Piezoelectronic Ultrasonic Unit Enables Versatility in Endodontic Procedures

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Abstract: Ultrasonic technology is an important component of the endodontic armamentarium, particularly during retreatment and endodontic microsurgery. This article presents two clinical cases demonstrating the versatility of a piezoelectric ultrasonic unit for nonsurgical and surgical retreatment. In the first case, the device facilitated post removal through a conservative access while preserving the existing restoration. In the second case, it was used for apical bevel refinement and retrograde preparation with continuous saline irrigation. The unit's interchangeable tips, integrated illumination and irrigation, real-time frequency tracking, and compact design provided stable performance and efficient workflow. These cases demonstrate the device's flexibility as a practical ultrasonic platform for a broad range of endodontic procedures.

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Having the appropriate armamentarium in endodontics is essential for maintaining an efficient and predictable clinical workflow. Instruments and equipment that provide consistent performance can directly influence the clinician's ability to complete complex procedures while minimizing treatment time and unnecessary removal of tooth structure. Equally important is versatility. A universal tool that can be used for multiple procedures adds efficiency while reducing the amount of equipment required in each operatory.

Reliability is another important consideration when selecting clinical equipment. A device that frequently malfunctions or requires extensive setup is not conducive to predictability in a busy endodontic practice. Ideally, an ultrasonic unit should be efficient, compact, easily transportable, and capable of performing multiple clinical functions without significant modification to the operatory.

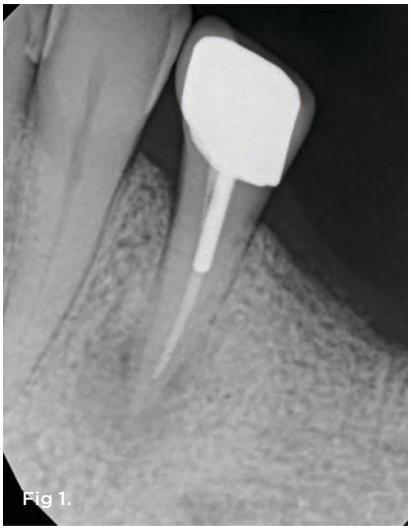
Nonsurgical retreatment and surgical retreatment are two important treatment modalities in endodontics. Approximately 40% to 60% of the author's clinical practice involves these procedures. Consequently, having a device that can be easily transferred between operatories and used for both nonsurgical and surgical treatment is particularly valuable. The EdgePiezo™ ultrasonic unit (EdgeEndo, edgeendo.com) has become an indispensable component of the author's clinical armamentarium because of its versatility, compact design, illumination, irrigation system, and consistent ultrasonic performance.

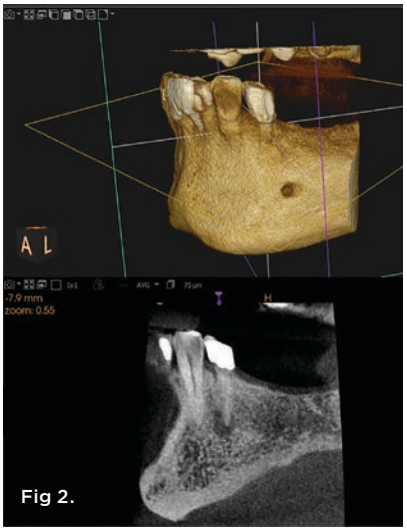
The following two cases demonstrate the use of this ultrasonic unit during nonsurgical and surgical retreatment. The first case illustrates its application during post removal through a conservative access preparation, while the second exhibits its use during apical surgery and retrograde preparation. Together, these cases show how a single ultrasonic platform can be incorporated into distinctly different endodontic procedures.

Nonsurgical Retreatment Case

A 76-year-old male patient presented with spontaneous and chewing pain associated with tooth No. 21 (Figure 1). He reported that the symptoms had begun approximately 2 weeks earlier. His medical history was significant for diabetes and hyperlipidemia, which were both managed with medication. The patient reported that his hemoglobin A1c had been measured approximately 1 month earlier by his primary care physician and was 6.2%.

The patient reported that a general dentist had completed root canal treatment approximately 10 years earlier, although he could not recall the exact year. Cone-beam computed tomography (CBCT) imaging demonstrated a low-density region at the apex of tooth No. 21 (Figure 2). The mental foramen was located distal to the low-density region, making surgical retreatment an unfavorable option.





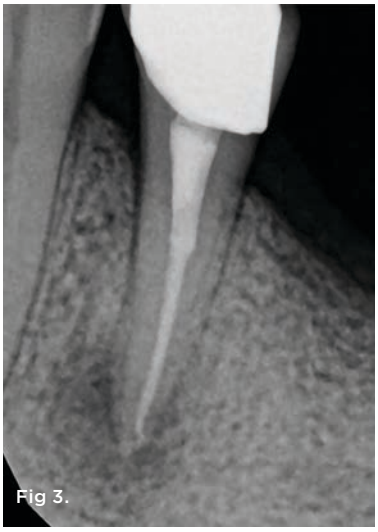


Fig 1. Preoperative periapical radiograph showing short endodontic filling material and metal post in the middle/coronal third, tooth No. 21. **Fig 2.** CBCT image showing close proximity of the mental foramen to the root apex. **Fig 3.** Postoperative radiograph after post removal and bioceramic-based obturation.

Clinical examination demonstrated tenderness to percussion and palpation, with no buccal mucosal pathology. The patient was presented with three treatment options: nonsurgical orthograde retreatment, extraction with likely subsequent implant placement and/or a distal-extension removable prosthesis, or no treatment. He elected the first option, nonsurgical retreatment, in an effort to retain the tooth. He also planned to pursue a single implant in the left posterior edentulous space adjacent to tooth No. 21 in the future and, therefore, did not want tooth No. 21 extracted, which would further increase the edentulous space and potentially require multiple implants in the same quadrant.

Before treatment, the patient was informed that a post was present and that its removal could potentially require removal of the existing crown. He was also informed that the post might not be removable. The patient understood these risks and elected to proceed. A final diagnosis was established: previously treated with symptomatic apical periodontitis.

Following administration of local anesthesia and rubber dam isolation, a small access preparation was created through the porcelain-fused-to-metal crown. The access was enlarged only enough to obtain circumferential visualization of the endodontic post (ParaPost®, Coltene) and its entire coronal aspect. Once the post head was visualized, a flame-shaped high-speed diamond was used to trough around the post and progressively expose more of its circumference.

The EdgePiezo was then introduced using the EdgeTip™ #2 at low ultrasonic power. The tip's tapered configuration and approximately 80-degree shaft provided favorable access around the post while maintaining a conservative access preparation. Ultrasonic energy was applied circumferentially to disrupt the cement interface and facilitate loosening of the post. The ultra-bright illumination incorporated into the head of the EdgePiezo further improved visualization during the procedure.

The unit was initially operated at approximately power level 5 to 6, with the power increased only when necessary. In the author's experience with previous ultrasonic units, patients often were distracted by or uncomfortable with the high-pitched chatter generated during activation. As a result, patients routinely needed to be warned about the chatter before ultrasonic use. The EdgePiezo's real-time frequency tracking substantially reduces this chatter, resulting in a more stable and streamlined ultrasonic experience. The reduced chatter allows the device to be used without having to alarm patients about the sound or feel of the unit.

Real-time frequency tracking may also contribute to consistent ultrasonic performance and reduced heat generation. The EdgePiezo's integrated water reservoir provides continuous irrigation during activation, assisting with temperature control. Because the reservoir is incorporated into the unit, the EdgePiezo does not require direct plumbing to the operatory. This allows the unit to be moved between operatories without structural modifications or dedicated plumbing.

In this case, the post was removed with relatively minimal effort in less than 2 minutes. Following post removal, the remaining retreatment procedure was completed using the Edge X7 file system to a final preparation size of 25/.06. Obturation was completed using EdgeBioCeramic™ ThermalFlow™ bioceramic sealer and gutta-percha (Figure 3).

The existing restoration was successfully maintained without damage. The ability to remove the post, complete the retreatment, and preserve the integrity of the existing crown demonstrated the value of the EdgePiezo as a conservative and efficient instrument for nonsurgical retreatment.

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Surgical Retreatment Case

A 46-year-old female patient with a noncontributory medical history presented with a dull ache associated with tooth No. 10. The patient denied pain with chewing and percussion but described a persistent, low-grade discomfort that remained noticeable throughout the day. She reported that the symptoms had begun approximately 3 months earlier but initially attributed the discomfort to having eaten something that irritated the tooth. Because the discomfort persisted, she presented to her general dentist, who noted a dark radiographic shadow at the apex of tooth No. 10 and referred her for endodontic evaluation.

Periapical radiography taken showed a post extending into the apical third of the root (Figure 4). The CBCT also demonstrated a buccal plate dehiscence and a relatively large low-density region associated with the apex of tooth No. 10. Clinically, no deep periodontal probing defects were identified. Percussion and palpation were negative, and no buccal mucosal pathology was noted.

A final diagnosis of previously treated with asymptomatic apical periodontitis was established. The same treatment options as presented in the first case were discussed with this patient. In this case, orthograde retreatment would have been particularly difficult and time-consuming because of the existing post and its apical position. Surgical retreatment was therefore considered the most predictable and efficient option, and the patient elected to proceed.

At the treatment appointment, local anesthesia was administered and a papilla-sparing flap was elevated. The buccal dehiscence was identified. An osteotomy was prepared, and apical resection was performed using an Edge FG Surg 161 bur. The crypt was subsequently excavated appropriately (Figure 5).

The EdgePiezo was then used to refine the bevel preparation with an SL-1 ultrasonic tip. Retrograde preparation was subsequently completed using the EdgeSurgicalTip™ #1 (Figure 6). The retropreparation was performed at power level 4 with saline irrigation supplied directly from the EdgePiezo water reservoir. The preparation was extended to the end of the existing post and subsequently filled with EdgeUtopia™ RRM root repair material (Figure 7).

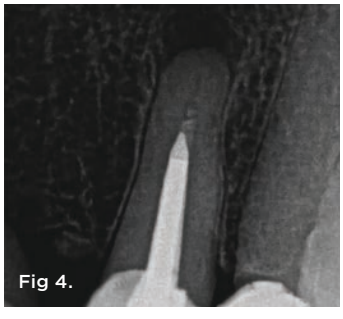
The flap was repositioned and polypropylene sutures were placed accordingly (Figure 8). In this case, the EdgePiezo provided a single instrument platform for both refinement of the surgical preparation and completion of the retrograde preparation. The integrated irrigation system simplified the surgical setup while allowing continuous saline delivery during ultrasonic activation.

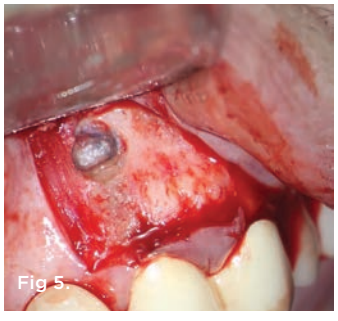
Discussion

A significant clinical benefit of the EdgePiezo unit is its versatility. Unlike an ultrasonic unit dedicated to a single application, the EdgePiezo can be incorporated into both nonsurgical and surgical endodontic procedures. The two cases presented demonstrate its ability to transition from post removal during nonsurgical retreatment to apical surgery and retrograde preparation without requiring a separate ultrasonic system.

During nonsurgical retreatment, ultrasonic energy is particularly useful when access to a post or other obstructive material is limited. The ability to trough circumferentially around a post while maintaining direct visualization can facilitate post removal while minimizing unnecessary removal of surrounding dentin. In the first case, the combination of the EdgeTip #2, angled shaft, illumination, and controlled ultrasonic energy allowed the post to be removed

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Fig 4.


Fig 5.

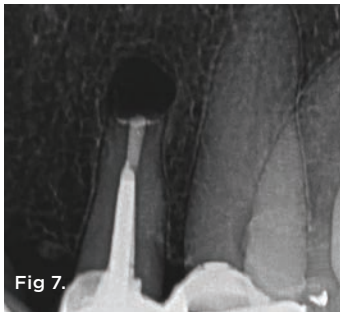

Fig 7.


Fig 8.

Fig 4. Preoperative radiograph illustrating the low-density region and deep post placement, tooth No. 10. **Fig 5.** Crypt visualization and post-retrofill placement. **Fig 6.** EdgeSurgicalTip #1. **Fig 7.** Postoperative radiograph showing retrofill placement. **Fig 8.** Polypropylene suture placement.

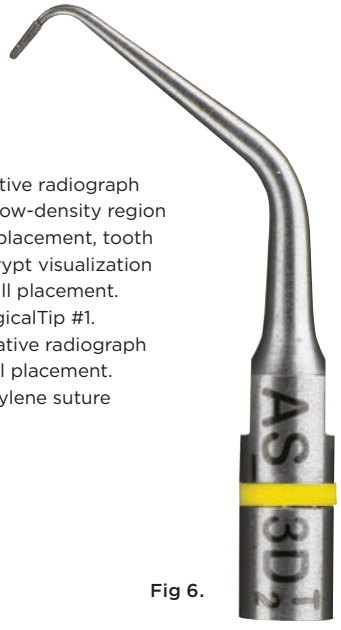


Fig 6.

through a conservative access preparation. This was particularly important because preservation of the existing restoration was a treatment objective.

The EdgePiezo also offers practical advantages in a busy clinical environment. Its compact footprint allows it to occupy minimal counter space, while the integrated water reservoir eliminates the need for direct plumbing. This makes the unit readily transferable between operatories. For an endodontic practice in which surgical and nonsurgical procedures may be performed throughout the same day, this portability can simplify setup and improve workflow.

Another notable feature is the unit's real-time frequency tracking. Ultrasonic devices can generate considerable audible chatter when the operating frequency becomes unstable or when the tip encounters changes in resistance.[1] In previous clinical experience, this sound frequently required that patients be warned before ultrasonic activation. The more stable operation of the EdgePiezo substantially reduces this chatter and ultimately lessens the probability of iatrogenic fracture induction. In addition to improving the patient experience, more consistent frequency control may contribute to predictable energy delivery and reduced unnecessary heat generation.

Temperature control is particularly important during ultrasonic procedures.[2] The EdgePiezo's integrated irrigation system allows a continuous water stream to be delivered during activation. In the surgical case, saline irrigation was delivered directly from the unit during retrograde preparation. This eliminated the need for a separate irrigation source and simplified the surgical field while providing continuous cooling.

The second case further demonstrates the value of having multiple ultrasonic tips available on the same platform. Rather than requiring different devices for different stages of treatment, the same ultrasonic unit could be used throughout the surgical procedure by interchanging appropriate ultrasonic tips.

From a practice management perspective, versatility can also translate into efficiency. Equipment that can be used for multiple procedures reduces the need to dedicate individual units to specific operatories. A compact, portable unit that can be rapidly prepared and transferred allows the clinician to maintain a consistent workflow between treatment rooms. This is particularly useful in an endodontic practice where surgical and nonsurgical retreatment may be performed throughout the same day.

The two cases also highlight the importance of matching the ultrasonic tip and power setting to the intended application. During post removal, the EdgeTip #2 was initially used at a lower power level and increased only when necessary. During surgical treatment, the EdgeSurgicalTip #1 was operated at power level 4 under saline irrigation. This ability to adjust power and select different tip configurations provides the clinician with customization and control over the amount and location of ultrasonic energy delivered.

Scan for more information.

> The ability to trough circumferentially around a post while maintaining direct visualization can facilitate post removal while minimizing unnecessary removal of surrounding dentin.

The EdgePiezo has consequently evolved the author's workflow from integrating ultrasonics for a limited number of procedures into a routine component of the endodontic armamentarium. Its ability to perform post removal, surgical retropreparation, and surgical bevel refinement, combined with its illumination, integrated irrigation, compact design, and stable ultrasonic operation, makes it useful across a broad range of clinical situations. Its versatility makes it an integral part of routine endodontics.

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Conclusion

The cases presented demonstrate how a versatile ultrasonic system can support both nonsurgical and surgical endodontic retreatment while promoting conservative, efficient treatment. By combining multiple tip configurations with illumination, integrated irrigation, stable ultrasonic performance, and portability, the EdgePiezo provides clinicians with flexibility across a range of procedures. Incorporating these capabilities into a single platform can simplify clinical workflows while helping clinicians maintain precision and control during complex endodontic treatment.

DISCLOSURE

This article was commercially supported by EdgeEndo.

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