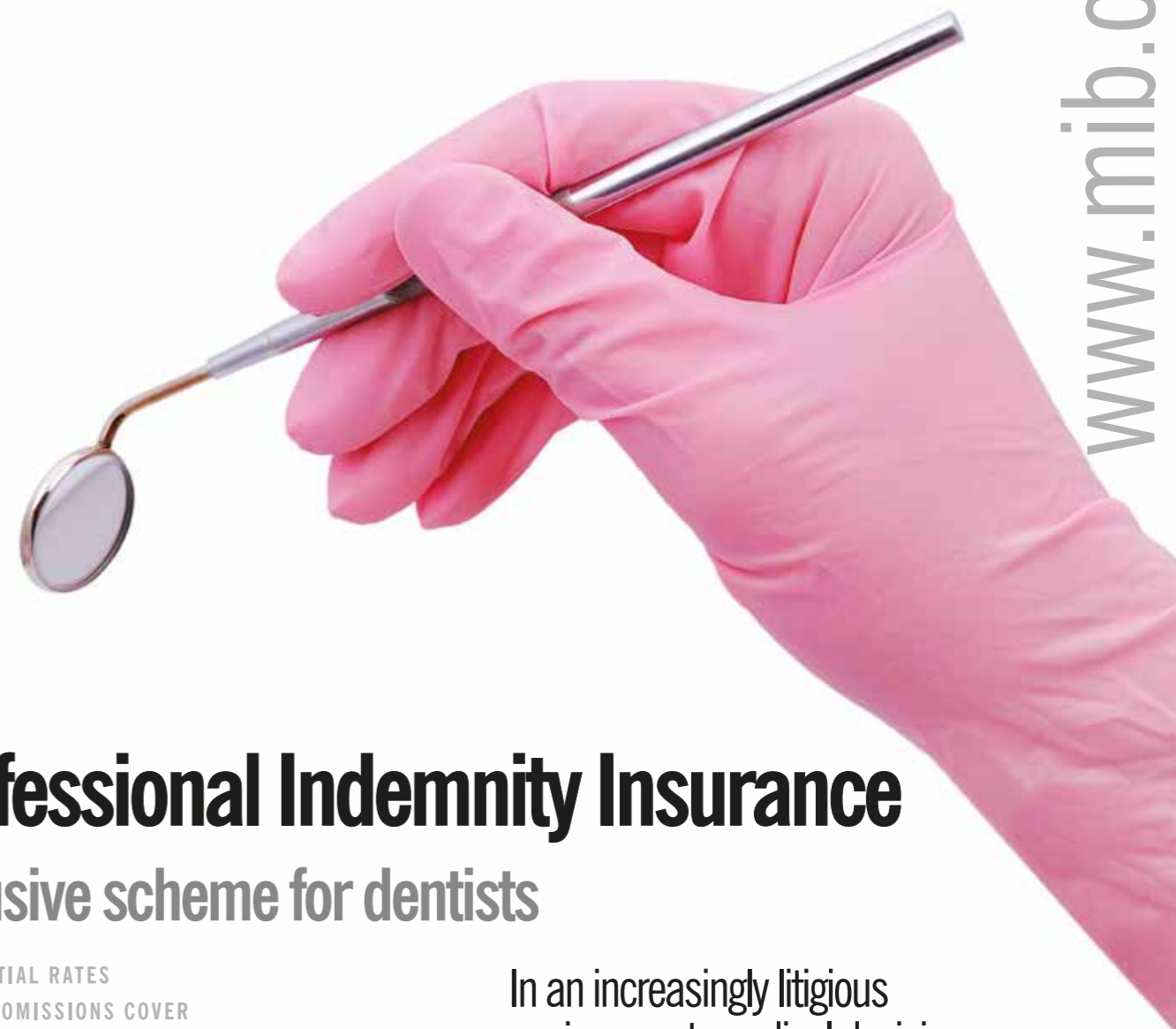
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CROWN LENGTHENING PROCEDURE REVISITED

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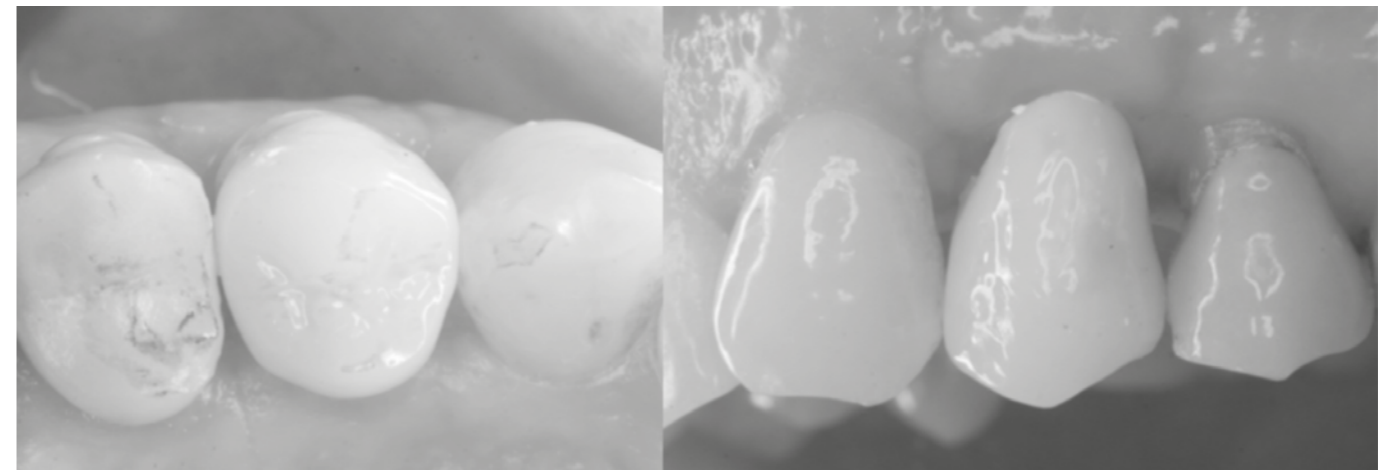
Full thickness mucoperiosteal flap was raised and endodontic therapy was completed in single visit.



After completion of restorative treatment rubber dam was removed and flaps were trimmed and sutured at new bone level.



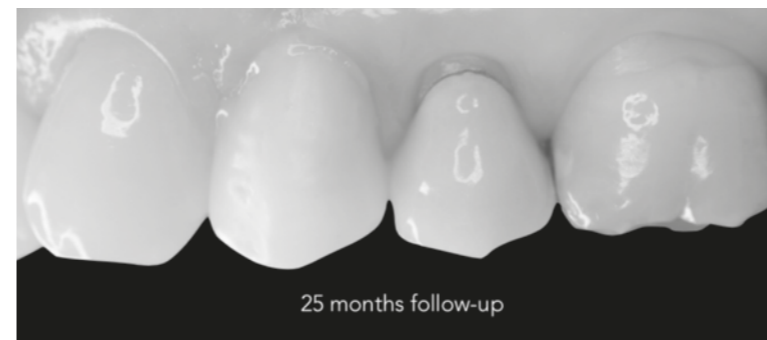
After one week of healing an impression was taken to fabricate provisional acrylic crown.



Provisional crown was cemented.



After 6 months of soft tissue healing a lithium disilicate was fabricated and cemented.



25 months follow-up



48 months follow-up



4 year followup of the the tooth in function. Healthy tissue can be appreciated around the prosthetic crown.

LINERS AND BASES

CAN WE LIVE WITHOUT THEM?

By Dr Adrienne Busuttil B.Ch.D., MSc. AGDP (Lond)

Management of deep caries, pulp protection, and liners and bases share a link between them that has been the cause of much debate and controversy in the field of operative dentistry.

This article is written to complement a presentation delivered at the last Smile for Health Conference which briefly reviewed this topic and the latest evidence available based on the contemporary philosophy of minimally invasive dentistry.

The starting point when managing a tooth with a deep carious lesion should always be to estimate the most likely pulpal condition as this shall, in turn, determine management. It is imperative to obtain a detailed pain history and to carry out meticulous clinical examination supplemented with a good-quality periapical radiograph and pulp sensibility testing to assess the status of the pulp.

If the pulp is necrotic, or there are signs of irreversible pulpitis, or signs that the periapical area is already involved, then routine operative treatment is not indicated and endodontic treatment or tooth extraction need to be considered.

On the other hand, if the pulp is healthy or there are symptoms of reversible pulpitis, then one can opt for operative intervention with the aim of removing the carious dentine and trying to maintain the vitality of the pulp. This means that pulpal protection needs to be considered for a vital tooth with a deep carious cavity.

WHEN? HOW DEEP IS DEEP?

The first obvious question in this regard is when a cavity should be classified deep enough to merit pulpal protection. How deep is deep? In a nutshell, it is the remaining dentine thickness (RDT), between the floor of

the prepared cavity and the pulp, that is the single most important factor in determining whether the pulp will be protected from insults or not.

Several studies show that 2mm RDT will provide an adequate barrier to protect the pulp from insults incurred by operative treatment. As the RDT decreases, the chance of pulpal response increases, and it has been shown that the greatest impact on the pulp occurs when the RDT is not more than 0.5mm.

At 0.25mm RDT there is osteoblastic cell death and the pulp loses its capacity to protect itself by the deposition of tertiary dentine. (1) (2) (3) (4) (5) (6) Hence, it can be concluded that dentine by far provides the best protection for the pulp and a RDT of 0.5mm or greater is necessary to avoid evidence of pulp injury. The problem is that assessment of cavity depth and RDT is difficult, even for experienced clinicians. (6)

In order to estimate the depth of a carious lesion and its proximity to the pulp, it is imperative to have a pre-operative radiograph. Clinicians have traditionally always followed the guideline that there is greatest risk to the pulp when the carious lesion radiographically appears to extend up to 1-2mm from the pulp.

Some more guidance for assessing radiographs comes from an evidence and consensus-based report compiled by The Japanese Society of Conservative Dentistry, in which a deep cavity is defined as one that radiographically extends into two thirds of the dentine. (7) More recently, the European Society of Endodontology issued a position statement in which extensive carious lesions are divided into two

radiographic categories: deep and extremely deep. (8)

Deep carious lesions are considered to be those which reach the inner quarter of dentine but with a radiographically detectable zone of hard or firm dentine remaining between the caries and the pulp.

Such a radiographic view implies that there is a risk of pulp exposure during operative treatment. On the other hand, an extremely deep carious lesion is one that is seen to penetrate the entire thickness of dentine on a radiograph. With this type of radiographic lesion, pulp exposure shall be unavoidable during operative treatment.

The RDT can also be estimated clinically during cavity preparation. Of course, the RDT cannot be measured directly, but knowledge of the thickness of enamel and dentine layers provides some clinical judgement as to how close to the pulp one is working while progressing with tooth tissue removal. In this regard, it is essential to keep in mind the anatomical variants between different teeth, between different tooth surfaces, and according to the patient's age.

WHY PULP PROTECTION IN DEEP CAVITIES?

In order to appreciate the relevance of concerns pertaining to remaining dentine thickness, it is essential to review why pulp protection needs to be considered in deep cavities in the first place. As table 1 clearly shows, dentinal tubules have a larger diameter and are more abundant nearer the pulp.

This means that with increasing cavity depth there is more chance of communication between the pulp and

the oral cavity by virtue of increased microexposures and an increase in dentine permeability.

Furthermore, the deeper the cavity, the greater the hydrodynamic effect. The theory of pulpal hydrodynamics is currently the most accepted theory explaining temperature sensitivity in restored teeth. If a restoration is not well-sealed, there is a resultant gap between the tooth and the restorative material into which dentinal fluid can flow.

Any stimulus, such as hot or cold, will cause a change in the flow rate which is interpreted as pain by the mechanoreceptors.

Hence, in a deeper cavity, there is a greater volume of dentinal fluid as well as more fluid flow, because the tubules are more abundant and more patent, meaning there is more potential for the hydrodynamic effect.

HOW CAN THE PULP BE PROTECTED IN A DEEP CAVITY?

Avoiding iatrogenic damage is a simple, yet important and easily overseen, indirect way of protecting the pulp. Tooth preparation can be traumatic to the pulp, especially friction and dessication. Thus, even the most experienced clinicians should strive to minimise adverse pulpal reactions from rotary instrumentation by using adequate handpiece air-water coolant spray, applying light pressure when using handpieces, avoiding aggressive and/or continuous cutting, and discarding blunt burs.

Secondly, a number of intermediate restorative materials, commonly referred to as liners and bases, have a synonymous link with pulp protection, since these are intended to act as a barrier between the pulp-dentine complex and the definitive restorative material, precisely with the aim of protecting the pulp.

The simplest definition of a liner would be a material that is used in cavity preparations in thin layers of not more than 0.5mm, in order to protect pulpal health.

Bases, on the other hand, are materials used in thicker layers of 1-2mm, again with the aim of

DENTINAL TUBULES	DIAMETER	DENSITY
At ADJ	0.8 µm	19,000/mm ²
At pulp	2.5 µm	45,000/mm ²

Table 1 Diameter and density of dentinal tubules at pulp and amelo-dentinal junction (ADJ)

providing a protective barrier for the pulp beneath restorations, and sometimes also serving other functions including dentine replacement, bulk build-up materials, and blocking undercuts in preparations for indirect restorations.

Liners are used for pulp capping which is a form of vital pulp therapy and which could be direct or indirect. Direct pulp capping involves applying the lining material directly onto exposed pulp to seal off the exposure and facilitate formation of reparative dentine and maintenance of the vitality of the pulp. (9)

This may be a viable option when the pulp is exposed during caries removal from a deep or extremely deep cavity. However, the success rate for direct pulp capping varies widely, with studies reporting success rates from 30% to 80%. (10) (11) (12) (13)

Thus, good long-term outcomes are not always obtained. This may be due to the choice of patients or to the pulp capping method used but, given that the prognosis of direct pulp capping is difficult to predict, it is considered by far better to avoid pulp exposure in the first place as much as possible.

This leads on to the third aspect of how to protect the pulp, which is to avoid pulp exposure. Without doubt, there is no better protection for the pulp than dentine itself.

A fundamental approach when carrying out operative treatment of caries within the sphere of minimal intervention dentistry is to conserve as much dentine as possible, maintain a good remaining dentine thickness, and avoid exposure of the pulp. (14) (15) (8)

A number of procedures have been advocated for avoiding exposure when dealing with deep caries. In order to understand these, it is first essential to touch base on the most recent caries-related terminology that

emerges from a consensus reached by the International Caries Consensus Collaboration (ICCC) in 2016 (15) and that was adopted in a recent position statement published by the European Society of Endodontology. (8)

Carious dentine is subdivided into two histopathological zones: the peripheral caries-infected zone which is irreversibly damaged and the deeper caries-affected zone which is reversibly damaged and has the potential to repair.

The ICCC recognised that, while these histological terms are easy to understand in theory, they are of limited help in practice when trying to describe and decide on the degree to which carious tissues should be removed clinically. Hence, the ICCC group took an approach whereby these histologic terms were linked to their clinical consequences, and agreed on the terms soft, leathery, firm and hard dentine, as shown in figure 1 below.

When removing carious dentine over the pulp, a hand excavator is preferred over a conventional bur as tactile feel is difficult when using a bur, even at low speed. Soft dentine is that which deforms easily and can be excavated with minimum resistance. Firm dentine is physically resistant to hand excavation and moderate force is needed to lift it with a hand excavator.

Leathery dentine is a transition spectrum between soft and firm dentine – it will not deform like soft dentine when an instrument is pressed onto it but it can still be lifted out without much force being required. Hard dentine produces an unmistakable scratchy sound when an excavator is run over it. A significant pushing force would be needed to engage hard dentine with a hand instrument; only a sharp cutting edge or a bur will lift it.

Continues on page 32.

LINERS AND BASES

CAN WE LIVE WITHOUT THEM?

Continues from page 21.

APPROACHES FOR REMOVING CARIOUS TOOTH TISSUE

i) *Non-selective removal to hard dentine*

This approach was previously known as complete excavation or complete caries removal. It is a 'non-selective' approach because the end point for removing carious tissue is based on the same criterion for all parts of the cavity, peripherally or pulpally. With this approach one must remove soft and firm carious dentine from the periphery of the cavity as well as from the central aspects of the cavity, until hard dentine is reached all over (Fig. 2).

Although this approach was a long-taught dogma, the removal of tooth tissue until hard dentine is achieved, even at the expense of pulpal exposure, is no longer advocated. Non-selective removal to hard dentine is considered overtreatment and has been superseded by more conservative selective caries-removal protocols. (16)

ii) *Selective removal to firm dentine*

In 'selective' removal of caries, different excavation criteria are used when removing caries from the periphery of the cavity in comparison to when removing caries in close proximity to the pulp. In this approach, the periphery of the

cavity should be cleaned to sound hard dentine but caries from the floor is removed only until firm (not hard) dentine is reached (Fig 2). This firm dentine has the potential for remineralization and serves to protect pulpal health. This approach is suitable for deep caries as defined by the European Society of Endodontology, as described earlier. (8)

iii) *Selective removal to soft dentine*

In some instances, the caries may be very deep – that is caries that extends more than two thirds into dentine – but there is still a zone of dentine separating the carious lesion from the pulp chamber. In this case, it is advisable to selectively remove caries to soft dentine. Thus, instead of taking firm dentine to be the end point of caries removal, some soft dentine is left over the pulpal floor (Fig 2). The main aim is to not expose or irritate the pulp, thereby promoting pulpal health.

The underlying rationale is that the placement of a properly sealed permanent restoration will seal off any remnant bacteria and deny them any source of nutrition such that the bacteria die off or go into dormancy, thereby enabling the lesion to arrest after restoration of the cavity. (15) (17)

iv) *Stepwise removal of carious dentine*

Another conservative approach for caries removal is the stepwise

technique which is essentially a combination of the two selective techniques described above. This technique involves the removal of caries in two stages, as shown in the clinical example depicted in Fig. 3 below. The pre-operative clinical picture and the corresponding radiograph show a lower second molar with deep caries that extends more than two thirds into dentine but there is still some dentine showing between the caries and the pulp. The first stage of operative treatment involves selective carious tissue removal to soft dentine and placement of a temporary restoration. Six months to one year later the vitality of the tooth is assessed and, if the tooth is vital, a second stage of operative treatment is carried out in which caries is selectively removed to firm dentine, followed by placement of a permanent final restoration. The objective of this procedure is to facilitate the physiological reaction that the pulp-dentine complex is inherently capable of. The demineralised dentine becomes remineralised and the amount of viable bacteria is reduced during the sealing phase. During the temporary sealing, the soft carious dentine which was intentionally left behind becomes harder and drier, thus upon re-entry in stage two the operator has the

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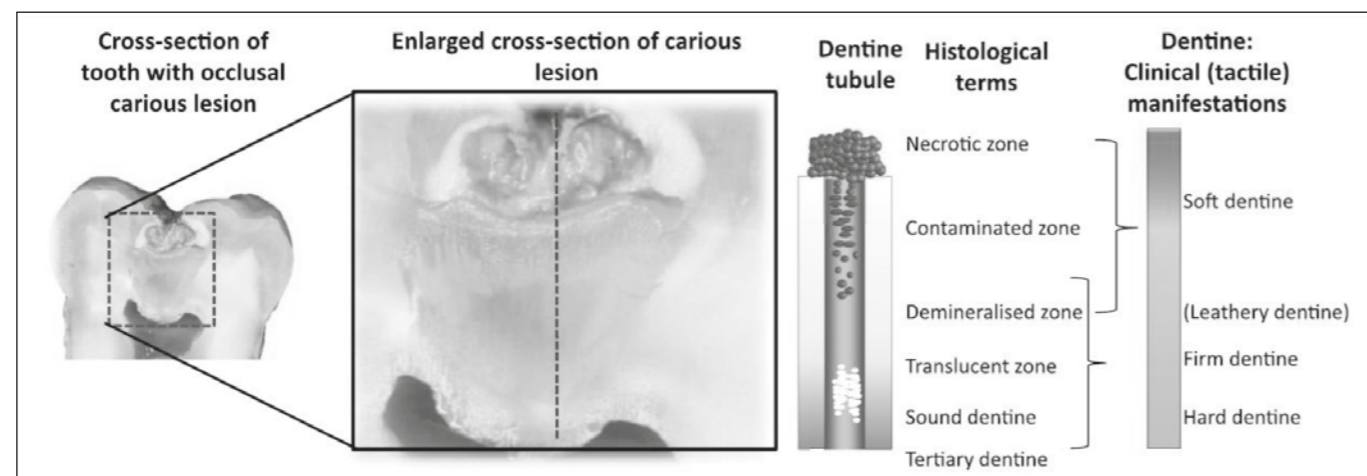


Figure 1 ICC - Different clinical presentation of dentine (15)

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LINERS AND BASES

CAN WE LIVE WITHOUT THEM?

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opportunity to remove caries up to firm dentine with less risk of pulp exposure. (18) There is strong accumulated evidence that both this two-stage stepwise removal approach and the one-stage selective removal of caries to soft dentine are appropriate and helpful minimal intervention approaches to treat lesions in close proximity to the pulp. They both reduce the risk of pulp exposure and post-operative symptoms compared with non-selective removal to hard dentine.

There is some evidence that suggests that one-stage selective removal may be more effective than two-stage stepwise removal. However, most literature concludes that there is still not enough evidence to draw definitive conclusions as to which technique is most effective and more research is needed in this respect. (8) (19) (20)

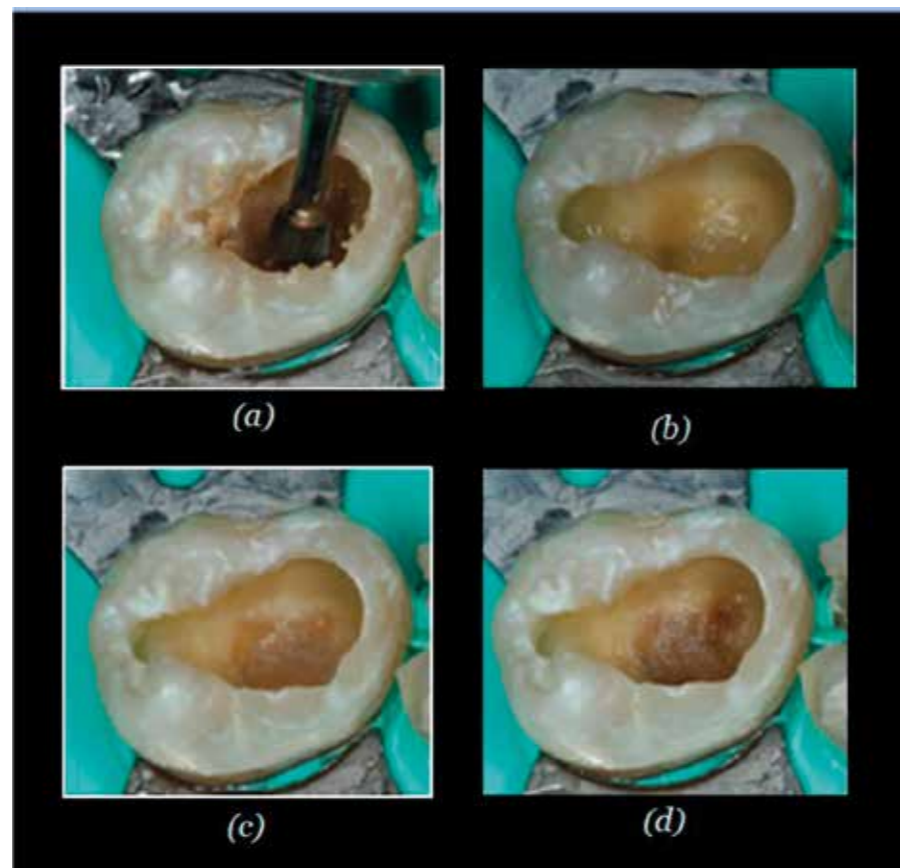


Figure 2 Approaches for removing carious tooth tissue
 (a) Creation of peripheral sound dentine. This is essential to have optimal quality of tooth tissue for bonding in order to achieve an adequately sealed final restoration.
 (b) Caries removal to hard dentine on the pulpal floor; near pulp exposure; not recommended.
 (c) Selective caries removal to firm dentine on the pulpal floor; end point for deep caries that is not extending into the inner 1/3 of dentine.
 (d) Selective caries removal to soft dentine on the

WHAT DOES THE PULP NEED TO BE PROTECTED FROM?

After having discussed in detail how the pulp can be protected, it is logical to review and define the ultimate aim of these approaches and understand what the pulp really needs to be protected from.

Thermal stimuli

One concern is protection from thermal stimuli and sudden intolerable changes in temperature. Post-operative sensitivity due to thermal conduction was a plausible concern with amalgam restorations. This is not the case with composite restorations as this material is a resin not a metal. Post-operative sensitivity after composite placement is often the result of inaccurate clinical technique, namely over-etching dentine, over-drying dentine, and failure to implement methods that reduce the effects of polymerisation shrinkage. The theory of pulpal hydrodynamics, named earlier, has gained acceptance as

an explanation for thermal sensitivity in restored teeth. Based on this theory, the emphasis is to create a good seal so that there are no gaps at the tooth-restoration interface. In light of this, the placement of a liner and/or base material under a composite material to reduce post-operative sensitivity is unreasonable. Thermal insulation is unnecessary and the emphasis should be on accurate clinical technique to achieve a good dentinal seal.

Chemical stimuli

Perhaps the most obvious chemical insult to the pulp in adhesive operative dentistry is acid etch. However, it is now accepted that the pulp-dentine complex can survive contact with quite powerful

acids (including 37% phosphoric acid) provided that the dentine is not over-etched and access to the pulp is effectively sealed at the end of treatment to prevent bacterial invasion. A couple of studies suggest that the use of a lining material might help impede monomer penetration (21) (22), but this evidence is considered to be weak in the latest consensus recommendations. (7)

On the contrary, as the biological compatibility of modern adhesive systems is becoming more and more understood, the clinical use of traditional liners and bases under adhesive restorations has been dramatically reduced.

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SENSITIVITY & GUM PROBLEMS CAN CO-EXIST^{1,2}

Gum recession is a leading cause of dentine exposure³, which can cause dentine hypersensitivity. Research shows that 44% of patients with dentine hypersensitivity changed their tooth brushing technique to avoid the affected areas,⁴ which may result in poor plaque control, a reason for continued dentine tubule exposure.³ In fact 50% of people prone to sensitivity also report concerns about their gum health.⁵

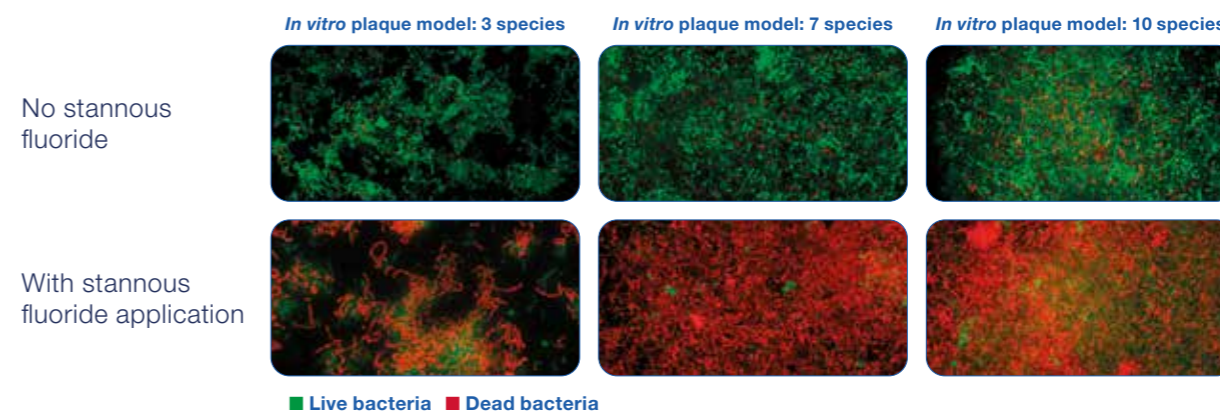
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Significant loss of viability of in vitro plaque when treated with 0.454% stannous fluoride toothpaste. Confocal Laser Scanning Microscopy (CLSM) images of in vitro plaque models with 3 (left), 7 (centre) or 10 (right) dental plaque bacterial species. The protocol and bacteria species used followed a model previously described in Malcolm et al. (2016) and Stephen et al. (2016). Samples treated with slurry of 16% w/v toothpaste for 3 minutes. Control represents untreated in vitro plaque models of 3, 7 or 10 bacterial species, respectively.

Aerobic and anaerobic bacteria, found in early and mature plaque, are affected by the antimicrobial action of stannous fluoride.^{6,9}

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References: 1. Addy M. Int Dent J 2002; 52: 367-375. 2. Bartlett DW et al. J Dent 2013; 41: 1007-1013. 3. Jacobsen P et al. Journal of Contemporary Dental Practice 2001; 2(1): 1-8. 4. GSK data on file, Clinical study report RH02026. 5. GSK data on file, Ipsos 2014. 6. GSK data on file, March 2018. 7. Tinanoff N. J Clin Dent 1995; 6: 37-40. 8. Bellamy PG et al. J Clin Dent 2012; 26: 71-75. 9. Altayyar I et al. Emer Life Sci Res 2015; 1(1): 8-12. Available at https://www.idjrs.com/uploads/38/1770_pdf.pdf

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LINERS AND BASES

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There are clinical studies showing that dentine and pulp protection by conditioning-and-sealing with adhesive resins is as effective as using a conventional calcium hydroxide lining in terms of preventing post-operative complications with composite restorations. (23)

It is not considered justified to place a liner and/or base material under a composite restoration just for the sake of protecting the pulp-dentine complex from chemical stimuli. Instead, adhesives are applied directly to dentine. Creating a chemical barrier is now seen more in terms of creating a good adhesive bond and a good seal at the tooth-restoration interface, in an attempt to minimize leakage at these margins.

Bacteria and toxins, and microleakage
Microleakage is an important phenomenon that the pulp needs to be protected from. It has long been demonstrated that the actual cause of pulpal irritation in restorations is microleakage and subsequent bacterial infection. (24) (25) Additional research

even theorises that post-operative sensitivity may be the result of bacteria and their by-products. (26) In the early days of adhesive dentistry, doubt was cast on the reliability of the seal achieved between the tooth and the composite material, and it thus became common practice to place a base material under the composite to protect the dentine-pulp complex from leakage.

Over the years, adhesive dentistry has advanced a great deal such that it is very possible to achieve strong adhesion and good marginal sealing when placing a composite restoration. With the modern and more developed adhesives available on the market, it is now accepted that, with good clinical technique, it is possible to achieve a good cavity seal that makes microleakage unlikely. Hence, the use of liners and bases under composites for the sake of sealing the pulp from the ingress of micro-organisms and protecting the pulp from the adverse effects of microleakage has been challenged. A composite restoration with an effective marginal seal is not dependent on an underlying base to protect the pulp from the damaging adverse effects of bacteria.

On the contrary, it is now believed that any material placed in bulk as a base for pulpal protection, such as glass ionomer cement (GIC) in the sandwich technique, will act as a barrier between the bonding agent and dentine thereby reducing the potential surface area of dentine available for bonding.

Moreover, the use of a bulk base leads to an overall reduction in strength of the overlying restoration and of the restored tooth itself. In addition, the more interfaces present in a restored tooth, the greater the number of areas that can potentially harvest bacteria.

PUTTING IT ALL TOGETHER – ARE LINERS AND BASES ACTUALLY NEEDED?

Liners are known to act as a physical barrier against bacteria and their toxins, provide a therapeutic effect such as being antibacterial, and induce hard tissue formation.

However, are lining materials actually needed to obtain these benefits? This is definitely the case for direct pulp capping. With respect to indirect pulp capping, this was advocated more than 200 years ago as a conservative

procedure for the pulp-dentine complex.

Traditionally, this procedure involved placement of a protective liner on a thin layer of demineralized tissue, more specifically on hard dentine, left over the pulp. In view of the fact that tissue removal to hard dentine is not advocated anymore, the term ‘indirect pulp capping’ is rather outdated and has been superseded by the term ‘indirect pulp treatment’ to compliment the more modern minimally invasive approaches to caries removal. Indirect pulp treatment is defined as the procedure in which non-remineralizable carious tissue is removed and a thin layer of caries is left at the deepest sites of the cavity preparation where complete caries removal would result in pulp exposure. It follows that this newer terminology is referring to the selective and stepwise caries removal procedures described earlier, with no mention of a protective lining material.

In spite of this, there is still no absolute consensus in the literature regarding the need for a liner when carrying out selective and stepwise caries removal. There is still some ambiguity as to whether the long-term clinical success rates of these conservative approaches are due to the liner material placed over the remaining tissue (typically calcium hydroxide) or simply the sealing of the carious dentine.

Results of recent clinical studies suggest that to achieve clinical success, a good marginal seal, preventing bacterial infiltration, is technically more important than the type of lining material used. Calcium hydroxide is known to be mechanically weak and soluble over time, so it has been questioned whether the long-term success rates of indirect pulp treatment could be attributed solely to the calcium hydroxide liner. In addition, protection of the dentine-pulp complex with an adhesive resin system has been shown to result in similar clinical and radiographic 24-month outcomes as compared to calcium hydroxide liner. (27) (28) (29)

A very recent systematic review concluded that there seems to be insufficient clinical evidence to support the recommendations for using a calcium hydroxide liner. The reviewed literature showed that calcium hydroxide liner has no beneficial influence on the clinical

success of selective or stepwise removal of carious tissue and the use of a calcium hydroxide liner in deep caries lesions is unnecessary.

However, it was also pointed out that the evidence available was of moderate to very low quality and further trials are necessary to provide stronger recommendations. (30) All in all, the most reasonable conclusions that can be drawn at present are that liners are required for direct pulp capping when carrying out vital pulp therapy of extremely deep caries. There is no justification to place a liner when treating a moderately sized carious lesion due to adequate remaining dentine thickness.

When treating deep caries, a liner does not appear necessary when selectively removing caries to firm dentine. However, when dealing with deep caries that has invaded the inner third of dentine and selective removal to soft dentine or stepwise excavation is carried out, then one cannot be sure of how much dentine thickness remains over the pulp and the use of a liner is recommended, not as much for its sealing ability, but more for its antibacterial effect and ability to induce hard tissue formation. A matter of utmost importance when carrying out vital pulp therapy is the maintenance of an aseptic environment. It is essential to maintain an aseptic procedure with the use of rubber dam throughout treatment, even if the pulp is not exposed. (8)

With respect to the need to use base materials, these are essentially only indicated for covering lining materials. Using a base material alone for the purpose of protection from thermal, chemical and other stimuli is not indicated under composite restorations for reasons discussed earlier on. A base material is only indicated if a liner has been used. It has been shown that liners usually do not have sufficient thickness, hardness, or strength to be used alone in a deep cavity and thus a liner needs to be covered by a base material prior to placement of the final restorative material. (31) (26) (32)

WHICH MATERIALS ARE SUITABLE LINERS AND BASES?

Calcium hydroxide remains one of the preferred materials for use as a liner. It is

sufficiently biocompatible to be placed adjacent to the pulp, and its alkalinity imparts antibacterial properties and induces the pulp to lay down secondary dentine. The drawbacks of calcium hydroxide include its solubility, the lack of bond to dentine and the development of tunnel defects and microleakage over time. (31)

There is some evidence to suggest that calcium silicate liners, such as mineral trioxide aggregate (MTA), perform better than calcium hydroxide liners, especially in direct pulp capping. (33) (34) (35) The main benefits of MTA are excellent physical and biological properties, as well as greater and faster deposition of a hard tissue barrier that is more homogenous and complete. Its limitations are the potential for discolouration and difficult clinical handling coupled with an extended setting time and a prolonged maturation phase.

Glass ionomer cement is the base material of choice under composite restorations when needed. GIC is able to chemically bond to tooth structure. It is sufficiently biocompatible, with a coefficient of thermal expansion that is close to that of tooth structure. It exhibits favourable pulpal response and can promote remineralisation even in areas of active caries. (31)

In conclusion, embracing a minimally invasive approach in managing deep caries will help avoid complications with pulpal involvement. Current evidence suggests that the end point for caries removal should be firm or leathery dentine on the pulpal floor, with a periphery of sound, hard dentine and enamel necessary for bonding. If a deep lesion extends to the inner third of dentine, a minimal amount of soft, infected dentine may be left on the pulpal floor to prevent pulpal exposure.

In modern day dentistry involving the use of advanced adhesive restorative materials, the clinical need of a separate layer of pulp protection has been shown to be unnecessary. Whereas a liner may be placed over the deep pulpal dentine, it may not be necessary. Finally, a bonded restoration should be carefully placed to create an effective seal that will prevent post-operative symptoms and further lesion progression.

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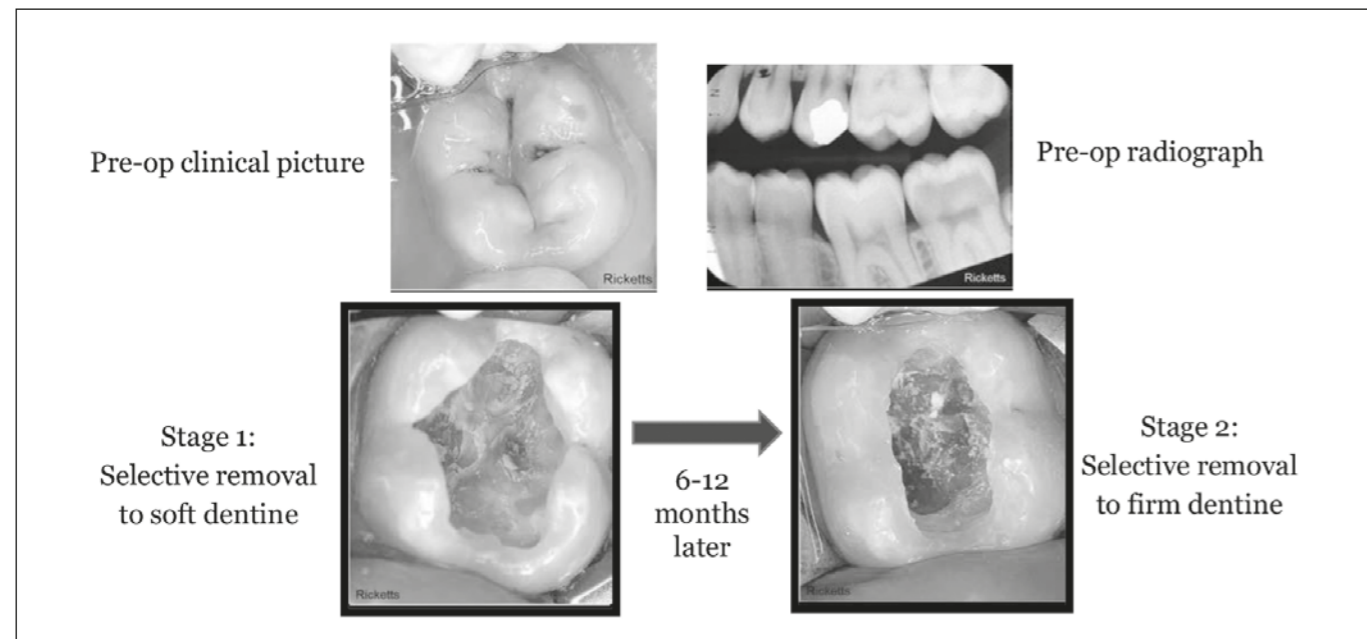


Figure 3 Stepwise removal of caries (18)

Stage 1: Selective caries removal to soft dentine. Hard dentine at periphery of cavity; wet soft dentine left pulpally.

Stage 2: After 6-12 months, dentine is dark, brown and no longer wet. Selective caries removal to firm dentine is now possible.

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REFERENCES

1. The Model Cavity Method Incorporating Dentine. Meryon, S D. 2, March 1988, *Int Endod J*, Vol. 21, pp. 79-84.
2. Restorative Pulpal and Repair Responses. Murray, P E, et al. 4, April 2001, *J Am Dent Assoc*, Vol. 132, pp. 482-491.
3. Cavity Remaining Dentine Thickness and Pulpal Activity. Murray P E, et al. 1, February 2002, *Am J Dent*, Vol. 15, pp. 41-46.
4. Remaining Dentine Thickness and Human Pulp Responses. Murray, P E, et al. 1, January 2003, *Int Endod J*, Vol. 36, pp. 33-43.
5. Response of Human Pulp following Acid Conditioning and Application of a Bonding Agent in Deep Cavities. de Souza Costa, C A, do Nascimento, A B and Teixeira, H M. 7, November 2002, *Dent Mater*, Vol. 18, pp. 543-551.
6. Effect of Different Adhesive Protocols vs Calcium Hydroxide on Primary Tooth Pulp with Different Remaining Dentin Thicknesses: 24-month Results. Büyükgöral, B and Cehreli, Z C. 1, March 2008, *Clin Oral Investig*, Vol. 12, pp. 91-6.
7. Clinical Guidelines for Treating Caries in Adults following a Minimal Intervention Policy - Evidence and Consensus Based Report. Momoi, Y, et al. 2, February 2012, *J Dent*, Vol. 40, pp. 95-105.
8. European Society of Endodontology Position Statement: Management of Deep Caries and the Exposed Pulp. Duncan, H F, et al. 7, July 2019, *Vol. 52*, pp. 923-934.
9. Torabinejad, W M. Principles and Practice of Endodontics. 1st. Philadelphia, PA: Saunders, 2002.
10. Treatment of Deep Caries Lesions in Adults: Randomized Clinical Trials Comparing Stepwise vs. Direct Complete Excavation, and Direct Pulp Capping vs. Partial Pulpotomy. Bjørndal, L, et al. 3, June 2010, *Eur J Oral Sci*, Vol. 118, pp. 290-297.
11. A Clinical Study of Direct Pulp Capping Applied to Carious-exposed Pulp. Matsuo, T, et al. 10, October 1996, *J Endod*, Vol. 22, pp. 551-556.
12. Pulp Capping of Carious Exposures: Treatment Outcome After 5 and 10 Years: a Retrospective Study. Barthel, C R, et al. 9, September 2000, *J Endod*, Vol. 26, pp. 525-528.
13. The Radiographic Outcomes of Direct Pulp-Capping Procedures Performed by Dental Students: a Retrospective Study. Al-Hiyasat, A S, Barrieshi-Nusair, K M and Al-Omari, M A. 12, December 2006, *J Am Dent Assoc*, Vol. 137, pp. 1699-1705.
14. Managing Carious Lesions: Consensus Recommendations on Carious Tissue Removal. Schwendicke, F, et al. 2, May 2016, *Adv Dent Res*, Vol. 28, pp. 58-67.
15. Managing Carious Lesions: Consensus Recommendations on Terminology. Immes, N P T, et al. 2, May 2016, *Adv Dent Res*, Vol. 28, pp. 49-57.
16. Operative Caries Management in Adults and Children. Ricketts, D, et al. 3, March 2013, *Cochrane Database Syst Rev*, Vol. 28.
17. Evidence-based Strategies for the Minimally Invasive Treatment of Carious Lesions - Review of the Literature. Giacomani, R A, et al. 7, July 2018, *Adv Clin Exp Med*, Vol. 27, pp. 1009-1016.
18. Infected Dentine Revisited. Kidd, E, Fejerskov, O and Nyvad, B. 9, November 2015, *Dent Update*, Vol. 42, pp. 802-809.
19. Incomplete Caries Removal: A Systematic Review and Meta-analysis. Schwendicke, F, Dörfer, C E and Paris, S. 4, April 2013, *J Dent Res*, Vol. 92, pp. 306-314.
20. Treatment of Pulp in Teeth Affected by Deep Caries - A Systematic Review of the Literature. Bergholtz, G, et al. 1, December 2013, *Singapore Dent J*, Vol. 34, pp. 1-12.
21. Selective Influence of Dentin Thickness upon Cytotoxicity of Dentin Contacting Materials. Galler, K, et al. 5, May 2005, *J Endod*, Vol. 31, pp. 396-399.
22. Cytotoxicity and Biocompatibility of Direct and Indirect Pulp Capping Materials. Modena, K C, et al. 6, November-December 2009, *J Appl Oral Sci*, Vol. 17, pp. 544-554.
23. Endodontic Complications After Plastic Restorations in General Practice. Whitworth, J M, et al. 6, June 2005, *Int Endod J*, Vol. 38, pp. 409-416.
24. Bacterial Penetration, Pulpal Reaction and Inner Surface of Concise Enamel Bond. Composite Fillings in Etched and Unetched Cavities. Brannström, M and Nordenvall, K J. 1, January 1978, *J Dent Res*, Vol. 57, pp. 3-10.
25. Effect of Acid Etching on the Dental Pulp in Adhesive Composite Restorations. Fujitani, M, Inokoshi, S and Hosoda, H. 1, February 1992, *Int Dent J*, Vol. 42, pp. 3-11.
26. Liners, Bases, and Cements: an in-depth review, Part 1. Weiner, R. 5, May 2008, *Dent Today*, Vol. 27, pp. 72, 74, 76.
27. Indirect Pulp Treatment: In Vivo Outcomes of an Adhesive Resin System vs Calcium Hydroxide for Protection of the Dentin-pulp Complex. Falster, C A, et al. 3, May-June 2002, *Pediatr Dent*, Vol. 24, pp. 241-248.
28. Indirect Pulp Capping in the Primary Dentition: a 4 Year Follow-up Study. Marchi, J J, et al. 2, Winter 2006, *J Clin Pediatr Dent*, Vol. 31, pp. 68-71.
29. Clinical and Microbiological Effect of Calcium Hydroxide Protection in Indirect Pulp Capping in Primary Teeth. Pinto, A S, et al. 6, December 2006, *Am J Den*, Vol. 19, pp. 382-386.
30. Is a Calcium Hydroxide Liner Necessary in the Treatment of Deep Caries Lesions? A Systematic Review and Meta-analysis. da Rosa, W L O, et al. 5, May 2019, *Int Endod J*, Vol. 52, pp. 588-603.
31. Calcium Hydroxide Liners: a Literature Review. Arandi, N Z. 9, July 2017, *Clin Cosmet Invest Dent*, Vol. 13, pp. 67-72.
32. Sturdevant, C M, et al. Bases Dental Materials. The Art and Science of Operative Dentistry. 3rd. St. Louis, MO: Mosby, 1994, pp. 235-239.
33. Clinical Outcome of Direct Pulp Capping with MTA or Calcium Hydroxide: a Systematic Review and Meta-analysis. Zhu, C, Ju, B and Ni, R. 10, October 2015, *Int J Clin Exp Med*, Vol. 8, pp. 17055-17060.
34. Comparison of CaOH with MTA for Direct Pulp Capping: a PBRN Randomized Clinical Trial. Hilton, T J, et al. 7(Suppl), July 2013, *J Dent Res*, Vol. 92, pp. 16S-22S.
35. A Review of the Literature on the Efficacy of Mineral Trioxide Aggregate in Conservative Dentistry. Hosoya, N, et al. 5, October 2019, *Dent Mater J*, Vol. 38, pp. 693-700.
36. Calcium Hydroxide Liners: a Literature Review. Arand, N Z. July 2017, *Clin Cosmet Invest Dent*, Vol. 9, pp. 67-72. ■



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