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Short Communication

Accuprox – Precision gauge for interproximal reduction

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Abstract

Accuprox – Precision Gauge for Interproximal Reduction (IPR) is an innovative clinical tool designed to enhance the accuracy and consistency of enamel reduction in orthodontics. Traditional IPR techniques often rely on subjective estimation, leading to variability and potential over- or under-reduction. Accuprox addresses this limitation by providing predefined thickness markers, ensuring controlled and standardized enamel removal. The gauge is simple to use, allowing clinicians to achieve precise space creation with minimal iatrogenic damage. By standardizing the IPR process, Accuprox enhances treatment predictability and reduces technique sensitivity, making it a valuable addition to orthodontic practice.

Keywords: Interproximal reduction, Enamel preservation, Orthodontic space management, Stainless steel gauge, Precision gauge.

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1. Introduction

Interproximal reduction (IPR), also known as stripping, enamel reproximation, or slenderizing, is a widely used orthodontic procedure for gaining space, resolving crowding, and correcting Bolton discrepancies while maintaining natural dentition.[1,2] IPR is commonly performed using abrasive strips, diamond burs, or discs, with space creation ranging from 0.2 mm to 0.5 mm per contact, depending on clinical needs.[3,4]

While effective, a major limitation of IPR is the difficulty in precisely measuring enamel reduction. Most orthodontists rely on visual estimation or feeler gauges, both of which introduce subjectivity and errors.[5,6] Over-reduction can lead to increased enamel sensitivity, caries risk, and compromised tooth integrity, whereas under-reduction may result in incomplete space creation, affecting treatment outcomes and stability.[7,8] A study by Radlanski and Jäger emphasized that improper IPR can lead to unfavorable changes in occlusion and periodontal health.[9] Additionally, studies have shown that manual IPR techniques without precise measurement tools can lead to inconsistent enamel reduction, affecting final occlusal relationships and long-term stability.[10,11] Furthermore, improper IPR has been associated with increased plaque accumulation and periodontal inflammation, underscoring the need for precision in enamel reduction.[12]

To address these concerns, we introduce Accuprox, a novel precision gauge designed to provide an accurate, reproducible, and efficient method to measure the amount of IPR performed intraorally. By offering calibrated measurement options in a simple, user-friendly device, Accuprox enhances precision, predictability, and procedural efficiency in orthodontic space management.[13]

2. Materials and Methods: (Figure 1)

1. Stainless steel band material (0.006-inch thickness, equivalent to 0.15 mm)
2. 0.016 x 0.022 stainless steel wire (0.022-inch thickness, equivalent to 0.5 mm)
3. 21-gauge stainless steel wire for framework
4. Bird beak plier

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5. Metal Scale
6. Monomer and polymer for Acrylization
7. Welder

2.1. Design & steps in fabrication

The fabrication of Accuprox begins with the framework preparation, where a 21-gauge stainless steel wire is cut and shaped to form the base structure. The wire is bent into a circular shape in the middle to hold the acrylic material and create a handle for easy manipulation. Following this, a helix formation is introduced by creating a helix 2.5 mm on either side of the central handle, which provides adjustability to the appliance.

Next, the measurement structure is designed by leaving another 2.5 mm from the helix and making a 90-degree bend to form a square-like structure with 1 mm sides, completing the framework (**Figure 2**). To enhance its functionality, band integration is achieved by incorporating 0.15 mm thickness stainless steel band material, which can also be folded to obtain a 0.30 mm thickness, aligning with the recommended anterior IPR values of 0.15 mm and 0.30 mm.

Figure 1: Stainless steel band material, 0.016 x 0.022 stainless steel wire, 21-gauge stainless steel wire, Bird beak plier, Metal Scale, Monomer and polymer, Welder

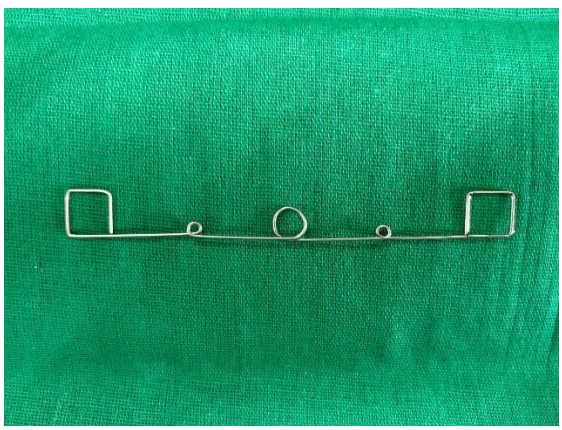

Figure 2: Framework after wire bending

Figure 3: 0.016 x 0.022" wire folded upon itself to obtain desired measurement

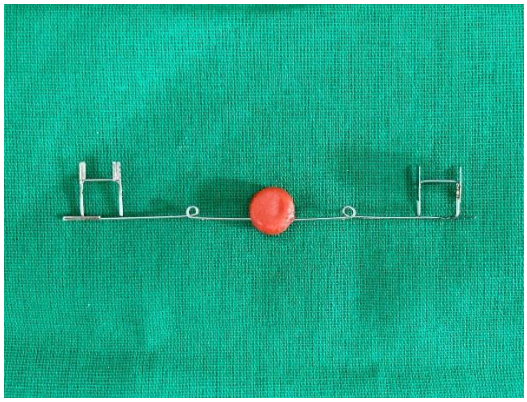

Figure 4: Completed design of gauge

Figure 5: Gauge in use for intraoral application.

For precise measurements, measurement guides are incorporated by welding a 0.016 x 0.022 stainless steel wire onto the structure, serving as a calibrated measurement marker. The selection of this wire is based on the fact that 0.022 inches equals 0.5 mm, allowing for accurate width measurements. Additionally, extra measurement options are included by folding 0.016 x 0.022 stainless steel wire onto itself and welding it to the framework, enabling the device to measure spacing of 1 mm, 1.5 mm, and 2 mm (**Figure 3**).

To ensure structural integrity, acrylic molding is performed using monomer and polymer to secure the framework. This is followed by polishing and finalization, where all edges are smoothed for safe intraoral use,

completing the fabrication of Accuprox (**Figure 4**). Once ready for intraoral use, (after obtaining proper consent from the patient) Accuprox can be inserted into the interdental space to verify the exact amount of enamel removed without the need for additional impressions (**Figure 5**).

3. Discussion

Interproximal reduction has long been a standard technique in orthodontics, particularly in aligner therapy, fixed appliance therapy, and cases requiring minor space creation.[14] While IPR provides an effective non-extraction alternative for achieving proper alignment, its success is highly dependent on accurate enamel removal. Over-reduction of enamel can weaken tooth structure, increase sensitivity, and predispose teeth to cervical wear and caries.[15] Under-reduction, on the other hand, may leave inadequate space for tooth movement, leading to compromised alignment and post-treatment instability.

3.1. Challenges with conventional IPR methods

Traditional methods, including abrasive strips, diamond burs, and IPR discs, rely heavily on visual estimation and manual gauging, which can lead to inconsistent space creation. Feeler gauges, often used to assess the amount of enamel removed, offer only an approximate measurement, making it difficult to standardize enamel reduction across multiple contacts. Additionally, clinicians performing IPR without accurate measurement tools may unintentionally remove uneven amounts of enamel from different interproximal contacts, altering the final occlusal scheme.

Accuprox was created to overcome these issues by offering an accurate, repeatable, and efficient approach for evaluating enamel reduction intraorally. The device includes calibrated measurement markers (0.15 mm, 0.3 mm, 0.5 mm, 1 mm, 1.5 mm, and 2 mm) for precise enamel reduction, a stainless steel framework for rigidity and long-term clinical use, helical adjustments for convenient intraoral placement and adaptability to different interdental areas, and a simple ergonomic design that allows for easy handling and quick measurements during procedure.

By eliminating subjective guesswork, AccuProx allows clinicians to verify IPR in real time, reducing the risk of over- or under-reduction. This ensures that the required space is achieved without compromising enamel integrity, leading to better treatment planning, more predictable outcomes, and improved patient safety.

4. Limitations

1. The current design has not yet undergone large-scale clinical validation and is based on pilot observations.
2. As a custom-fabricated tool, operator-dependent variations may occur during its assembly.
3. Standardization across different clinical setups and instruments remains a challenge.
4. Insertion and manipulation require chairside time and technique-sensitive handling.

5. Conclusion

Accuprox provides a simple, durable stainless-steel gauge that replaces guesswork in interproximal reduction with calibrated, ergonomic precision. By measuring enamel removal and remaining space in one step, it prevents over- or under-stripping, speeds chairside workflow, and integrates easily with fixed appliances or clear aligners. The result is more consistent, predictable tooth movement, fewer clinical errors, and better patient outcomes.

6. Conflict of Interest

None.

7. Source of Funding

None.

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