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CASE REPORT

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Efficacy of blue heat-treated rotary file in primary molar pulpectomy: a case report*

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ABSTRACT

One of the main advantages of using a continuous rotary system in pulpectomies is the reduction in instrumentation time. This case presents a 3-year and 11-month-old girl who, upon intraoral clinical examination, exhibited a deep and extensive carious lesion with pulpal involvement in tooth 85. Radiographically, an occlusal radiolucent image was observed, clearly indicating pulpal involvement, consistent with pulpal necrosis and chronic apical periodontitis. A pulpectomy was performed using the NiTi Race® Evo #25/06 rotary system at 500 rpm and with a torque of 2.1 Ncm. In the clinical examination, the surrounding gingival tissues were in good condition. Radiographically, there was no evidence of root resorption or signs of infection, and bone regeneration was observed at the furcation level. The rotary system proved to be effective in both shaping and filling the canals, reducing the time required for instrumentation.

Keywords: pulpectomy; root canal preparation; primary tooth.

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INTRODUCTION

Pulpectomy is indicated in primary teeth with pulp involvement and pulp necrosis (1). For this procedure, biomechanical instrumentation is essential for cleaning and shaping the canal in order to achieve proper obturation (2). However, primary molars have irregularly shaped root canals that make biomechanical preparation difficult (3).

There are different canal instrumentation techniques (manual and rotary) that aim to provide adequate preparation (4). The manual technique is commonly used, in which a series of sequential files are used to shape the root canal (5), and its disadvantages are longer working time and inadequate canal shaping (6).

On the other hand, the continuous rotary system, which moves clockwise, uses nickel-titanium (NiTi) files and requires less working time (7), giving satisfactory results in the conical shaping for root canal obturation (8). These files have advantages such as shape memory, flexibility, and fracture resistance (9), reducing deviations and preserving the anatomy of the root canal (10). In pediatric dentistry, satisfactory results have been obtained with the use of this system and NiTi files (11).

The continuous rotary system has introduced heat treatment to NiTi files (gold and blue) to give them greater flexibility, thus increasing their resistance to fatigue and torsion (12) and allowing for well-shaped canals with optimal obturation results (13). In this context, Race® Evo files are blue heat-treated NiTi instruments used in the continuous rotary system. They have a triangular cross-section with sharp edges and a rounded tip, which demonstrate resistance to flexibility and fracture (14); therefore, their application in pediatric dentistry could be effective.

This report was reviewed by the Ethics Committee of Universidad Privada San Juan Bautista, with approval code No. 0582-2023-CIEI-UPSJB, and informed consent was obtained from the patient's mother.

The objective was to demonstrate the effectiveness of using the Race® Evo (Switzerland) #25/06 single file in the biomechanical instrumentation of tooth #85 with pulp necrosis and chronic apical periodontitis.

CASE PRESENTATION

We present a 3-year-11-month-old patient, an only child, from the district of Ventanilla, Callao, Peru, who came to the Pediatric Dentistry Service of Hospital Nacional Daniel Alcides Carrión accompanied by her mother. The mother expressed concern and anxiety due to her daughter's dental pain, which was attributed to the presence of dental caries.

During the consultation, the girl was shy and uncooperative. The clinical examination revealed an extensive and deep carious lesion with pulp involvement, inflammation of the marginal gingiva, and the presence of a dental fistula in tooth #85 (Figure 1A). The radiographic study confirmed a large and deep crown caries lesion with pulp involvement, as well as a periapical and interradicular osteolytic process, accompanied by surrounding condensative osteitis (Figure 1B). The definitive diagnosis was pulp necrosis with chronic apical periodontitis. The treatment plan consisted of a pulpectomy using a continuous rotary system to ensure complete removal of the necrotic tissue and preserve the integrity of the tooth.

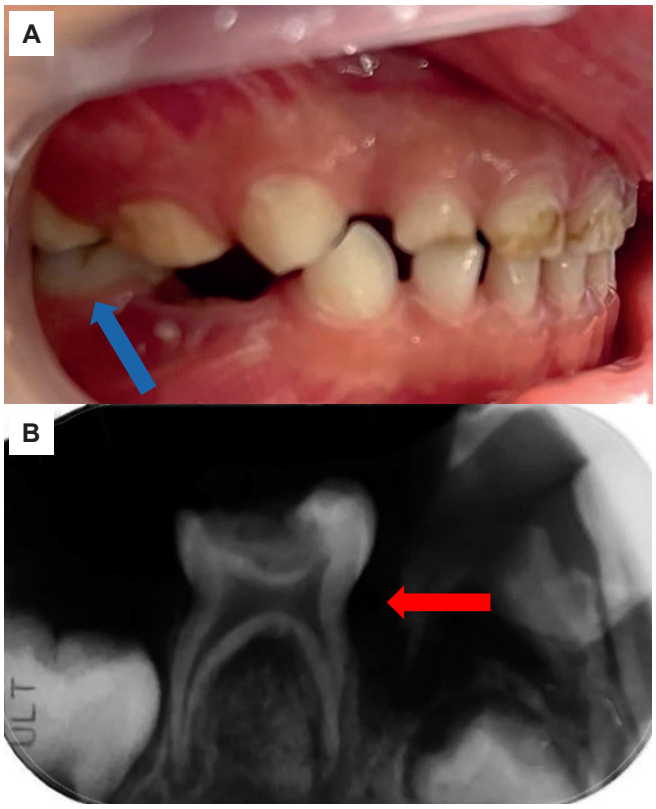

Figure 1. Initial clinical and radiographic examination of tooth #85. A) Clinical photograph of the area. B) Periapical radiograph before treatment.

The carious lesion was removed and the pulp chamber of tooth 85 was opened using a round diamond bur No. 001-023 (black tape). The mesial and distal canals were identified with K-Nitiflex® Maillefer No. 15 hand files, establishing a working length of 9 mm for all canals by corono-apical measurement. Instrumentation was performed with the Race® Evo #25/06 continuous rotary system, set to a working length of 9 mm, using the FKG Endomotor calibrated to a torque of 2.1 Ncm and a speed of 500 rpm. The biomechanical instrumentation technique included sweeping movements in the cervical and middle thirds and pecking movements in the apical third, followed by cleaning of the remaining pulp tissue (Figure 2).

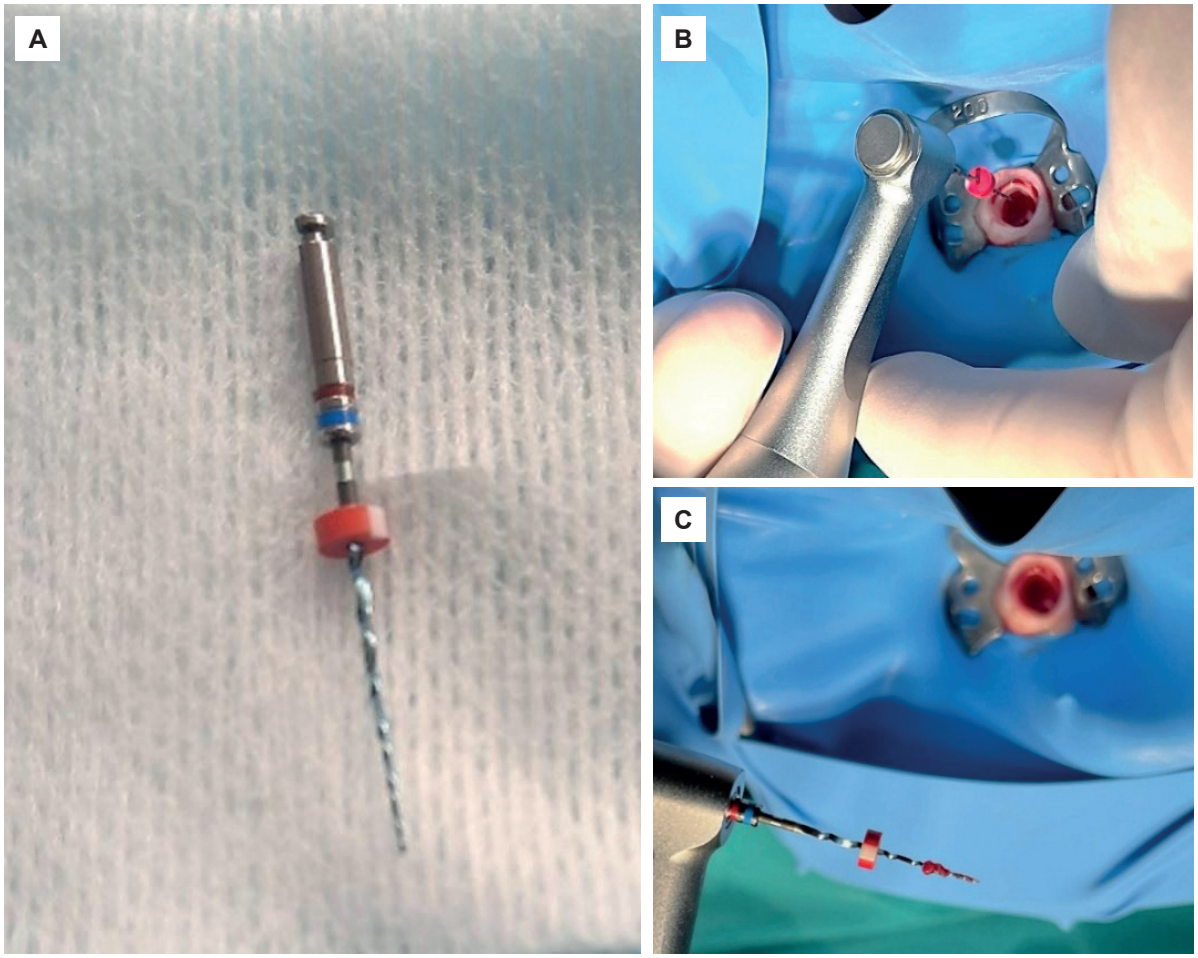

Figure 2. Race® Evo rotary system and biomechanical instrumentation. A) Race® Evo #25/06 21 mm file (blue alloy). B) Biomechanical instrumentation of tooth #85. C) Pulp remnants from tooth #85.

The instrumentation time was recorded and compared with reports of manual instrumentation. It was irrigated with rifocin diluted in sterile water and dried with sterile paper cones. Obturation was performed with CTZ paste in a 1:1:2 ratio, using eugenol as a vehicle until a paste-like consistency was obtained, introducing the paste into the canals with a #001 lentulo (red tape) at 125 rpm and 2.1 Ncm of torque. Subsequently, a 1 mm sub-base of zinc oxide and eugenol was applied, over which a 1 mm layer of flowable glass ionomer (i.seal®) was placed and light-cured for 15 seconds; the procedure was completed with a direct resin inlay for the final restoration.

One week later, the first follow-up was performed, during which the mother reported that the girl was no longer in pain and could chew food more comfortably. The clinical evaluation showed that the surrounding tissues were normal and the restoration had an optimal marginal seal (Figure 3A). Radiographically, a radiopaque image compatible with the crown restoration, chamber seal, and root canal filling was observed, along with an interradicular and periapical osteolytic process accompanied by surrounding condensative osteitis (Figure 3B).

At the second follow up, performed 15 days after treatment, the girl was more sociable with the dental staff, and her mother reported no discomfort after the procedure. Clinical examination of tooth #85 revealed healthy gingival tissues, no pain on percussion, and the restoration in good condition. Radiographically, adequate sealing of the coronal restoration and root canals was evident; however, a radiolucent image was identified at the interradicular and periapical levels, with alteration in the surrounding trabecular bone pattern, suggesting the presence of an area undergoing repair (Figure 3C).

At the third follow-up, 20 days after treatment, the girl was calm and cooperative during the dental examination. Clinically, the soft and hard tissues surrounding tooth #85 were in good condition, while the radiographic evaluation revealed adequate occlusal crown restoration, correct chamber sealing, and complete root canal filling; however, a sequela of external root resorption was identified in the mesial root (Figure 3D).

Two months later, at the fourth check-up, the patient remained receptive during the evaluation. Clinically, tooth #85 showed the restoration in good condition, with no signs of discomfort. Radiographically, good

sealing of the occlusal restoration and root canals was observed, as well as a reduction in the radiolucent image in the interradicular area, suggesting an ongoing recovery process (Figure 3E).

To facilitate understanding of the procedure and follow-up of the case, a detailed summary is presented in Table 1.

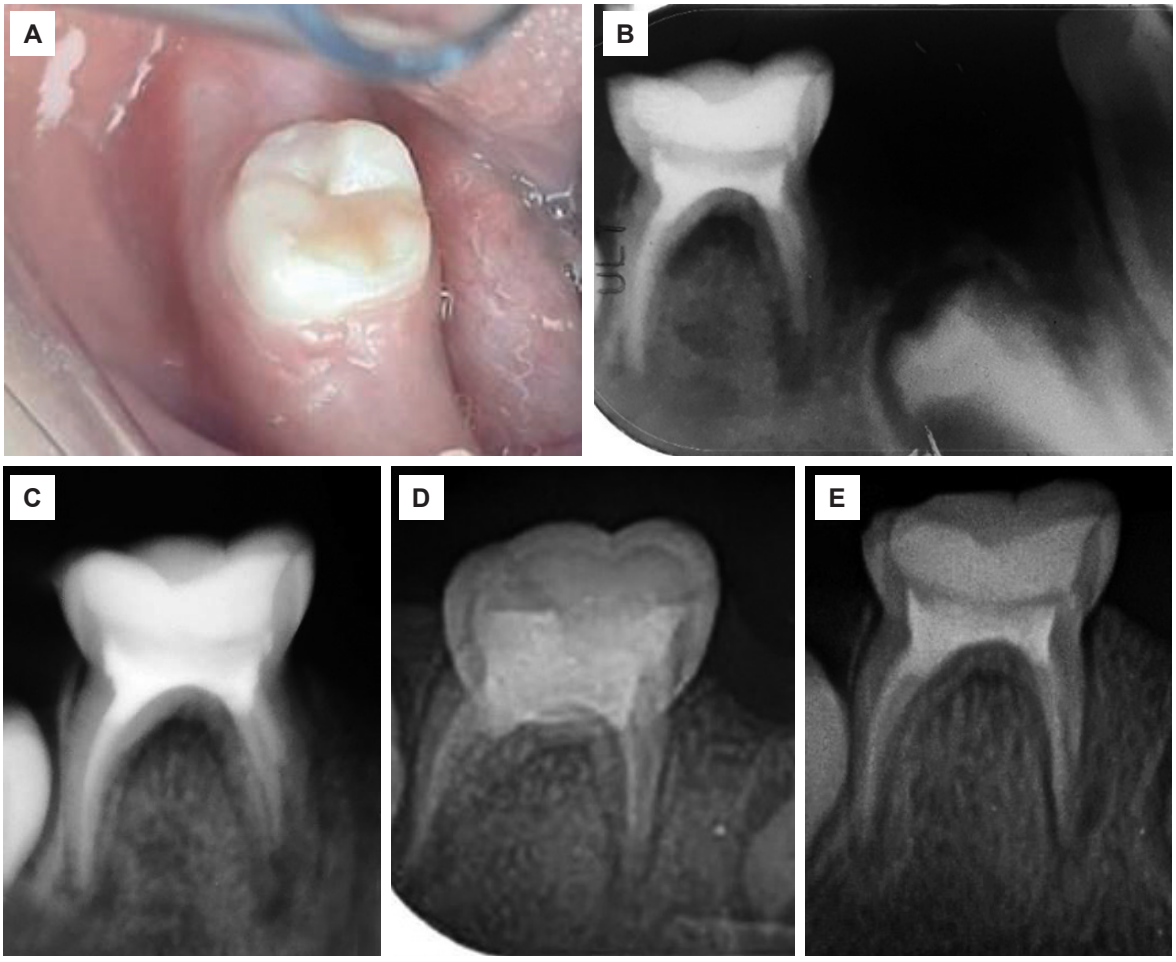

Figure 3. Clinical and radiographic follow-up of tooth #85 over time. A) First clinical follow-up one week after treatment. B) First radiographic follow-up one week after treatment: periapical radiograph. C) Second radiographic follow-up 15 days after treatment. D) Third radiographic follow-up 20 days after treatment. E) Fourth radiographic follow-up two months after treatment.

Table 1. Chronology of case follow-up.

Checkup	Results
Initial examination and treatment (07/09/2022)	Clinically: Extensive carious lesion with pulp involvement, fistula at tooth #85 (Figure 1A). Radiographically: Radiopaque image at the coronal level with pulp involvement, periapical and interradicular osteolytic process with surrounding condensing osteitis (Figure 1B). Description of the patient and her family: Anxious and concerned mother; the girl is shy and uncooperative.
First check-up (07/14/2022)	Clinically: Soft tissues surrounding tooth #85 healthy, restoration with marginal seal in good condition (Figure 3A). Radiographically: Optimal shape and filling of the root canals of tooth #85 (Figure 3B). Description of the patient and her family: Absence of dental pain and improvement in masticatory function.

Table 1. (*Continuation*).

Checkup	Results
Second check-up (07/30/2022)	Clinically: Healthy gingival tissues, no pain on percussion, restoration in good condition.
	Radiographically: Bone regeneration process at the furcation level, no evidence of resorption or infectious processes (Figure 3C).
	Description of the patient and her family: Girl sociable with dental staff, no discomfort after treatment.
Third check-up (08/20/2022)	Clinically: Soft and hard tissues surrounding tooth #85 in good condition.
	Radiographically: No evidence of resorption or infection (Figure 3D).
	Description of the patient and her family: The girl cooperates with the dental examination.
Fourth check-up (11/10/2022)	Clinically: Tooth #85 with restoration in good condition, no discomfort.
	Radiographically: No signs of resorption or infection are observed, reduction of the radiolucent image in the interradicular area of tooth #85 (Figure 3E).
	Description of the patient and her family: She is receptive to the evaluation.

DISCUSSION

Priyadarshini et al. (3) reported that the instrumentation time with the Kedo-SG Blue rotary system was significantly shorter (2.7840 ± 3.4217 minutes-seconds), followed by the Kedo-S system (4.5908 ± 1.54886 minutes-seconds), in mandibular molars, compared to Kedo-SH manual files (5.8800 ± 4.8345 minutes-seconds) and K-type files (6.2167 ± 3.0978 minutes-seconds). Similarly, Shah et al. (5) demonstrated that instrumentation with the Kedo-S (19.25 minutes) and Pro-AF (21.89 minutes) rotary systems was faster than with K-type hand files (27.87 minutes). In the present report, the instrumentation time with the Race® Evo #25/06 rotary system in the canals of tooth #85 was only 1 minute, showing superior efficiency compared to the times recorded in previous studies with manual systems.

Esentürk et al. (15) concluded that the Revo-S rotary system demonstrated greater efficiency in shaping canals compared to manual instrumentation. Similarly, Schachter et al. (16) showed that the Kedo-S and ProTaper Gold rotary systems obtained favorable results in shaping canals in primary mandibular molars compared to manual techniques. In this report, the use of the single Race® Evo #25/06 file showed equally satisfactory results in shaping curved canals, highlighting its effectiveness compared to other methods mentioned in the literature.

Reddy et al. (17) evaluated three rotary systems (Kedo-SG Blue, Kedo-S Square, and Pro AF Baby Gold) in lower primary molars and found that Kedo-SG Blue and Pro AF Baby Gold achieved less root canal transport. Meanwhile, Abdelkafy et al. (18) analyzed the use of single files (ProTaper Next X3 #30/0.07, Fanta AF Baby files #30/0.06, and Kidzo Elephant file #30/0.06) and concluded that there were no significant differences in canal transport between them. In this report, the single Race® Evo #25/06 file was used, which showed minimal canal transport and efficient preparation in the curved areas of tooth #85, thanks to its heat-treated alloy with blue technology, which optimized its performance in complex canals.

Priyadarshini et al. (3) reported that the use of the NiTi Kedo-SG Blue rotary system in pulpectomies of lower primary molars resulted in 20% overfilling, in contrast to manual K-type files, which achieved 73.3%. Similarly, Sruthi et al. (6) found 13.3% overfilling with the Kedo-SG Blue system, significantly lower than the 60% obtained with manual K files. On the other hand, Preethy et al. (19) compared different systems and observed that Kedo-SG Blue produced 20% overfilling, while ProTaper Gold produced 33.3% and manual K-type files produced 26.6%. Govindaraju et al. (20) demonstrated that ProTaper S2 NiTi files achieved 26.7% overfilling, and the K3 system achieved 20%, both lower than the 40% recorded with manual K files (No. 15-30). In this report, optimal filling was achieved using the single Race® Evo #25/06 file with blue heat treatment, ensuring precision and adequate control of the seal in the canals of tooth #85.

One of the limitations of this case report was the difficulty in identifying previous evidence from clinical trials or reports that have used Race® Evo #25/06 files in primary teeth, which limited direct comparisons in terms of filling quality and instrumentation time. Therefore, this would be the first report documenting the use of these files in pediatric dentistry, opening up new opportunities for future research. Although the

clinical and radiographic results were successful, it is not possible to generalize the conclusions beyond this case, as confounding factors related to the patient and her environment may have influenced the individual clinical response, leading to susceptibility to bias (21).

Finally, although case reports represent a low level of scientific evidence, they are a valuable starting point for further research (22). In this sense, the innovative therapeutic approach presented in this case may serve as a stimulus for future studies with greater methodological rigor and a higher level of evidence, thus contributing new knowledge in the area.

CONCLUSIONS

The Blue Race® Evo #25/06 heat-treated rotary system, used as a single file in pulpectomies of a lower primary molar, proved to be efficient in both shaping and filling the canals in the present case. An instrumentation time of 1 minute was achieved for the canals of tooth #85, significantly lower than the time reported by Priyadarshini et al. (3) and Shah et al. (5) with manual instrumentation (6.2167 ± 3.0978 minutes-seconds and 27.87 minutes, respectively). These results highlight the advantage of the Race® Evo rotary system in terms of efficiency, especially when compared to traditional manual techniques.

Conflict of interest:
The authors declare no conflict of interest.

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Ethics approval:
Study approved by the Ethics Committee of the Universidad Privada San Juan Bautista, with registration code No. 0582-2023-CIEI.UPSJB. Likewise, the principles of bioethics were approved by means of an informed consent form signed by the patient's mother.

Author contributions:
GJHG: conceptualization, research, execution of case report treatment, software, analysis of results, writing – original draft, writing – review & editing.
MEDP: methodology, supervision, formal analysis, writing – original draft, writing – review & editing.
GTR: conceptualization and design of the case report, supervision, formal analysis, writing – original draft, writing – review & editing.

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