Understanding e.max as the ideal material for indirect posterior and anterior restoration

Dr Kenneth Malament
USA

Posterior restorations are among the most frequently performed treatments in dentistry today, yet various challenges and limitations still exist in their execution. Whether for cases involving full coverage, partial, implant-supported, or aesthetic restorations, the process of selecting the appropriate material for indirect posterior treatments can be wrought with confusing information because the requisite demands may seem contradictory.

Among the considerations for posterior restorations are establishing proper isolation for adhesive cementation, ensuring adequate resistance of the selected material for long-term function, and achieving proper anatomical form and marginal integrity. 1-5 Superior fit contributes to the best possible outcome and functional longevity for the patient. 5 While strength of the selected restorative material helps to ensure resistance against the masticatory force exerted on posterior dentition, Combined, ideal anatomic form, marginal adaptation, and appropriate proximal contact and contour are required of materials and resulting restorations used in posterior treatments. 6,7

Additionally, aesthetics in posterior restorations has become an increasingly important consideration for both patient and clinician despite their location in less visible areas of the mouth. Shade and color matching between the restorative material and natural tooth structure is necessary for creating lifelike restorations. 8,9 Not surprisingly, considering the multiple requirements for posterior restorations, it can be challenging for clinicians to determine the most appropriate material for various indications. 10 High-strength allceramic materials are recommended for posterior restorations based on their strength. However, some have lacked aesthetics. 11 Recently, non-ceramic materials have evolved to compete with ceramic in posterior restorations. The numerous indirect resin composites now available may perform well in certain clinical situations, but they still require further research to determine whether they are viable for long-term success. 12,13

Lithium disilicate
Lithium disilicate (e.max) is categorised as a glass-based ceramic. It is generally composed of quartz, lithium dioxide, phosphorus oxide, alumina, potassium oxide, and other components. 14 These powders are combined to make a glass melt that is moulded and then formed into blocks or ingots. The manufacturing process creates a highly thermal shock-resistant glass-ceramic due to the low thermal expansion that results during manufacturing. 15 Within the material, needle-like crystals form and comprise about two-thirds of the volume. 16 The ingots can be processed using the CAD/CAM technique. Lithium disilicate can be cemented using adhesive bonding (such as Multilink N/Automic, Ivoclar Vivadent) or conventional cementation techniques. 4 The monolithic property of e.max contributes to the strength and aesthetics of the restoration. The traditional use of a high-strength core material made of zirconia or alumina decreased aesthetics owing to the high value and increased opacity compared with glass-ceramic materials. Even though these high-strength core materials demonstrated excellent mechanical properties, the added layers of veneered ceramic, which have a much lower strength, caused the overall strength of the restoration to decrease. 17 Lithium disilicate circumvents these problems and offers both strength and high aesthetics for an expanded range of indications other ceramics. e.max offers 560 MPa in strength, which is over twice the strength of other materials.
Thirteen patients (seven women and six men; age range: 55–52 years) with 15 periodontally involved non-salvageable teeth were included in this study. During the replantation procedure, the affected teeth were gently extracted and the granulation tissue, calculus, remaining PDL, and necrotic cementum on the root surfaces were removed. Tetracycline hydrochloride, at a concentration of 100μg/ml, was applied to the root surfaces for 5 minutes. The teeth were then replaced in their sockets and splinted.

After six months, no root resorption or ankylosis was observed radiographically. Although the period of evaluation was short, the authors suggest that IR may be an alternative approach to extraction in cases in which advanced periodontal destruction is present and no other treatment can be considered. Araujo et al. demonstrated that root resorption, ankylosis and new attachment formation, among other processes, characterized healing of a replanted root that had been extracted and deprived of vital cementoblasts. It was also demonstrated that Emdogain therapy, that is, conditioning matrix proteins on the detached root surface, did not interfere with the healing process. Peer reviewed nine cases of IR that illustrated the feasibility of the procedure for a variety of indications. Only one case of replantation showed evidence of pathosis, reflected by root resorption or ankylosis. His report suggests that IR is a reliable and predictable procedure, and should be considered more often as a treatment method to maintain the natural dentition. Yu et al. reported a case in which a combined endodontic-periodontic lesion on a mandibular first molar was treated by IR and application of hydroxyapatite.

Four months after the surgery, a porcelain–metal full crown restoration was completed. At the 15-month follow-up examination, the tooth was clinically and radiographically healthy and functioned well. Shintani et al. performed an IR of an immature mandibular incisor that had a refractory periapical lesion. The incisor was extracted and the periapical lesion was removed by curettage. The root canal of the tooth was then rapidly irrigated, and filled with a calcium hydroxide and isoform paste, after which the tooth was secured with an archwire splint. Five years later, no clinical or radiographic abnormalities were found, and the root apex was obturated by an apical bridge formation. Kaufman reported successful results of a maxillary molar tooth treated with IR after a four-year follow-up period. A mandibular first molar, which was replanted, by Czonstkowsky and Wallace showed no signs of resorption and ankylosis after six months. Different investigators reported success rates varying from 52 to 95% with follow-ups of between one to 22 years in posterior teeth.1517 Bender and Rossmann reported a success rate of 77.8% in molars. Among 14 mandibular molars, the success rate in first molars was 85.7%, and 71.4% in second molars. Of the four maxillary molars, three first molars and one second molar, one first molar failed, resulting in a 66.7% success rate in first molars.24 Raghobar and Vissink reported 29 replanted 29 teeth, consisting of two first molar molars, 17 mandibular second molars, one mandibular third molar, and 13 maxillary second molars, and followed them for an average of 62 months. The success rate was 72% and 25 of them were still in function.20

**Conclusion**

For extraction and replantation to be successful, the following criteria must be met:

- Informed consent must be obtained from the patient.
- All roots need to be conically shaped.
- The teeth need to be somewhat mobile.
- A good knowledge of oral surgery is needed with respect to extraction.

Intentional replantation is a treatment alternative that should not be underrated, especially when conventional endodontic or surgical treatment is not possible. This is an excellent treatment with a predictable result, I have performed approximately 50 replantations, and have lost only one tooth to date.

In order to be successful with extraction and replantation cases, the practitioner must have the right patient and the right rapport with that patient. The practitioner must also be able to assess the tooth and be confident that it can be extracted without breakage. Additionally, the practitioner must be able to recognize tooth morphologies that may lead to extraction problems. This is a skill that is perfected through experience.

Replantation is a predictable and acceptable method of treatment in my office when patients present with root canals that require retreatment due to failure or those that cannot be completed owing to sclerosing of the canals...