Table S1. Study characteristics.

Source	Study type	No of patients	Patient age	Periodontal and bone injury (Piezocision procedure)			Intervention/ Comparison	Tooth movement measured	Observation period
				No. of incision	Length (mm.)	Depth(mm.)			
Charavet et al 2016	RCT (parallel group)	24	30 ± 8 (mean 27 ± 7)	5 cuts in the buccal gingiva between anterior teeth.	5	3	Piezocision / Control	Upper and Lower anterior teeth decrowding	every 2 weeks until Complete decrowding (500-650 days)
Alfawan et al 2018	RCT (parallel group with split-mouth design)	36	18.08 ± 3.5	2 cuts in the buccal gingiva	10	3	Piezocision /Laser-assisted corticotomy	Retraction of maxillary canines	4 months
Yavuz et al 2018	CCT (parallel group)	35 control	13-19	11 cuts in the buccal gingiva between 6 – 6	7	3	Piezocision/ Discision/ Control	Alignment of anterior teeth	Complete Ortho. Treatment
Al Imam et al 2019	RCT (parallel group)	40	16-31	5 cuts in the buccal and 2 cuts in palatal gingiva between anterior teeth.	5	3	Piezocision / Control	Moving the maxillary anterior teeth backward	12 weeks
Alqadasi *et al*. 2020	CCT (parallel group with split-mouth design)	24	14-40	A cut at the midpoint of the extraction site at buccal gingiva	3	3-5	Piezocision / Control / Micro-Osteoperforations	Retraction of maxillary canines	At intervals of 2 weeks, 1 month, 2 months, and 3 months.

Source	Study type	No of patients	Patient age	Periodontal and bone injury (Piezocision procedure)			Intervention/ Comparison	Tooth movement measured	Observation period
				No. of incision	Length (mm.)	Depth(mm.)			
Areqi *et al*. 2020	CCT	44	20–27	2 cuts in the buccal gingiva, mesial and distal to the extraction site	The length was not specified.	3	Piezocision / Control	Second molar protraction	1 year
Arya *et al*. 2023	RCT (parallel group with split-mouth design)	24	18-25	2 cuts in the buccal gingiva, mesial and distal to canine	10	3	1.piezocision/conventional technique 2.Photobiomodulation/ conventional technique 3.Combination of piezoelectric photobiomodulation techniques /conventional technique	Retraction of maxillary canines	84^{th} day between the 3-week intervals (Week 1, Week 21, Week 42, Week 63).
Hatrom et al.2020	RCT	26	16-24	7 cuts in buccal gingiva between anterior teeth and distal side of the canine root and corticotomy by piezotome to remove the bone from the extraction socket distal to the canine root and palatal side of the socket in same day of premolar extraction.	The length was not specified.	3	Piezocision / Control	En-masse retraction	4 months

Source	Study type	No of patients	Patient age	Periodontal and bone injury (Piezocision procedure)			Intervention/ Comparison	Tooth movement measured	Observation period
				No. of incision	Length (mm.)	Depth(mm.)			
Fernandes *et al2021*	RCT (split-mouth design)	51	15-38	3 cuts at mesial and distal to canine and mesial to premolar	5	3	Piezocision /Control/ Alveolar corticotomy	Retraction of maxillary canines	24 weeks
Alhaija *et al*. 2022	RCT	40	18-30	2 cuts at mesial and distal to molar	The length was not specified.	3	Piezocision /Control	Second molar protraction	10 Months
Hadeel *et al*. 2022	RCT (split-mouth design)	23	23.5	A single cut distal to the canine	3	3	Piezocision /Control (among average facial height and high facial height subjects)	Retraction of maxillary canines	To,T1,T2 (6-week intervals)
Hawkins *et al*. 2022	RCT (split-mouth design)	40	14-28	A single cut distal to the canine	4-5	3	Piezocision /Control	Retraction of maxillary canines	18week period. (6week intervals)
Simre SS *et al*. 2022	RCT (parallel group with split-mouth design)	24	20.5	1 cut at middle of extraction space	10	2	Piezo (study group) / Bur (control group)	Retraction of maxillary and mandible canines	M1 (0 - 1st month) M2 (1st - 3rd month) M3 (3rd - 5th month)

Source	Study type	No of patients	Patient age	Periodontal and bone injury (Piezocision procedure)			Intervention/ Comparison	Tooth movement measured	Observation period
				No. of incision	Length (mm.)	Depth(mm.)			
Sonone *et al*. 2022	RCT (parallel group with split-mouth design)	50	19-33	1 cut at distal of canine	not specified.	3	-Piezocision /Control, -Alveolar corticotomy/ Control -Piezocision / Alveolar corticotomy	Retraction of maxillary canines	10 weeks
Sultana *et al*.2022	RCT	16	18-30	5 cuts on the buccal gingiva between the roots of six anterior teeth.	4-5	3	Piezocision /Control	Alignment of maxillary and mandibular anterior crowding in leveling stage	3 months
Gibrel *et al*. 2023	RCT	32	18-26	5 cuts on the buccal gingiva between the roots of six anterior teeth.	5-8	3	3Dsurgical guide piezocision/ Control	Decrowding of maxillary anterior teeth	140 days
Orgrenim *et al*. 2023	RCT (split-mouth design)	21	>14	2 cuts in buccal gingiva, away from second mandibular molar (2 and 5 mm)	not specified.	3	Piezocision /Control	Second molar protraction	112 days

Abbreviations RCT Randomised Clinical Trial, RANKL Receptor activator of nuclear factor ligand, OPG Osteoprotegerin. GCF Gingival crevicular fluid, CBCT cone beam computed tomography, IDP interdental papilla. a visual analog scale (VAS)

Table S2. Outcome of included studies.

Source	Was piezocision effective?	Tooth movement Results	P value	Other result	P value
Charavet et al 2016	yes	Reduction in the overall treatment duration by 43% compared to the control group.	(*P* =0.0001)	No significant increases in root resorption, dehiscence or fenestration were observed in either group	(*P* = .67)
Alfawal et al. 2018	yes	The rate of canine retraction was higher by double in the first month and 1.5 in the second month . the total duration was showed a reduction of approximately 25%.	(*P* < 0.001)	No significant variances observed between the experimental and control sides concerning anchorage loss and upper canine rotation in both groups.	(*P* >0.05)
Yavuz et al 2018	yes	Reduction in the overall treatment duration by 23% compared to the control group.	(P = 0.003)	No statistically significant differences between the two experimental groups regarding VAS and periodontal parameter values.	P > 0.05)
Al-Imam et al 2019	yes	In the experimental group, was increase in the rate of incisor retraction a 53%, accompanied by a 27% reduction in the time required for retraction.	(*P* < 0.001)	A significantly lower rate of anchorage loss. Conversely, there was significantly greater incisor tipping observed in the control group compared to the experimental group.	(*P* < 0.001)

Source	Was piezocision effective?	Tooth movement Results	P value	Other result	P value
Alqadasi *et al*. 2020	yes	Piezo groups was showed significantly higher rate 1.17 / month of tooth movement after 3 months	($P < 0.001$)	Decreased canine palatal bone height was reported on the experimental side of the Piezo group, but the overall changes were insignificant.	(P = 0.15)
Areqi *et al*. 2020	yes	The rates of tooth movement were 1.26 ± 0.12 mm per month in the piezocision group and 0.68 ± 0.19 mm per month in control group.	($P < 0.01$)	The concentration of IL-1b in the GCF was elevated in the piezocision group in comparison to the no piezocision group.	(P= 0.02)
Hatrom et al.2020	yes	The rate of tooth movement per month was 1.2 mm in the piezocision and 0.6 mm in the control group.	($P < 0.01$)	In addition, there was a notable reduction in the amount of tipping and root resorption observed in the incisors of the piezocision group. The pain reported was significantly more pronounced on the initial day in the PCG compared to the control group ;nonetheless, pain levels became comparable between the two groups after 24 hours.	(P< 0.05) (P<0.001)
Fernandes *et al 2021*	No	From the 2nd to the 24th week, PZ exhibited reduced cumulative incisal and cervical measurements compared to the control group.	($P < 0.05$)	Differences in biomarker expression were noted at specific timepoints within all groups, yet a clear pattern was not observed.	($P < 0.05$)

Source	Was piezocision effective?	Tooth movement Results	P value	Other result	P value
Alhaija *et al*. 2022	Yes	Both early and late piezocision resulted in a comparable impact, enhancing the temporary second molar protraction within the initial 2-3 months post-surgery. The application of piezocision led to a one-month reduction in the time needed for the closure of the mandibular first molar space.	($p > 0.001$)	The amount of anchorage loss, characterized by mandibular incisors proclination and distal movement of the mandibular second premolar, exhibited consistency across the three groups examined in the study.	($p > 0.05$)
Hadeel *et al*. 2022	No	Three months post piezocision surgery intergroup comparisons showed that rates of canine retraction for control sides and intervention sides were not significantly different.	(P >0.05)	There was no statistically significant observed in anchorage loss among the different groups in the study.	(P >0.05)
Hawkins *et al*. 2022	No	There was no statistically significant variance observed in space closure, rotation and anchorage loss among the different groups in the study.	($P = 0.89$)	With the exception of a single patient, all individuals experienced minimal pain following the piezocision surgery; however, they generally found the procedure to be manageable and indicated that they would recommend it to	
Simre SS *et al*. 2022	Yes	The average rate of tooth movement was 1.00 ± 0.07 mm per month in the bur group and 1.41 ± 0.08 mm per month in the piezo group.	(P =0.0001)	In the assessment of postoperative complications (periodontal pocket of more than 5 mm., Fenestration/dehiscence) from bur group more than piezo group but more gingival recession in piezogroup.	(P < 0.05)

Source	Was piezocision effective?	Tooth movement Results	P value	Other result	P value
Sonone *et al*. 2022	Yes	During the 10-week period, there were significantly greater differences in canine movement rates between the piezocision side and the control side (conventional orthodontic treatment).	($P < 0.05$)	Biomarker expression was detected at particular timepoints, yet no clear pattern was identified among groups.	($P > 0.05$)
Sultana *et al*.2022	Yes	During the 10-week period, the rates of canine movement were significantly greater on the piezocision side compared to the control side (conventional orthodontic treatment)..	(P=0.018) ($P < 0.05$)	No changes in the gingival recession, pocket depth, and pulp vitality in both groups were observed. Patients who received piezocision surgery experienced no or mild pain and were satisfied with the treatment.	($P > 0.05$)
Arya *et al*. 2023	No	The average rate of tooth movement was no statically difference, 0.72 mm per month in the piezo group and 0.62 mm per month in the control group.	(P =0.576)	Did not evaluate others outcomes.	-
Gibrel *et al*. 2023	Yes	A 53% reduction in the overall tooth movement time compared to the control group.	P<0.0001	Did not evaluate others outcomes.	-
Orgrenim *et al*. 2023	Yes	Consistently, the arch length decreased with a larger reduction observed in the experimental group. Additionally, there was a notable and statistically significant increase in the mesialization measurements within the experimental group.	(p < 0.001).	a reduction in root morphology in both groups, with the piezocision group exhibiting a higher decrease. No significant changes in OPG were observed in the piezocision group.	(p <0.001) (p =0.148)

Abbreviations :Overall alignment time = OAT, Micro Osteoperforations = MOP, Orthopantomograph=OPG