# **3M<sup>™</sup> Health Care Academy**

# Can you close my gap? My challenge as a dentist is to go beyond the diastema closure.

by Dr Aodhan Docherty

Dr Aodhan Docherty has a passion for using direct composite resin to achieve beautiful, aesthetic results. In this clinical case he describes his technique to close an anterior diastema, with very pleasing and affordable results for the patient. Read on to learn practical hints and tips for this often challenging procedure.

The use of direct composite resin in the closure of anterior diastemas has become a routine procedure for many of today's dentists. Composite resin provides an aesthetic, conservative, cost effective and functional means of closing diastemas. In addition to composite resin bonding, there are several other treatment options available for diastema closure, each with their own advantages and disadvantages. These techniques include: porcelain veneers or crowns, orthodontic work and soft tissue surgery/repositioning. These techniques may be used in combination or alone depending on the presenting condition and the desired outcome.



Figure 1

Direct bonding in diastema cases has the advantage of being an economical option in terms of finances and conservative in terms of tooth structure. These cases do however present challenges in terms of creating excellent proximal contact and contours, as well as shade selection. The key to creating a natural and aesthetic restoration is a complete understanding of adhesive and clinical protocol as well as an appreciation for tooth anatomy.

Filtek<sup>™</sup> Supreme XTE composite resin by 3M Oral Care has been chosen as the restorative material for this case. When 3M Oral Care launched Filtek Supreme restorative well over a decade ago the gold standard at that time for anterior composite was microfill resin due to its unmatched aesthetics. The development of nano-filled particle technology led to the creation of a composite resin which combines both nanoparticle and nanocluster fillers. This revolutionised anterior composite dentistry by achieving a balance of aesthetics and physical properties. Filtek Supreme XTE demonstrates a lasting polish, excellent handling and wear, similar to enamel. The system is based on the VITAPAN classical shade system (with some additions). It comprises of 36 different shades and is simplified into 4 levels of opacity (in descending order): dentine (most opaque), body, enamel and translucent.

## CASE STUDY

The following case involves closure of a congenital midline diastema in a 31 year old lady which was purely an aesthetic concern for the patient.

## **Pre-restorative Stage**

*Examination*: On initial presentation, the patient noted that she disliked her midline diastema and the colour of her teeth. Thick plaque deposits were visible, enlarged probing pocket depths measured with generalised subgingival calculus was present. After a full periodontal charting was completed, it was determined that the patient had generalised chronic mild periodontitis (Figs. 1 & 2).



Figure 2





*Periodontal protocol*: The patient underwent four hygiene visits and at recall there was a significant improvement in probing depths and oral hygiene (Fig. 3).

Tooth width proportion and diastema width: Digital calipers (Dentagauge 3) were used to determine the width of the diastema, and it was approximately 1 mm (Fig. 4).



Figure 4

Whitening protocol: 10% carbamide peroxide in custom made trays for 14 nights, followed by a 60 minute in-chair session with 34% hydremide peroxide (Fig. 5).



#### Figure 5

Diagnostic wax-up and fabrication of a matrix: Alginate impressions were taken of the upper and lower arches, and in the laboratory, wax was added to the 1 mm midline diastema, approximately 0.5 mm per proximal surface, and occlusion was checked using the lower model. A silicone putty key was then made from this, in order to transfer the palatal anatomy and incisal edges. The use of a putty key is absolutely essential in order to transfer the desired clinical outcome and hence minimising any errors in building the form of the initial increments (Fig. 6).



Figure 6

## **Restorative Stage**

#### **1. Shade Selection**

For the clinician to select the correct shade of composite resin, it's important to first understand and have an appreciation for the anatomy of the tooth and how light creates perception of the colour we see. The colour that we perceive is actually the result of light interacting with the dentine and enamel layers, each with varying thickness depending on where exactly in the tooth we are looking<sup>1</sup>. The dentine primarily provides the hue, chroma and opacity of the tooth, while the enamel acts as a light modulating layer which modulates the underlying dentine colour<sup>1</sup>. It is the degree of translucency/opacity of the enamel which will determine how it modulates the reflected light. The more translucent the enamel, the greater colour saturation of the underlying dentine will shine through. With greater enamel opacity, less light will reach the underlaying dentine and hence less colour saturation is reflected to the eye. These principles can similarly be applied to the thickness of the enamel and we know that the enamel at the cervical third is the thinnest. Hence we often see the best representation of the underlying dentine shine through the cervical third and one approach that a clinician may take for shade selection, is to cure a dentine-shade composite sample here to check the dentine shade and cure an enamelshade sample along the middle/incisal to check the enamel shade. Note that the incisal third of the tooth is more often translucent hence this should also be taken into consideration when selecting a shade for this region of the restoration.

With an understanding of the way that light interacts with the enamel and dentine we are in a favourable position to select a shade. Given the large variety of composite systems now available on the market, whilst the VITA shade guide is a good guide for shade analysis, it can never replace an intra-oral mock up. The literature has demonstrated that the VITA shade guide has poor colour compatibility to corresponding composite resins<sup>2</sup>. In addition, it would be advisable to avoid using the shade guides included in composite systems as they are often acrylic and do not correlate to the corresponding cured composite themselves<sup>3,4,5</sup>.

Hence a methodical approach to shade selection would involve creating your own custom shade tabs using the composite resin system you have chosen to use. Simply using a VITA shade tab pressed into some PVS material, you have a custom mold which you can use to create your own tabs. These tabs can then be glued to clear plastic sticks and shade selected by holding the tab across the middle third of the tooth to gauge the overall enamel shade and from then, the clinician may automatically backtrack and select the dentine shade as it is generally one shade darker than the enamel shade<sup>6</sup>.

With the increased prevalence of teeth whitening, we must also consider the effect this has on the dentine and enamel, as this will influence our shade selection. Firstly, oxidised tooth structure tends to become more opaque and demonstrate a higher value, hence the clinician should avoid overly translucent enamel shades and check the value using a black and white photograph. Secondly, the release of oxidative species created during the whitening process may not be immediate and hence remain within the tooth structure for a number of days, compromising the penetration of resin based materials7. In this case study, there was a period of 14 days between the end of the whitening process and placement of adhesive restorations. Shade assessment was completed using 3 shades (WE, A1, B1) of Filtek Supreme XTE composite samples cured along the middle third of the central incisors. On visual inspection, the WE shade matched closely and when viewing a black and white photograph, the value of the WE matched ideally (Fig. 7). Note that due to the whitening process, there was negligible incisal translucency and the central incisors were relatively opaque. Furthermore, because there is only approximately 0.5 mm of composite to be added onto both proximal surfaces, single monochromatic shade may be used as there is insufficient space for a dentine layer. It is important to note that when restoring a diastema, a common issue is 'shine-through' which is the grey/dark appearance of the restorative material due to the dark oral cavity, hence using an opaque material can help to block this8. The WE shade has just the right amount of opacity to combat the 'shine through'. Shade selection is best performed at the very start of the appointment, i.e. prior to rubber dam placement, as teeth will dehydrate and as a result their value will increase9.



Figure 7

#### 2. Mock Up

At this stage, it is the author's preference to ensure that the correct shades, opacity and translucencies have been selected with a mock-up. In cases where there is no time to take impressions and create a putty key prior to the appointment, this is often a good time to take a putty key from this mock-up. Ensure that the composite is cured, because there are significant changes that occur post-curing, for example with hybrids, they become more translucent, higher chroma and lower in value<sup>10</sup>. If a clinician tries shades without curing then there will be a notable difference after curing and this undoubtablywould be detrimental to the overall result.

#### 3. Isolation

The teeth were isolated using a split dam technique and poly-vinyl material to seal the palatal area (Fig. 8). Use of rubber dam controls moisture and contamination within the working area. Unless a split dam technique is being employed, then the use of ligatures is essential in order to expose the proximal embrasure areas which allows for excellent access for both placement and finishing of these areas.



Figure 8

#### 4. Tooth preparation

Mechanical preparation of teeth is not necessarily required when closing diastema, however the use of a very fine buccal bevel may enhance the aesthetics and degree of enamel bonding. A bevel can help to mask the transition between the composite and the tooth structure and enhance the retention and marginal integrity of the restoration<sup>11</sup>. In this case, there was no mechanical preparation, however there was air abrasion of the central incisors using a Prep-Start Unit (Danville engineering) using 27 µm aluminium oxide particles in order to remove the debri (Fig. 9).



Figure 9

Adjacent teeth were protected via the use of teflon tape during the abrasion procedure and the surfaces were then thoroughly cleaned with a pumice slurry.

#### 5. Bonding

The enamel was etched for 30 seconds with 37% orthophosphoric acid, and the microbrush was constantly agitated to enhance the delivery of fresh etch to the tooth structure. Adjacent teeth where protected with teflon tape. Scotchbond<sup>™</sup> Universal Adhesive (3M Oral Care) was applied to the teeth in a gentle scrubbing motion, gentle air thinned and then light cured.

#### 6. Layering technique: Palatal shell

The putty key was then seated and a line lightly scribed onto it using a sharp explorer to indicate the proximal surface of the central incisors. When the putty key is removed, the two lines are used as a guide for the clinician in placement of the composite resin, minimising flash or deficiencies. Approximately 0.3-0.5 mm of Filtek Supreme XTE WE was placed onto the putty key and adapted by using a long bladed instrument (TNCVIPC, Hu Friedy) and brush (Fig. 10).





#### 7. Stratification technique: Dentine/Enamel

In this case, a single monoshade WE Filtek Supreme XTE was chosen, with the buccal aspects of the restorations completed separately with the use of a single clear mylar strip (Fig. 11).

#### 8. Finishing and polishing

The first step of the contouring protocol is to ensure the incisal length and thickness is correct. This was checked by taking the putty key and placing it against the teeth which allows the clinician to assess if the correct length has been achieved and viewing the thickness of the incisal aspect relative to the adjacent tooth structure. A course red Sof-lex<sup>™</sup> disc (3M Oral Care) was used for this step.



Figure 11

The second step of the contouring protocol is to establish the buccal line angles. A pencil is used to scribe the line angles (Fig. 12). Using a course red Sof-lex disc, the line angles were adjusted and it is imperative that the three facial planes of the incisor (gingival, middle and incisal) are taken into consideration, otherwise a single flat facial plane will be created.



Figure 12

Fine buccal contouring and anatomy was placed using a red flame diamond bur without water, which allows the clinician to clearly visualise the working field. Interproximal areas were finished using yellow metal finishing strips. Polishing was done using the Sof-lex range Orange series followed by the Sof-Lex Diamond Polishing system, Beige then Pink spirals (Figs. 13-15). This was followed by a soft goat-hair brush and finally, a cloth wheel mop with diamond finishing paste.



Figure 13



Figure 14



Figure 15



Figure 16



Figure 17

# CONCLUSION

Composite resin is an excellent treatment option for closure of anterior diastemas being minimally invasive, economical and time efficient. An intimate understanding of both tooth anatomy and the properties of resin are essential to create predictable and reproducible results (Figs. 16-19). This case demonstrates that given the appropriate width of the diastema, a single shade may produce a biomimetic result which provides form, function and aesthetics. The final restorations are essentially blended with a chameleon effect and cannot be distinguished from the adjacent dentition.

Figure 20 shows the 12 month recall demonstrating the excellent performance and result. By the request of the patient I have also restored the chipped tooth 22 at this appointment and the patient is very happy with the end result.



Figure 18



Figure 19



Figure 20

#### REFERENCES

- Fahl N Jr. A polychromatic composite layering approach for solving a complex Class IV/direct veneerdiastema combination: part I. Practical Procedures & Aesthetic Dentistry. 2006; Nov-Dec;18(10):641-5; quiz 646
- (2) Priest G, Lindke L. Tooth color selection and characterization accomplished with optical mapping. Practical Periodontics & Aesthetic Dentistry 2000;12(5):497-503; quiz 04
- (3 Paravina RD, Kimura M, Powers JM. Color compatibility of resin composites of identical shade designation. Quintessence Int. 2006; 37(9):713-9 (as cited in Fahl, 2010)
- (4) Park SK, Lee YK. Shade distribution of commercial resin composites and color difference with shade guide tabs. Am J Dent. 2007;20(5):335- 9 (as cited in Fahl, 2010)
- (5) Browning WD, Contretas-Bulnes R, Brackett MG, Brackett WW. Color differences: polymerized composite and corresponding Vitapan Classical shade tab. J Dent. 2009;37(Suppl 1): e34-9. (as cited in Fahl, 2010)

- (6) Fahl N Jr. Mastering Composite Artistry to Create Anterior Masterpieces—Part 1. Journal of Cosmetic Dentistry. 2010, Volume 26, Number 3
- (7) Pimentel AH, Valente LL, Isolan CP, Münchow EA, Piva E, and MoraesEmail RR. Effect of waiting time for placing resin composite restorations after bleaching on enamel bond strength. Applied Adhesion Science 2015 3:23
- (8) Ho C. Diastema closure with a micro-hybrid composite resin. Dental Practice September/ October 2006; 156-160
- (9) Fahl N Jr. Achieving ultimate anterior esthetics with a new microhybrid composite. Compendium of Continuing Education in Dentistry Suppl. 2000;(26):4-13; quiz 26.
- (10) Fahl N Jr. Tip of the month- Shade selection. Seattle Study Club HQ 2016
- (11) Vargas M. Conservative aesthetic enhancement of the anterior dentition using a predictable direct resin protocol. Practical Procedures in Aesthetic Dentistry. 2006;18:501-7.



# **Dr Aodhan Docherty**

Dr Aodhan Docherty received his Bachelor of Medical Science followed by a Bachelor of Dentistry with Honours from the University of Sydney. He has a passion for continuing education and is an alumni of both Newton Fahl's Academy and the Kois Academy. He maintains a successful private practice centered on both general dentistry and comprehensive aesthetic dentistry in Sydney, Australia.

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# **Scientific Affairs**

Janice Pitt Email: jpitt3@mmm.com **Stephen Langdon** Email: sdlangdon@mmm.com







#### 3M Oral Care

**3M Australia Pty Limited** Building A, 1 Rivett Rd North Ryde NSW 2113 Ph: 1300 363 454 www.3M.com.au **3M New Zealand Limited** 94 Apollo Drive Rosedale Auckland 0632 Ph: 0800 80 81 82 www.3M.co.nz



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