



Evaluation of the Effect of Corticotomy vs Corticocision on Orthodontic Movement: Systematic Review

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How to cite this paper: Amzil, I., Bejdigane, A., Amine, K. and Ousehal, L. (2025) Evaluation of the Effect of Corticotomy vs Corticocision on Orthodontic Movement: Systematic Review. *Open Access Library Journal*, **12**: e12854.

<https://doi.org/10.4236/oalib.1112854>

Received: December 22, 2024

Accepted: September 21, 2025

Published: September 24, 2025

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Abstract

Purpose: A systematic review was conducted on the evidence for the effectiveness of corticotomy and corticision on orthodontic tooth movement. **Materials and Methods:** Electronic search strategy following databases: Medline (PubMed), ScienceDirect and Google Scholar using the following keywords: Orthodontic movement, Corticotomy, Corticision, Piezocision. Systematic reviews, randomized clinical trials and case series published from 2007 in French and English were included in our systematic review. The articles were read by two independent reviewers and to assess the quality of the articles, a critical reading grid developed by Salmi was used. **Results:** Sixteen eligible articles were included in the review. Four articles discussing corticotomy (2 randomized clinical trials RCT + 2 case series CS), seven articles discussing corticision (5 randomized controlled trials RTC, 1 controlled clinical trial CCT and 1 systematic review), and 5 articles comparing corticotomy to corticision (1 controlled clinical trial, 2 randomized clinical trials, and 2 systematic reviews). **Conclusion:** Corticotomy and corticision are promising tools for accelerating and improving orthodontic tooth movement. However, a comprehensive understanding of the biological mechanisms and careful evaluation of each case are essential to ensure safe and effective results. Further studies are needed to explore the long-term efficacy of these procedures and to refine clinical protocols to optimize clinical outcomes for orthodontic patients.

Subject Areas

Dentistry

Keywords

Orthodontic Movement, Corticotomy, Corticocision, Piezocision

1. Introduction

During the last decades, the number of patients seeking orthodontic treatments has increased, as have the aesthetic demands and the desire for shorter treatment times [1].

Traditional orthodontic treatment frequently requires long treatment periods; most conventional orthodontic treatments require almost two years to complete [2], leading to increased patient dissatisfaction and higher treatment expenses [3] [4]. Extending the treatment duration by 6 months can result in a significant 23% reduction in patient adherence [5]. Furthermore, the risk of iatrogenic complications, including root resorption, may increase as the duration of treatment increases [6].

Different techniques, both surgical and non-surgical, are used as coadjuvants of orthodontic treatment [7]. Recently, one of the most commonly used techniques has been corticotomy [8]-[10]. This is defined as a surgical procedure in which the cortical bone is cut, perforated, or mechanically altered, without actually affecting the medullary bone [11].

In 1959, Köle introduced corticotomy to facilitate rapid tooth movement by surgically cutting the alveolar bone [12] [13]. He applied corticotomy and osteotomy to treat different types of malocclusion. Moreover, a surgical method utilizing corticotomy to facilitate bony-block relocation of teeth within the bone has been employed in orthodontic treatment, aiming to reduce treatment duration and minimize root resorption [12] [14]. Subsequently, this concept was modified by Wilcko *et al.*, who suggested that tooth movement is facilitated by the demineralization/remineralization process. Their revised approach includes both buccal and lingual full-thickness flaps, selective partial decortication of the cortical plates, simultaneous bone grafting or augmentation, and closure of the primary flap [15].

Although corticotomy procedures are quite efficient and predictable, they are relatively invasive because of the requirement for full muco-periosteal flaps, bone injury and suturing, which potentially result in postsurgical discomfort and complications such as pain, swelling, slight interdental bone and attached gingiva loss or infection [16] [17], which can dissuade patients.

Many flapless alternative techniques have been suggested to avoid the invasiveness of the corticotomy procedures, thus producing less pain and discomfort with the possibility of initiating the Regional Acceleratory Phenomenon [18].

The advantages of these procedures include their minimally invasive nature, repeatability, low morbidity, and low cost, as well as the fact that they do not require specialized surgical skills. These benefits enhance their appeal to both patients and orthodontists. However, these techniques may also increase the risk of

root damage.

Some of these alternatives are corticision [19], Micro-Osteoperforation (MOP) [19], piezopuncture [20] and piezocision [21]-[23].

As an alternative flapless technique, corticision, a minimally invasive periodontal procedure without flap elevation, using a burr or a Scalpel on the interradicular attached gingiva passing through the gingiva and cortical bone into the cancellous bone, is considered a promising tooth acceleration technique because of its various advantages on periodontal health, simplicity, availability, and lower cost.

Accordingly, piezocision has been introduced as an alternative to conventional corticotomy [24]. Piezocision uses an ultrasonic microsaw (piezotome) instead of a scalpel to create small, controlled incisions without raising a full-thickness flap, which allows for precise cutting of the bone around the tooth [25]. Although studies investigating the effects of this dental approach have been conducted, the results remain inconsistent and relatively limited [14] [26] [27]. Several studies have documented noteworthy acceleration in the pace of tooth movement when comparing piezocision to traditional orthodontic approaches [20] [28]. Conversely, several studies have indicated no significant distinctions in the results between piezocision and conventional orthodontic treatment [12] [27].

So the aim of this systematic review was to identify the benefit and reliability of each technique in the orthodontic literature.

2. Materials and Methods

2.1. Study Selection and Data Extraction

To identify the studies to be included, we adopted the electronic search strategy following databases: Medline (PubMed), ScienceDirect and Google Scholar.

The research was conducted on all papers published from 2007 to 2023.

Key terms used obtained from MESH Terms were:

- Orthodontic movement
- Corticotomy
- Corticocision
- Piezocision

The research equations used were: [and] [or].

These keywords were used separately and by crossing them to establish an initial reference list.

2.2. Eligibility Criteria

Inclusion criteria

The articles included in our systematic review were systematic reviews, as well as randomized RTC and non-randomized clinical trials NRTC and case series CS related to the effect of corticotomy and corticision in orthodontic tooth movement that meet the following inclusion criteria:

- Dating from June 2007 to June 2023.
- Published in French or English (because English and French are the languages

we know).

Exclusion criteria

- Articles detailing therapeutic approaches that do not involve corticotomy and corticision.
- Literature review articles.
- Articles using corticotomy and corticision to treat conditions other than dental malocclusion.
- Articles based on studies conducted on animals.

2.3. Analysis and Study Selection

The articles were read by two independent readers, which allowed us to select those whose results were used to write our literature review.

To assess the quality of the articles, we used a critical reading grid developed by Salmi (Figure 1).

Reference

Authors.....
 Title.....
 review.....
 year..... Volume (n°) (.....)
 Pages.....

Summary

Objective and justification
 Study diagram; compact groups
 Study population and number of subjects
 Conduct of the study

Main results

Check the box corresponding to compliance with the criterion: Y = Yes, I = incomplete, N = no, NA = does not apply, NK = don't know. A response checked N to a criterion in italics = unacceptable study.

Criteria	Y	I	N	NA	NK	Comments
Study design						
<i>Clear formulation of the objective</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Hypothesis made a priori	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Study design adapted to the objective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Selection procedures						
<i>Inclusion criteria described and adequate</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Exclusion criteria described and adequate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Indication of the number of refusals before the study	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Identical procedures in all groups	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Suitable sample size	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Ethical rules respected</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Conduct of the study						
Withdrawals indicated, explained and reasonable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Withdrawals balanced between groups	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Reliable and valid main gentlemen</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Analysis of results						
Methods adapted to the question and the design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Consideration of important variables	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Verifiable of raw data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Consideration of multiple comparisons	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Conclusion

Qualité	Cocher
Very good	<input type="checkbox"/>
Rather good	<input type="checkbox"/>
Poor but acceptable	<input type="checkbox"/>
Unacceptable	<input type="checkbox"/>
Not qualified to judge	<input type="checkbox"/>

Discussion (strengths and weaknesses)

The reader _____ Date / /

This grid is not covered by copyright: it can be copied or printed without permission but with mention of the source – Salmi L.R. Critical reader and scientific medical communication. How to read, present, write and publish a clinical or epidemiological study. 3rd edition. Issy-les- Moulinaux (France): Elsevier Masson; 2012.

Figure 1. Generic grid for critical reading of a clinical or epidemiological study.

2.4. Risk of Bias

Protocol-related biases are associated with the choice of language: only articles in French and English were selected, which could overlook studies published in other languages.

3. Results

At the end of the initial search, 430 articles were preselected. After restricting the period to 2007-2023 and applying the “Humans” filter, we identified 220 articles that could correspond to the studied topic and that are literature reviews, systematic reviews, case series, and clinical trials, as specified in the inclusion criteria.

Articles reporting only one case, articles not related to the effect of corticotomy and corticision on orthodontic tooth movement, and articles reporting in vitro or animal experiments and author opinions were excluded.

Literature review articles were also excluded (Totaling 4 articles).

At the end of this step, 37 articles were selected for full reading. After removing duplicates, we proceeded with full abstract reading and full-text reading of the selected articles, which reduced the number of articles included in our study to 16 (Figure 2).

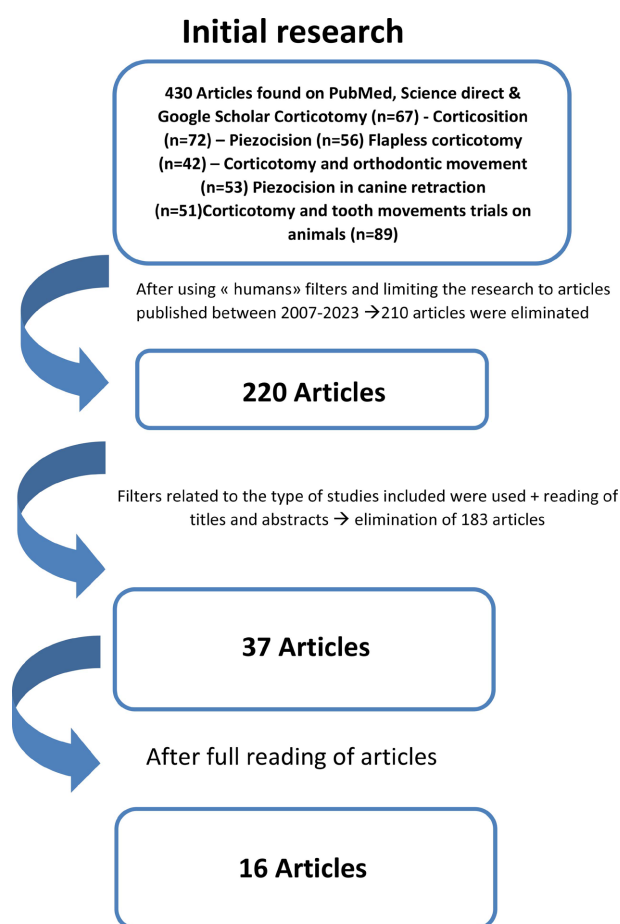


Figure 2. Prisma diagram of the study.

Of the 16 articles selected, 2 were case reports, 3 were systematic reviews, and 11 were clinical trials discussing corticotomy, corticocision and also comparing both techniques (**Tables 1-3**).

Table 1. Overview of articles discussing corticotomy.

Study	Method	Intervention/ Comparison	Country	Scoop of the Study	Participants	Tooth Movement	Results
Fischer <i>et al.</i> [29]	Case series	Corticotomy	United States	Single center	6 participants with bilaterally impacted canines, including 4 girls and 2 boys whose average age is between 11.1 and 12.9 years.	Exposure of palatal impacted canines	A surgical technique assisted by corticotomy makes it possible to reduce the duration of orthodontic treatment of palatal canines
Ma Z <i>et al.</i> [30]	Randomized clinical trial	Piezoelectric corticotomy	China	Single center	30 participants: +15 participants including 6 men and 9 women with an average age of 27 years treated with traditional orthodontic traction. +15 participants including 5 men and 10 women with an average age of 24 years treated by orthodontic traction with corticotomy.	Orthodontic traction of impacted mandibular third molars	The use of piezoelectric corticotomy allows a more efficient and faster traction of third molars.
Al-Naoum F <i>et al.</i> [31]	Randomized controlled trial	Corticotomy	Syria/ Saudi Arabia	Single center	30 participants including 15 men and 15 women with an average age of 20.04 ± 3.63 years.	Retraction of the maxillary canines	Alveolar corticotomy increased orthodontic tooth movement and was accompanied by moderate degrees of pain and discomfort.
Aboul-Ela SM <i>et al.</i> [4]	Case series	Corticotomy	Egypt	Single center	13 participants including 5 men and 8 women with an average age of 19 years.	Retraction of the maxillary canine	The average daily rate of canine retraction was significantly higher on the corticotomy side than on the control side, by 2 times during the first 2 months after corticotomy surgery. No loss of molar anchorage occurred during canine retraction on either the operated or nonoperated side. There was no statistically significant difference between preoperative and postoperative measurements of plaque index, probing depth, attachment loss, and gingival recession.

Table 2. Table relating to articles discussing corticocision.

Study	Method	Intervention/ Comparison	Country	Scoop of the Study	Participants	Tooth Movement	Results
Aksakalli <i>et al.</i> [32]	Controlled clinical trials	Piezocision	Türkiye	Single center	10 participants including 4 men and 6 women with an average age of 16.3 years.	Retraction of the maxillary canines	Piezocision-assisted distalization accelerates tooth movement, reduces loss of anchorage for posterior teeth and does not induce any maxillary transverse changes. Furthermore, piezocision has no negative effects on periodontal.
Tunçer <i>et al.</i> [26]	Randomized controlled clinical trial	Piezocision	Türkiye	Single center	31 participants (EG: 16 et CG:15); loss of 1 patient from EG. EG (M:2; F:13) et CG (M:2, F:13). Average age: EG: 17.7 et CG: 17.0.	Mass maxillary retraction	Based on the results of this study, the Piezocision technique was found to be ineffective in acceleration mass retraction and in prompting a difference in the studied GCF parameters, skeletal and dental variables.* (GCF: gingival crevicular fluid)
Patterson <i>et al.</i> [33]	Randomized controlled clinical trial	Piezocision	Australia	Single center	14 participants; including 6 men and 8 women with an average age of 16 years.	Version of the maxillary posterior plane vestibule	Total root resorption was significantly greater on the piezocision side than on the control side. The piezocision procedure resulted on an average 44% increase in root resorption.
Uribe <i>et al.</i> [27]	Randomized clinical trial	Piezocision control	USA	Single center	41 participants (EG: 21 et CG: 20); loss of 12 patients: 16 EG et 13 CG. M:12, F:17; EG (M:6; F:10) et CG (M:6, F:7). Average age: EG: 29.4 y CG: 30.0 y.	Alignment of the mandibular incisors	This randomized clinical trial did not demonstrate that piezotome-assited orthodontics and corticision were more effective in reducing anterior mandibular crowding.
Gibreal <i>et al.</i> [34]	Randomized clinical trial	Piezocision	Syria	Single center	36 participants (EG: 18, CG: 18); loss of 2 patients, left 17 to analyse in each group. M: 15, F:19, EG (M:8; F:9) et CG (M:7, F:10). Average age: EG: 20.2 y CG: 20.3 y.	Alignment of the mandibular incisors	The deviation values of the surgical guide nearly zero, confirming that this innovative technique is clinically applicable. Furthermore, this technique has proven to be impressively effective in acceleration the orthodontic movement of teeth.
Strippoli <i>et al.</i> [35]	Randomized clinical trial	Piezocision Conventional orthodontic treatment	Canada	Single center	24 participants: +12 treated with Piezocision, with an average age of 28 ± 6 years. +12 treated with conventional orthodontic treatment, with an average age of 17.1 ± 0.8 years.	Alignment of the mandibular incisors	The orthodontic treatment combined with piezocotocicion reduced the duration of orthodontic treatment.

Table 3. Table relating to articles comparing corticotomy to corticocision.

(a)						
Study	Method	Intervention/ Comparison	Country	Number of processed articles	Results	
Yi <i>et al.</i> [14]	Systematic review	Piezocision	China	4	All studies reported an acceleration of tooth movement after piezocision and three reported a significant reduction in treatment duration in the piezocision group. No deleterious effects on periodontal status, satisfaction, pain perception, root resorption or anchorage control were reported in the studies.	
(b)						
Study	Method	Intervention/ Comparison	Country	Participants	Tooth movement	Results
Abbas <i>et al.</i> [1]	Controlled clinical trials	Piezocision Corticotomy Control	Egypt	20 participants (Piezocision/Control group: 10, Corticotomy/Control group: 10); gender confused distribution; Age: 15 to 25 years; no loss of patients.	Retraction of the maxillary canines	Corticotomies produces greater canine rates than piezocision at 4 time points. Canine root resorption was greater on the control side. The other variables studied showed no differences between the experimental and control side. Corticotomy-facilitated orthodontics and piezocision are effective treatment modalities to accelerate canine retraction.
Alfawal <i>et al.</i> [23]	Randomized controlled clinical trial	Piezocision Laser-assisted flapless Corticotomy	Syria	32 participants (19 women, 13 men, average age of 18.25 ± 3.05 years) were randomly divided into two equal groups: the lazer-assisted flapless corticotomy (LG; n = 16) and the piezocision group (PG; n = 16); 1 lost to follow up to each group.	Canine retraction	LAFC and piezocision have been associated with high levels of pain and discomfort. They both accelerate orthodontic movement.
Fernandes LSMCP <i>et al.</i> [36]	Randomised controlled clinical trial	Piezocision Corticotomy	Brésil	47 participants (19 M/28 W): +Group 1: Corticotomy*Control: 16 including 5 men and 11 women with an average age of 21.1 years +Group 2: Piezocision*Control: 16 including 8 men and 8 women with an average age of 19.4 years. +Group 3: Corticotomy*Piezocision 15 including 6 men and 9 women with an average age of 21.6 years.	Canine retraction	Alveolar corticotomy and piezocision did not accelerate maxillary canine retraction and did not induce a distinct pattern of biomaker expression.

Continued

(c)					
Study	Method	Intervention/ Comparison	Country	Number of processed articles	Results
Viwattanatipa <i>et al.</i> [16]	Systematic review	Piezocision Corticotomy	Thailand	5	This technique reduces the duration of orthodontic treatment to a third that required of conventional orthodontics. Alveolar bone on the labial and palatal/lingual surfaces provides root coverage as the dental arch expands. Orthodontics assisted by corticotomy has been reported in a few clinical cases and appears to be a promising adjuvant technique.
Apalimova <i>et al.</i> [37]	Systematic review	Corticotomy Piezocision	Spain	9	Corticotomy procedures performed even with conventional methods or piezocision lead to an increase in dental movements and acceleration during the first months which then returns to baseline values. The traditional corticotomy technique, performed with surgical cutters and handpieces, provides faster results than piezocision. However, it is more invasive and may result in greater surgical morbidity.

The case reports all highlighted the benefit of corticotomy in reducing orthodontic treatment duration, primarily through a clinically significant acceleration of tooth movement. The article by Aboul-Ela *et al.* [4], based on a series of 13 clinical cases treated with corticotomy, also demonstrated that this approach does not compromise patients' periodontal status.

In our review, 3 articles were systematic reviews.

The review by Yi *et al.* [14] investigated the role of piezocision in shortening treatment duration and also examined the periodontal consequences of this technique. The authors concluded that piezocision significantly reduces treatment time without causing periodontal damage.

The systematic reviews by Viwttannatip [16] and Aplaimova [37] compared piezocision and corticotomy. They concluded that traditional corticotomy with flap elevation enables faster tooth movement than piezocision but is more invasive from a periodontal perspective.

The 11 clinical trials included in our review compared the effects of corticotomy and piezocision on orthodontic tooth movement.

A total of 295 patients were enrolled across these studies, with or without control groups.

The conclusion from these trials was that both corticotomy and piezocision are effective in reducing treatment time by accelerating orthodontic tooth movement when compared to control groups.

4. Discussion

Our work is a detailed systematic review, we only included systematic reviews, as well as randomized clinical trials and case series related to the effect of corticot-

omy and corticision in orthodontic tooth movement.

The critical reading of the selected articles revealed that alveolar corticotomy is defined as a surgery that consists of performing a superficial resection of the alveolar bone, limited to the cortical bone and penetrating only slightly into the medullary bone in the area where it is desired to reduce alveolar resistance or move dental elements more quickly.

Fisher *et al.* [29] conducted a case series in 2007 in the United States. Corticotomy was performed on six participants with bilaterally impacted canines, including 4 girls and 2 boys with an average age ranging from 11.1 to 12.9 years. They concluded that corticotomy helps reduce the duration of orthodontic treatment for impacted palatal canines.

Aboul-Ela SM *et al.* [4] also conducted a case series in 2011 in Egypt. Corticotomy was performed on 13 participants, including 5 men and 8 women, with an average age of 19 years. They concluded that the average daily rate of canine retraction was significantly higher on the corticotomy side than on the control side, by 2 times during the first 2 months after corticotomy surgery. There was no molar anchorage loss during canine retraction, either on the operated side or the non-operated side. There was no statistically significant difference between preoperative and postoperative measurements of plaque index, probing depth, attachment loss, and gingival recession.

Ma Z *et al.* [30] conducted a randomized clinical trial in China in 2015. Thirty participants were treated and divided into 2 groups:

- Group 1: 15 participants, including 5 men and 10 women, with an average age of 24 years, treated with orthodontic traction with piezoelectric corticotomy.
- Group 2: 15 participants, including 6 men and 9 women, with an average age of 27 years, treated with traditional orthodontic traction.

They concluded that the use of piezoelectric corticotomy allows for more effective and faster traction of third molars.

Al-Naoum *et al.* [31] also conducted A split-mouth design randomized controlled trial in 2014 in Syria and Saudi Arabia. Thirty participants, including 15 men and 15 women, with an average age of 20.04 ± 3.63 years, were treated with corticotomy for retraction of maxillary canines. They concluded that alveolar corticotomy increased orthodontic tooth movement but was accompanied by moderate degrees of pain and discomfort.

According to these two case series and these two randomized clinical trials, we can conclude that corticotomy allows for faster orthodontic movement.

Corticocision is a less invasive surgical procedure than corticotomy, involving the creation of osteotomy cuts only in the cortical bone surrounding the teeth to be moved, using a bone burr or an osteotomy saw.

Aksakalli *et al.* [32] conducted a randomized clinical trial in Türkiye in 2016. They performed piezocision on 10 participants, including 4 men and 6 women, with an average age of 16.3 years, for retraction of maxillary canines. They concluded that piezocision-assisted distalization accelerates tooth movement, reduces

anchorage loss for posterior teeth, does not induce any maxillary transverse changes, and furthermore, piezocision has no negative effects on periodontal health.

Tunçer *et al.* [26] conducted a randomized clinical trial in Türkiye in 2017. They performed maxillary en masse retraction using piezocision on 31 participants. They concluded that piezosurgery was ineffective in accelerating orthodontic movement.

Patterson *et al.* [33] conducted a randomized clinical trial in Australia in 2016. Piezocision was performed on 14 participants, including 6 men and 8 women, with an average age of 16 years. They concluded that total root resorption was significantly greater on the piezocision side compared to the control side. Piezocision resulted in an average increase of 44% in root resorption.

Uribe *et al.* [27] conducted a randomized clinical trial in the USA in 2017. They performed piezocision on 41 patients for mandibular incisor alignment. Their study did not demonstrate that orthodontics assisted by piezocision and corticision were more effective in reducing anterior mandibular crowding.

Gibreal *et al.* [34] conducted a randomized clinical trial in Syria in 2023. They performed piezocision on 36 patients for mandibular incisor alignment. They concluded that this technique showed impressive effectiveness in accelerating tooth movement during orthodontic treatment.

Strippoli *et al.* [35] conducted a randomized clinical trial in Canada in 2018. Twenty-four participants were treated:

- 12 were treated with piezocision, with an average age of 28 ± 6 years.
- 12 were treated with conventional orthodontic treatment, with an average age of 17.1 ± 0.8 years.

They concluded that orthodontic treatment combined with piezocorticision reduced the duration of orthodontic treatment.

According to the 6 randomized clinical trials, two have demonstrated that piezocision is ineffective in accelerating tooth movement. The other four have affirmed that piezocision is effective in reducing treatment time and accelerating tooth movement.

Yi *et al.* [14] conducted a systematic review in China in 2017. They reviewed 4 articles, all of which reported that tooth movement is accelerated after piezocision. Three articles also reported a significant reduction in treatment duration in the piezocision group.

CORTICOTOMY VS CORTICOCISION:

Abbas *et al.* [1] conducted a randomized clinical trial in Egypt in 2016. They enrolled 20 participants (Piezocision/Control group: 10, Corticotomy/Control group: 10) aged 15 to 25 years of both genders for maxillary canine retraction. They concluded that corticotomies resulted in greater canine displacement rates than piezocision at 4 time points. Root resorption of the canine was more pronounced on the control side. The other variables studied showed no differences between experimental and control sides.

Both orthodontic treatments facilitated by corticotomy and by piezocision were effective modalities for accelerating canine retraction.

Alfawal *et al.* [23] conducted a randomized clinical trial in Syria in 2018. They included 32 participants (19 females, 13 males) with a mean age of 18.25 ± 3.05 years, randomly assigned to two equal groups: The Laser-assisted Corticotomy group (LG; $n = 16$) and the Piezocision group (PG; $n = 16$) for canine retraction.

They concluded that both techniques accelerated orthodontic movement but caused pain and discomfort after surgery (more pronounced in the corticotomy group).

Fernandes Larissa Salgado da Matta Cid Pinto *et al.* [36] conducted a randomized clinical trial in Brazil in 2021. They enrolled 47 participants for maxillary canine retraction:

- Group 1: Corticotomy*Control: 16 participants, including 5 males and 11 females, with a mean age of 21.1 years.
- Group 2: Piezocision*Control: 16 participants, including 8 males and 8 females, with a mean age of 19.4 years.
- Group 3: Corticotomy*Piezocision: 15 participants, including 6 males and 9 females, with a mean age of 21.6 years.

They concluded that alveolar corticotomy and piezocision did not accelerate maxillary canine retraction.

According to these 3 randomized clinical trials, 2 noted that corticotomy and piezocision accelerate maxillary canine retraction, while 1 noted that these two surgical techniques did not accelerate canine movement.

Therefore, it can be concluded that corticotomy and piezocision facilitate tooth movement, specifically in the case of canines.

Viwattanatipa *et al.* [16] conducted a systematic review in Thailand in 2018. They analyzed 5 articles and concluded that both techniques (corticotomy and piezocision) reduce the duration of orthodontic treatment to one-third of that of conventional orthodontics and appear to be promising adjunctive techniques.

Apalimova *et al.* [37] conducted a systematic review in Spain in 2020. They reviewed 9 articles and concluded that corticotomy and piezocision procedures lead to an increase in dental movements and accelerations during the initial months, which then return to baseline values.

Corticotomy, performed with surgical burs and handpieces, shows faster results than piezocision. However, it is more invasive and may lead to greater surgical morbidity.

According to the results of the two systematic reviews, it can be concluded that corticotomy as well as piezocision clearly accelerate orthodontic movement.

5. Conclusions

In summary, our study focused on evaluating the effect of corticotomy and corticision on orthodontic tooth movement.

The results provided valuable insights into the efficacy and clinical implications

of these procedures in orthodontic practice.

Overall, it has been demonstrated that corticotomy and corticocision can accelerate and facilitate orthodontic tooth movement.

These techniques induce specific biological responses, such as accelerated bone resorption and activation of bone remodeling processes, allowing quicker repositioning of teeth.

Clinical evidence also suggests that these procedures can reduce the total duration of orthodontic treatment and improve the long-term stability of results.

However, it is important to note that corticotomy and corticocision are not suitable for all patients. Comprehensive preliminary evaluations, including radiographic analyses and clinical evaluations, are necessary to identify appropriate cases and exclude potential contraindications. Furthermore, accurate planning and execution of these procedures are essential to minimize associated risks and maximize benefits for patients.

For optimal results, it is recommended to integrate corticotomy and corticocision into a global treatment plan, combining them with other conventional orthodontic techniques. A multidisciplinary approach involving orthodontists, periodontists, and oral surgeons is often necessary to ensure proper coordination and communication.

In conclusion, corticotomy and piezocision are promising tools for accelerating and enhancing orthodontic tooth movement. However, a comprehensive understanding of the biological mechanisms involved, along with careful evaluation of each case, is essential to ensure safe and effective outcomes. Further studies should focus on standardizing the various procedures. More high-quality randomized controlled trials are needed to explore the long-term efficacy of these techniques and to refine clinical protocols, ultimately optimizing outcomes for orthodontic patients and supporting evidence-based recommendations for orthodontic practice.

Conflicts of Interest

The authors declare no conflicts of interest.

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