KINETIC PREPARATION IN MICROSCOPE DENTISTRY

Peter Kotschy, MD, DDS[1]

The use of microscope dentistry for preparation procedures requires instruments that do not use water spray and do not interfere with the direct or indirect vision of the working field. Traditional preparation instruments such as diamond burs can produce microcracks in the tooth, which negatively affect the outcome, especially in the anterior region. For example, the edges of the teeth may crack or splinter during preparation. As a solution to these problems, this article demonstrates the use of the kinetic preparation technique with 27-µm aluminum oxide particles, which are blasted with varying pressure onto the tooth surface. *Int J Microdent* 2009;1:42–47

[1]Private Practice, Vienna, Austria.

Correspondence to:
Prof Dr Peter Kotschy
Lindengasse 41/15
1070 Vienna, Austria
Fax: 43 1 524 17 98
Email: peterkotschy@parodontologie.cc

Traditional dentistry requires high- or low-speed handpieces or bur instruments for enamel and dentin preparation. Sonic or ultrasound instruments are also used. Water cooling is often inevitable with such instruments, which has the added benefit of flushing any chipping out of the working area. On the other hand, the operator's vision of the working field may be disturbed.

Based on the pressure applied and type of instrument used, cracks may occur during preparation. Such flaws may not be visible without a microscope; however, they can lead to much larger cracks. This is especially a problem in elderly patients.

In addition to cracks and flaws, preparation procedures can lead to pain for the patient, who may find the sensation of pressure and vibration applied to the teeth to be uncomfortable. This, in turn, produces stress for both the patient and clinician. For the clinician, this stress is encountered throughout the dental career.

The use of water spray can obstruct the visual field in both microscope and traditional dentistry. Further, the preparation instrument blocks the operator's vision of the preparation area (Fig 1). To inspect the preparation, the instrument must be lifted frequently, thus halting the progress of the procedure. Therefore, direct control of the procedure and steady work are not possible. In addition, when using rotating instruments, it is possible for the lubricant to leak out, which negatively affects adhesion.

In 1945, Black[1] introduced the kinetic preparation technique without water spray, an alternative treatment option that enables the erosion of the dental substance—even when viewed indirectly—without visual interference of the preparation instrument (Fig 2).

With rare exceptions, this type of preparation is nearly painless and noiseless and without heat, vibration, or pressure on the tooth. Therefore, the patient is always relaxed and often even sleeps during treatment.

The kinetic preparation is carried out not only with a direct view of the working field, but also in locations that were previously inaccessible. Preparation is performed with

Fig 1 With traditional preparation techniques, the working field is obscured by the instrument itself.

Fig 2 The kinetic preparation technique provides a clear view of the working field without water spray.

only pressure from the fingertips, reducing tension of fingers, hands, arms, and shoulders—the whole body is relaxed. This allows for the highest possible precision during preparation, which in turn benefits the adhesion system that is used.

This kinetic preparation technique is widely used in the United States; however, it was largely discredited in Europe for two reasons. First, when treating with the naked eye or even with loupe magnification, it is not possible to control erosion, especially at higher pressures, with the kinetic preparation procedure. This can lead to inadvertent harmful and uncontrolled deep preparations. Second, aluminum oxide particles ricochet after colliding with the tooth surface. This can create an aerosol cloud in the operating field, which cannot be controlled with traditional dental suctions.

The dental operating microscope solves the first problem, and an appropriate external suction system, which prevents the cloud of particles, solves the second.

MATERIALS AND METHODS

Using an airborne particle–abrasion instrument (PrepStart, Danville Engineering) (Fig 3), 27-μm aluminum oxide particles are blasted onto the tooth surface. Based on the desired depth of the preparation and nozzle used, the pressure is set between 3 and 9 bar. This instrument is equipped with a foot switch and has a very thin tube that carries the stream of particles to the autoclavable handpiece. The autoclavable nozzles, from the same manufacturer, have angulations of 45 degrees, 80 degrees, 90 degrees, and 120 degrees, and diameters of 0.38 mm, 0.48 mm, and 0.66 mm (Fig 4).

If even greater precision is desired, nozzles with smaller diameters can be inserted into the 0.66-mm nozzle and fixed using light-curing flowable composite resin (Fig 5).

Figure 6 shows an extracted tooth, on which the difference is visible between a traditional preparation with a diamond rotary bur on the edge and the central kinetic preparation

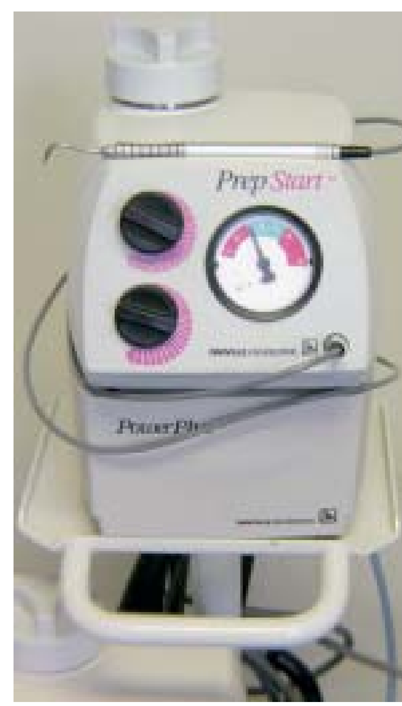
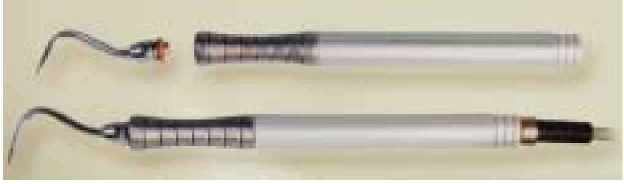


Fig 3 The preparation unit including the booster, which raises the air pressure up to 9 bar.



Figs 4a and 4b The assortment of handpieces and nozzles are fully autoclavable and offer excellent precision.

Figs 5a and 5b By bending and twisting the individualized nozzles, all regions and surfaces in the mouth are easy to reach.

Fig 6 Extracted tooth that was gilded after preparation for analysis. On the edge, a traditional preparation was carried out using a diamond bur; in the center, the kinetic preparation technique was used. Note the superior surface achieved with the kinetic preparation.

Fig 7 Magnification ×78 shows the smooth preparation surface.

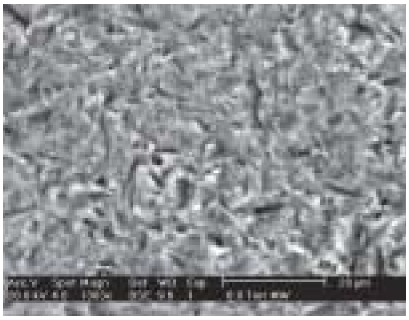


Fig 8 Magnification ×1,303 shows the extremely microretentive surface without any remaining aluminum oxide.

on the dentin, which shows a smooth, consistent surface. Magnified views of the same tooth (Figs 7 and 8) show not only an excellent surface with the desired preparation, but also one that is ideal for adhesion.

After testing many external suctioning devices, the author prefers the use of the Big Power suction system (Big Power), which was developed for patients with dust mite allergies. A benefit of this machine is that it provides filtration not only with a conventional high-efficiency particulate air filter, but also via a water bath with disinfectant, which is refreshed daily. This provides perfect air cleaning without heating the air. The machine can be installed into a noise protection box (Fig 9) in the treatment room or it can stand in a separate room up to 15 m away.

Preferably, the patient is protected by rubber dam and a mask over the nose and eyes. All members of the dental team should wear masks and glasses. The microscope (Promagis, Zeiss) (Fig 10) is protected against any dust action with a sterile drape.

Fig 9 Big Power suction system installed in a noise-protection box.

Fig 10 Relaxed ergonomic 9 o'clock working position. The patient, dentist, and assistant wear masks. The patient also wears video glasses under the mask.

Fig 11 Use of the external suction during treatment. Without rubber dam, the lips are protected with Optragate (Ivoclar Vivadent), and the dentist and assistant work following the principle of four-handed dentistry.[2–5]

Ideally, the dental assistant follows the treatment via an external monitor. The patient follows the treatment with video glasses, worn under the mask, which display the microscope image via a three-chip camera installed in the microscope. Experience has shown that allowing the patients to witness the treatment helps motivate them to preserve their teeth using proper oral hygiene.

Patient positioning follows that described in a series of papers by the same author.[2–5] If no rubber dam is used, the position of the patient's head lets the tongue rest close to the throat region to help ensure the patient does not inhale the aluminum oxide particles. As an additional precaution, the assistant must leave a small pool of water deep in the patient's mouth to prevent inhalation or swallowing. The nose is protected by a mask, and the eyes by the video glasses and mask (Fig 11).

Fig 12 Small, individually designed occlusal preparation.

Fig 13 The preparation is painless and provides an excellent adhesive surface. The flexible mucosa is not irritated by the ricochet of aluminum oxide particles.

Fig 14 The Göttinger light sensor (IC Lercher) makes even the most minimal caries lesions visible. Removal of the caries can be performed easily without danger to the incisal edge using kinetic preparation.

Fig 15 The atraumatic, contactless preparation can also be used on vital teeth up to the pulp without anesthesia.

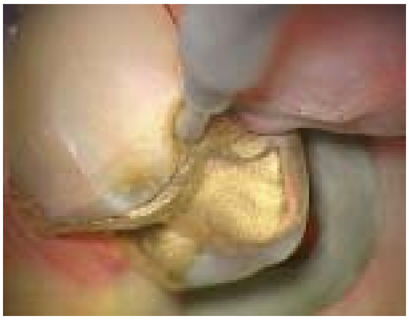


Fig 16 When preparing previous restorations, the high precision of the kinetic technique is crucial to promote tooth conservation.

Fig 17 Entry into the pulp chamber is easy to perform.

Fig 18 Removal of caries lesions in the pulp region can be performed with the highest precision.

Fig 19 The revision of root-canal treatments on straight channels is facilitated by the kinetic preparation. The channel wall is perfectly cleaned and optimally prepared for adhesion.

Fig 20 The removal of the retention pin is possible through the circular erosion of the surrounding cement.

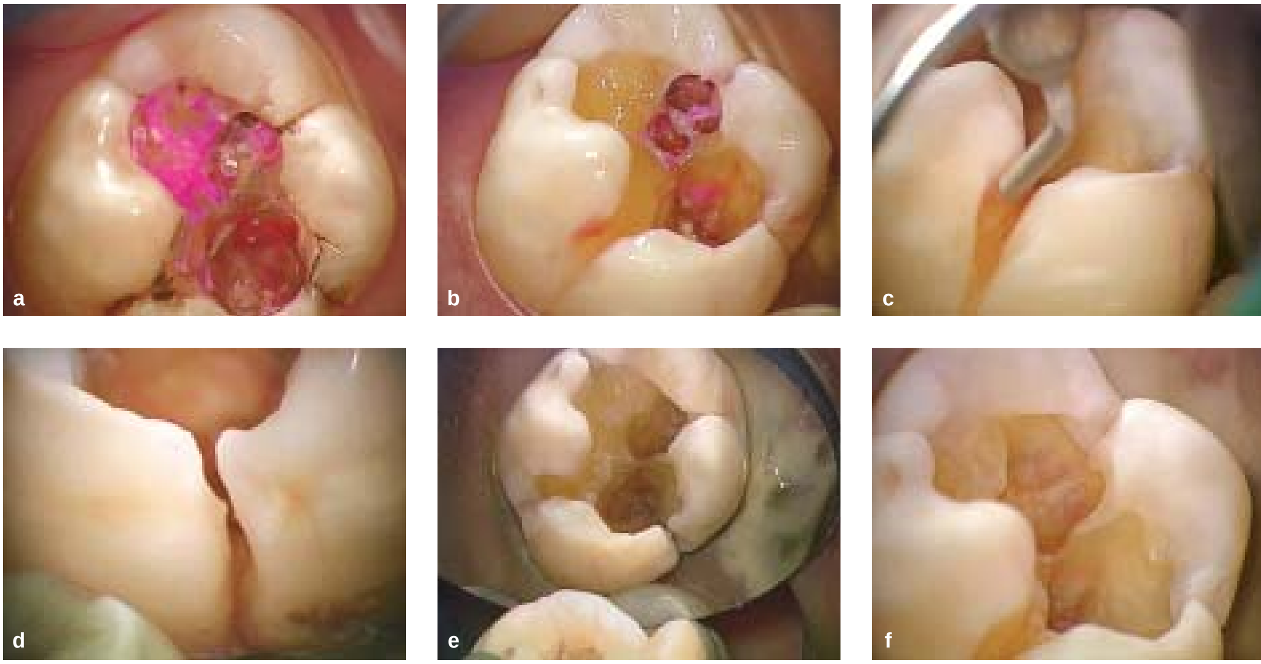
RESULTS

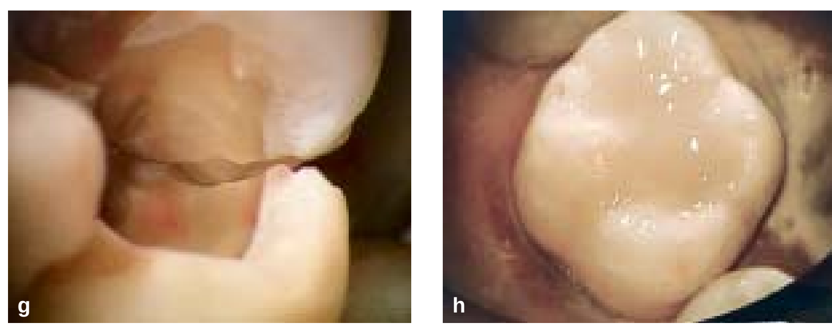
The results are shown in Figs 12 to 21.

DISCUSSION

No preparation technique that is gentler to the tooth or to the patient is known by the author. Further, patient satisfaction has risen since he switched from the traditional preparation method. Patients appreciate this method because it eliminates uncomfortable contact and reduces pain. Only a few very sensitive patients have shown light irritation after preparation with this method.

The author still uses the traditional technique with rotating instruments for specific preparation forms; however, Black[1] showed that all preparations can be performed with the kinetic preparation technique.





Figs 21a to 21g Precise removal of decayed material inside the tooth. After removal of the amalgam restoration with maximum conservation of the intact tooth substance, composite resin is placed. Therefore, the traditional root-canal treatment and crown placement are avoided.

Fig 21h Fully restored tooth with light-cured microfilled hybrid composite in layers technique.

CONCLUSION

The kinetic preparation technique, in conjunction with the operating microscope, solves the problems inherent in traditional preparations, including obstruction of the operating field due to water spray and microcracks created by traditional burs. This technique uses 27-µm aluminum oxide particles, which are blasted onto the tooth surface with varying pressure. This technique is nearly painless and silent while also eliminating heat, vibration, and pressure. It provides the clinician a direct view of the preparation and the highest possible precision. Therefore, this technique offers both patients and clinicians a stress-free treatment with excellent results.

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