The Monoblock Technique – a revolution in adhesive dentistry?

PRIV. DOZ. DR. MED. DENT. STEFAN J. PAUL

A composite cement with an integrated bonding system that can also be used as a core build up material has been a long-awaited dream in restorative denstistry.

According to standard practice today, 3 to 4 different materials, which are often from different manufacturers, are required for bonding to dentin and enamel, fabricating composite core build ups, and adhesive cementation. Since modern composite materials in dentistry are still based on methacrylate, combining materials – for example, a bond from one manufacturer with the composite of another – is often not a problem. Nevertheless, it would be desirable to have one integrated system available.

Coltène/Whaledent has recently developed a dual-curing composite material that can be used as a cement as well as a core build up material (ParaPost Para-Core Automix 5 ml). A chemical curing dentin bonding agent, which is compatible with the material, is also available (ParaBond consists of a Non-Rinse Conditioner and Adhesive A & B, which requires mixing before application; and is why it is defined as a two-step bonding system). ParaBond and ParaCore can be used for: 1. adhesive cementation of a root canal post, 2. fabrication of a core build up, and 3. adhesive cementation of a permanent restoration. Coltène/Whaledent describes this time-saving application as the "Monoblock Technique." The ParaBond/ParaCore System demonstrated excellent sealing against marginal microleakage, which indicates good to very good clinical viability [20].

The Monoblock Technique is particularly suitable when light-transmitting, metal-free root canal posts are used with endodontically-treated teeth that will be fitted with a crown. Root canal posts provide greater retention of the core build up, and distribute masticatory forces along the interface of the residual tooth structure [3, 10, 17]. The use of metal-free root canal posts prevent the greyish translucency at the gingival margin caused by the light reflexion from metal root canal posts.

Publications regarding the use of root canal posts recommend that any further weakening of the residual tooth structure caused by the use of a post should be avoided as much as possible. Root canal posts are primarily indicated whenever there is over 50% loss of tooth structure. The smallest diameter of root canal post should always be used to ensure that there is no overloading of the abutment tooth by the final restoration [4, 5, 13, 19]. From an esthetic point of view, prefer-

Fig. 1: Preoperative clinical situation

Fig. 2: Sufficient root canal filling

Fig. 3: Shade selection by the dental technician

Fig. 4: Preoperative clinical situation with a latex rubber dam

Fig. 5: Preoperative clinical situation with a roeko rubber dam clamp for the anterior teeth

Fig. 6: Removal of the old restoration using a Diatech diamond FG 850L 016 12ML

ence should be given towards the use of a glass fiber reinforced or ceramic root canal post; in which a direct core build up is generally fabricated during the same appointment. Ceramic root canal posts can however also be combined with a ceramic core using the indirect technique.

There are conflicting opinions regarding the necessary properties for root canal posts and core build up materials. Some authors stipulate that root canal posts and dentin should have a similar modulus of elasticity [1, 2, 9, 14], whereas others claim that the rigidity of root canal posts will increase the service life expectancy of the post [1, 15]. Neither theory is supported by adequate clinical studies. In regards to direct core build up materials, amalgam is far superior in terms of its strength and dimensional stability, although it has definite disadvantages, such as discoloration of the tooth structure due to corrosion, which rules out its use in the anterior region. Composites have a high flexural strength, while glass ceramics appear to be very suitable for fabricating a core build up in the anterior region [20].

Glass fiber reinforced root canal posts

According to a recently released meta-analysis [6], prefabricated glass fiber reinforced and ceramic root canal posts failed more quickly than custom casted, metallic root canal posts. However, the failure pattern of the prefabricated glass fiber reinforced root canal posts was significantly more favourable than prefabricated or custom cast metal posts. It can be concluded from these and other results based on in vitro studies [7, 11, 18] that glass fiber reinforced root canal posts are highly suitable for clinical use. Initial clinical data supports this supposition [8]. Although the radiopacity of glass fiber reinforced root canal posts still needs improvement, retreatment in the case of a fracture or an endodontic emergency can be completed without any problem. Unfortunately, there are still no relevant long-term studies; and a projection of the clinical behavior based on the in vitro results should be treated with caution.

Clinical case presentation

A 19 year-old patient was seeking an esthetic improvement in the upper right central tooth (Fig. 1). During the clinical examination a horizontal fracture line was detected on the labial aspect of the tooth, which ran approx. 4 mm coronally to the gingival margin (Fig. 1). In addition, the mesiodistal width was 1 mm less compared to tooth 21. The gingival zenith of teeth 11 and 21 were at the same level. A sufficient root canal filling on tooth 11 was visible on the radiograph (Fig. 2).

There were two alternative treatment options: insert a glass fiber reinforced root canal post and crown the tooth with an all-ceramic restoration; or perform internal bleaching and insert a glass fiber reinforced post without fitting a crown. The patient agreed to the first treatment option. The tooth shade was selected using a standardized shade guide (Fig. 3). A glass fiber reinforced root canal post was then fitted, adhesively cemented and a direct core build up fabricated using the ParaBond/ParaCore System (Fig. 4 – 28). A dental radiograph was taken afterwards to check the post (Fig. 29).

The tooth was then prepared. The sulcus was widened using the double cord

Fig. 7: Tooth with the old restoration removed and exposure of the root canal filling

Fig. 8: Removal of the root canal filling at the entrance of the root canal using a Diatech diamond FG 850L 016 12ML

Fig. 9: Removal of the root canal filling and preparation of the root canal using a Gates 1 + 2

Fig. 10: Removal of the root canal filling and preparation of the root canal using a Moser 1-3

Fig. 11: The tooth is then prepared using ParaPost drills in sequentially larger sizes until the predetermined diameter and depth is achieved.

Fig. 12: Trial placement of the ParaPost Fiber Lux

technique. The double mix technique using an addition-cured silicone was used for taking the impression (Fig. 30 – 37). In this case, AFFINIS PRECIOUS was selected, which features optimal surface affinity. This property ensures that the correction material covers the tooth surfaces immediately, even in a moist environment; and is therefore crucial for producing accurate impressions. Silver pigmentation allows excellent detail readability for assessing the quality of the impression. A direct temporary restoration was then fabricated and fitted using a silicone-based temporary cement (Fig. 38 + 39).

10 days later, the condition of the soft tissue was excellent (Fig. 40–43). The emergence profile of the completed glass ceramic crown was very successful and corresponds well with the adjacent tooth (Fig. 44).

Following permanent adhesive cementation using the ParaBond/ParaCore System, the glass ceramic crown had a very acceptable length-width ratio; and the surface texture as well as the reflexion lines were an excellent match to the adjacent tooth. The gingival zenith and formation of the central papilla were highly satisfactory (Fig. 45 – 59).

Seven days after the crown was permanently fitted, the adjacent teeth were rehydrated again and exhibited a harmonious shade match with the restored tooth (Fig. 60). An excellent marginal seal was confirmed on a follow up radiograph (Fig. 61).

Conclusion

The Monoblock Technique using Para Bond and ParaCore saves time and material; and is very versatile in an important area of restorative dentistry.

CONTACT

Priv. Doz. Dr. med. dent. Stefan J. Paul
Stadelhoferstrasse 33
CH-8001 Zürich
eMail: office@drpaul.ch

Fig. 13: Seated ParaPost Fiber Lux

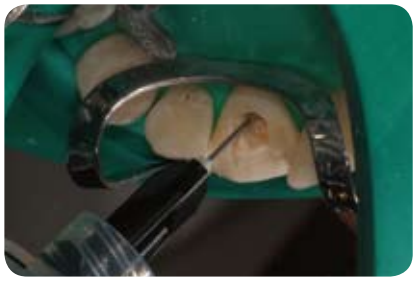

Fig. 14: Irrigation of the root canal with sodi um hypochlorite

Fig. 15: Drying of the root canal with sterile paper points

Fig. 16: Non-Rinse conditioner is massaged into the root canal and onto the con tact surface for 30 seconds

Fig. 17: Excess Non-Rinse conditioner is removed from the root canal using a sterile paper point

Fig. 18: The tooth is then dried for 2 seconds using a gentle air stream

Fig. 19: The adhesive A+B, mixed to a 1:1 ratio, is left in the root canal and on the contact surface for 30 seconds

Fig. 20: Removal of excess adhesive from the root canal using a sterile paper point

Fig. 21: The tooth is then dried for 2 seconds using a gentle air stream

Fig. 22: Application of ParaCore core & resin cement directly into the root canal using the root canal tip

Fig. 23: Untreated ParaPost Fiber Lux Post is pre-coated with ParaCore and cemen ted into the root canal

Fig. 24: Removal of excess ParaCore

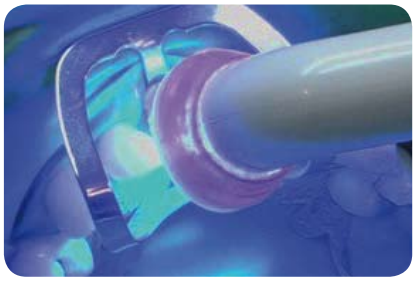

Fig. 25: Translucent ParaPost Fiber Lux Post is light cured for 20 s using the Coltolux LED to fixate it into place

Fig. 26: Free-hand core build up using ParaCore core & resin cement

Fig. 27: The core build up is then contoured manually.

Fig. 28: Each side of the core build up is poly merized for 20 seconds

Fig. 29: Radiograph after cementation of the post

Fig. 30: A Comprecord retraction cord size 0 is placed

Fig. 31: Preparation of the tooth using diffe- rent types of Diatech diamonds

Fig. 32: Completed tooth preparation

Fig. 33: Closed gingival sulcus

Fig. 34: Second retraction cord for gingival compression

Fig. 35: Removal of the second retraction cord before taking the impression

Fig. 36: Open gingival sulcus

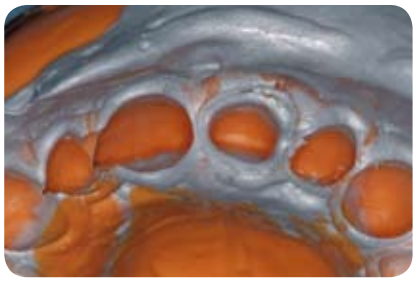

Fig. 37: Double mix impression using AFFINIS heavy body and AFFINIS PRECIOUS light body

Fig. 38: Trial placement of the temporary restoration fabricated using CoolTemp Natural

Fig. 39: Temporary restoration is cemented using TempoSIL 2

Fig. 40: Removal of the temporary restoration at the second appointment

Fig. 41: Prepared tooth and healed gingiva

Fig. 42: The prepared tooth is cleaned using a fluoride-free cleaning paste

Fig. 43: Prepared tooth before placement of the permanent restoration

Fig. 44: Trial placement of the permanent restoration

Fig. 45: The gingiva is slightly compressed using a retraction cord to ensure for optimal cementation

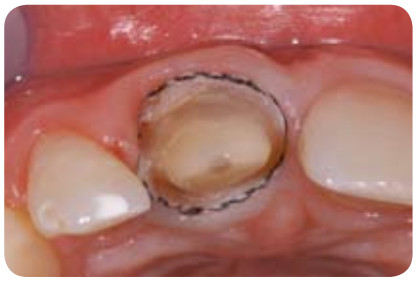

Fig. 46: Comprecord retraction cord in the sulcus

Fig. 47: The restoration is tried in again with the retraction cord in place to ensure for an accurate fit

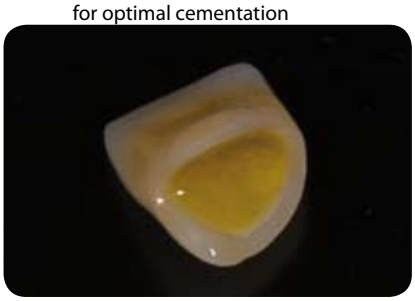

Fig. 48: The inside of the restoration is etched…

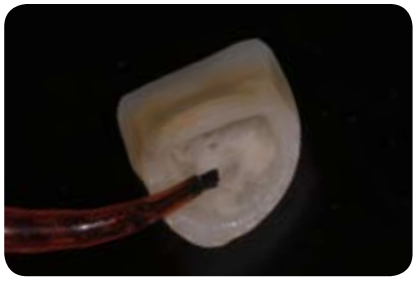

Fig. 49: … and silanized – always according to the manufacturer's instructions

Fig. 50: The non-rinse conditioner is massaged in for 30 seconds

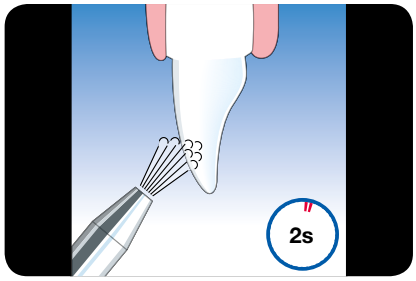

Fig. 51: The non-rinse conditioner is dried using a gentle stream of air

Fig. 52: The mixed adhesive is applied onto the prepared tooth and left for 30 seconds

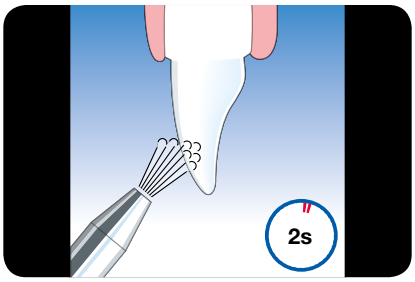

Fig. 53: The adhesive is dried for 2 seconds using a gentle stream of air

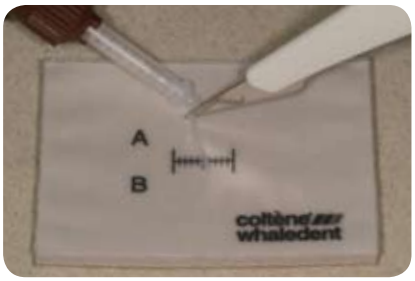

Fig. 54: The Root Canal Tip can be shortened using a scalpel for easy extrusion

Fig. 55: ParaCore is applied directly into the crown

Fig. 56: Initial removal of the excess cement using a sponge pellet

Fig. 57: Removal of excess cement interproximally using dental floss

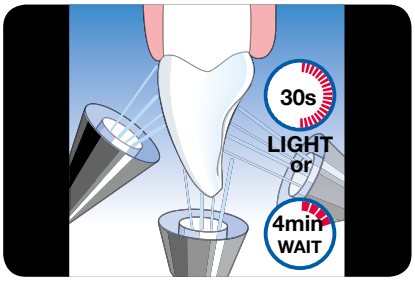

Fig. 58: ParaCore can be chemically cured or light cured

Fig. 59: Occlusion is checked using Hanel articulating paper

Fig. 60: Postoperative clinical situation

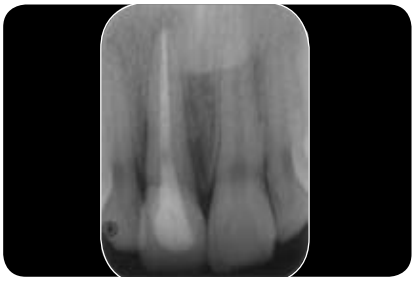

Fig. 61: Postoperative radiograph

References

1 Anusavice KJ. Dental ceramics and metal ceramics. In: Okabe T, Takahashi S (eds). Transactions of the International Congress on Dental Ceramics, South Carolina, 1989. Academy of Dental Materials, 1989:159-172.

2 Assif D, Oren E, Marshak BL, Aviv I. Photoelastic analysis of stress transfer by endodontically treated teeth to the supporting structure using different restorative techniques. J Prosthet Dent 1989;61:535-543.

3 Caputo AA, Standlee JP. Restoration of endodontically treated teeth. In: Caputo AA, Standlee JP. Biomechanics in clinical dentistry. Chicago: Quintessence, 1987:185-203.

4 Christensen GJ. Posts, cores and patient care. J Am Dent Assoc 1993;124:86-90.

5 Fernandes AS, Dessai GS. Factors affecting the fracture resistance of post-core reconstructed teeth: A review. Int J Prosthodont 2001;14:355-363.

6 Fokkinga WA, Kreulen CM, Vallittu PK, Creugers NH. A structured analysis of in vitro failure loads and failure modes of fiber, metal, and ceramic post-and-core systems. Int J Prosthodont 2004;17:476-482.

7 Goracci C, Sadek FT, Fabianelli A, Tay FR, Ferrari M. Evaluation of the adhesion of fiber posts to intraradicular dentin. Oper Dent 2005;30:627-635.

8 Grandini S, Goracci C, Tay FR, Grandini R, Ferrari M. Clinical evaluation of the use of fiber posts and direct resin restorations for endodontically treated teeth. Int J Prosthodont 2005;18:399-404.

9 Hornbrook DS, Hastings JH. Use of a bondable reinforcement fiber for post and core build-up in an endodontically treated tooth: Maximizing strength and aesthetics. Pract Periodontics Aesthet Dent 1995;7:33-42.

10 Nathanson D, Ashayeri N. New aspects of restoring the endodontically treated tooth. Alpha Omegan 1990;83:76-80.

11 Naumann M, Preuss A, Rosentritt M. Effect of incomplete crown ferrules on load capacity of endodontically treated maxillary incisors restored with fiber posts, composite build-ups, and all-ceramic crowns: An in vitro evaluation after chewing simulation. Acta Odontol Scand 2006;64:31-36.

12 Paul SJ, Werder P. Clinical sucess of zirconium oxide posts with resin composite or glass-ceramic cores in endodontically treated teeth: A 4-year retrospective study. Int J Prosthodont 2004;17:524-528.

13 Randow K, Glantz PO. On cantilever loading of vital and non-vital teeth. An experimental clinical study. Acta Odontol Scand 1986;44:271-277.

14 Rudo DN, Karbhari VM. Physical behaviors of fiber reinforcement as applied to tooth stabilization. Dent Clin North Am 1999;43:7-35.

15 Scherrer SS, de Rijk WG. The fracture resistance of all-ceramic crowns on supporting structures with different elastic moduli. Int J Prosthodont 1993;6:462-467.

16 Sorensen JA, Ahn SG, Berge HX, Edelhoff D. Selection criteria for post and core materials in the restoration of endodonti cally treated teeth. In: Transactions of the Conference on Scientific Criteria for Selecting Materials and Techniques in Clinical Dentistry, Siena, Italy, September 2001. Academy of Dental Materials, 2001:67-84.

17 Sorensen JA, Martinoff JT. Intracoronal reinforcement and coronal coverage: A study of endodontically treated teeth. J Prosthet Dent 1984;51:780-784.

18 Stricker EJ, Göhring TN. Influence of different posts and cores on marginal adaptation, fractures resistance, and fracture mode of composite resin crowns on human mandibular premolars. An in vitro study. J Dent 2006;34:326-335.

19 Torbjörner A. Treatment management. Posts and cores. In: Karlsson S, Nilner K, Dahl BL (eds). A textbook of fixed prostho dontics. Stockholm: Go thia, 2000:173-186.

20 Millar B, Sanjukta D. A comparison of marginal leakage in vitro for all-ceramic crowns luted with seven cements. King`s College London Dental Institute at Guy`s, King`s and St. Thomas` Hospitals, London, UK. Poster Presentation, 4th ConsEuro Meeting Seville, Spain, 12. – 14. March 2009.