TABLE S1: Effects of corticotomy and piezotomy on OTMR, AR and OTD

	Studies	**Main Objective**	**Study design** **Number of patients**	**Surgical technique**	**OTMR (canine)** **Calculated acceleration (%)**	**OTD**	**Outcome**
PIEZOTOMY STUDIES	(Ma et al. 2015)	Efficacy of piezoelectric corticotomy for orthodontic ***traction of mandibular third molars*** close to the inferior alveolar nerve.	Comparative CT ***Piezocorticotomy vs no corticotomy*** . 30 subjects . corticotomy group 15 . no corticotomy group : 15	. **piezoelectric corticotomy** exposure . orthodontic traction of impacted 3rd molar		4 months vs 7.53 months - 46.88%	corticotomy technique moves teeth more rapidly, and results in quicker treatment time with less discomfort
	(Wu et al. 2015)	Improved Accelerated osteogenic Orthodontic treatment duration evaluation	Comparative CT : ***Piezosurgery vs No corticotomy*** .control group :12 .experimental group :12 .Class III *extraction surgical cases*	Improved Accelerated Osteogenic Orthodontic (IAOO): **Flap + vertical interradicular buccal piezosurgical corticotomy + Graft**	0.43mm/month vs 0.26mm/month 65.38%	12.48 months vs 18 .87 months -33.86%	The IAOO can reduce the surgical orthodontic treatment time for the skeletal Class III surgical patient by more than half a year on average
	(Fischer 2007)	evaluate the effectiveness of a new surgical technique in the treatment of ***palatally impacted canines***	RCT ***Piezocorticotomy vs no corticotomy*** - 6 subjects -split-mouth design	- canine exposure by **piezosurgery** - cortical perforation distal and mesial to canine extended to edentulous area	1.06 mm/month vs 0.75 mm/month 41.33%		corticotomy-assisted surgical technique helps reduce orthodontic treatment time for palatally impacted canine by 28 to 33%.
	(Aksakalli et al. 2016)	Compare the extent of canine distalization during orthodontic treatment with and without piezocision	Comparative CT ***Piezocision vs No Corticotomy*** . 10 subjects Class II cases . split-mouth . maxillary *1st bicuspid extraction cases*	. 10mm **Vertical interproximal incisions** 5mm apical to the mesial and distal interdental papilla of the maxillary canines. 3mm depth **piezo-surgical** cortical alveolar incisions	2.215mm/month vs 1.255mm/month 76.49%		Piezocision-assisted distalization accelerates tooth movement, decreases the anchorage loss for posterior teeth

	Study	objectives	Study design Number of patients	Surgical technique	OTMR (canine) Calculated acceleration (%)	- OTD - OTD reduction (%)	Outcome
CORTICOTOMY STUDIES	(Sakthi et al. 2014)	Efficiency and treatment outcome of patients treated with corticotomy-assisted en-masse orthodontic retraction	Comparative clinical trial ***Corticotomy vs no corticotomy*** . 40 subjects . experimental group: 22 . control group: 18 . 4 1st bicuspids extraction cases	. Incision distal canine to distal canine . full thickness flap . 3 mm above the apical region of the tooth . buccal interradicular **vertical decortication (surgical burs)** **. horizontal decortication** 2mm beyond roots	1.57mm /month (mandible) to 1.8mm/month (maxilla) vs 0.87mm/month (mandible) to 1.02mm /month (maxilla) 80.46% (mandible) 76.47% (maxilla)		The rate of retraction with study group was twice as faster when compared to the control group, accelerating during the first 2 months of retraction
	(Shoreibah, Salama, and Attia 2012)	evaluate the effect of corticotomy-facilitated orthodontics (CFO) in adults using a further modified technique versus traditional therapy in orthodontic tooth movement	. Comparative CT ***modified technique of corticotomy vs no corticotomy*** . 20 subjects . corticotomy group (I) :10 . no corticotomy group(II):10	-		17.5 weeks ± 2.8 weeks vs 49 weeks ± 12.3 weeks - 64.29%	corticotomy-facilitated orthodontic tooth movement using a further modified technique significantly reduces the total time of treatment

	(Suryavanshi et al. 2015)	Maxillary canine rate of movement during extraction space closure	Comparative CT : ***Corticotomy vs No corticotomy*** . 20 subjects split mouth design . maxillary *1st bicuspid extraction*	Incision + buccal Full thickness Flap+ buccal osteotomy (**Surgical) bur** + connection to lingual cortical **(chisel)**	1.2mm/month vs 0.81mm/month 48,15%		Modified corticotomy technique serves as an effective and safe way to accelerate orthodontic tooth movement,

OTMR = Orthodontic Tooth movement; OTD = Orthodontic Treatment Duration; CT = Clinical Trial; CFO = corticotomy-facilitated orthodontics;

TABLE S2 : Effects of DAD on OTM

	Studies	Main Objective	Study design Number of patients	Surgical and distraction technique	- CDR - Distraction time	Outcome
PERIODONTAL DISTRACTION	(Leethanakul et al. 2014)	Effect of DAD on maxillary canine movement rate	Comparative CT: Distraction. vs Conventional . 18 female subjects, . split-mouth	. deepening socket . distal interseptal bone thickness reduction . surgical burs . no distractor	1.35mm/month vs 1.13mm/month NA	Interseptal bone reduction can enhance the rate of canine movement
	Liou and Huang 1998)	Present a new technique of rapid canine retraction through distracting the periodontal ligament with a distraction device	CT : Periodontal distraction 15 subjects	Interseptal bone undermining distal to the canine with a bone bur, . vertical grooving inside the extraction socket along the buccal and lingual sides and extending obliquely toward the socket base .distractor : 0.5 to 1mm activation/day	2.16 mm/week 3 weeks	Periodontal ligament could be rapidly distracted without complications.
	(Sayin and al.2004)	Evaluate the effects of rapid canine distalization on dentoalveolar tissues during the rapid distalization of canine teeth with semirigid, individual tooth-borne distractors	CT 18 patients	**vertical osteotomies** at the buccal and lingual sites of the interseptal bone adjacent to the canine **. distractors** were activated 0.25 mm three times/day	1.92 mm/week (maxillar) 1.17 mm/week (mandibular) 3 weeks	Rapid canine distalization with periodontal distraction reduces the treatment time, and both the upper and lower canines can be distalized successfully in three weeks with controlled distal tipping
	(Mowafy et Zaher 2012)	Evaluate the anchorage loss, amount and time of canine retraction, and canine tipping concomitant with periodontal ligament distraction (PLD) using intermittent and continuous forces	RCT . 30 subjects . split-mouth	. Interseptal bone undermining distal to the canine with a bone bur, . vertical grooving inside the extraction socket along the buccal and lingual sides and extending obliquely toward the socket base . Distractor: Intermittent force Vs continuous force distractor	1.11 mm/ week vs 0.16 mm/week 5.4 weeks vs 27.9 weeks	Anchorage loss occurs with dental distraction. No difference in anchorage loss with either type of force. Intermittent force causes slow bodily movement. Intermittent force causes rapid tipping of the canine

ALVEOLAR DISTRACTION	(İşeri et al. 2005)	Effect of DAD on dentofacial structures	CT : Distraction 10 subjects	. Flap + corticotomy + Dentoalveolar distraction . Distractor: 0.8mm activation/day	0.8mm/day 10.05 days 10,05 days	The dentoalveolar distraction technique is an innovative method that reduces overall orthodontic treatment time by nearly 50%
	(Kumar et al. 2013)	Canine distalization rate under DAD	CT : Distraction 7 subjects	. Flap + corticotomy + Dentoalveolar distraction . Distractor: 0.75mm activation/day	0.4864mm/day 14.60 days	DAD reduces orthodontic treatment duration by 6 to 9 months in patients who need extraction, with no need for any sort of anchorage reinforcement
	(Kharkar et Kotrashetti 2010)	Effect of DAD on dentofacial structures	CT : Distraction 6 subjects	. Flap + corticotomy + Dentoalveolar distraction + . Distractor: 2mm activation/day	0.52mm/day 12.5 days	distraction osteogenesis for rapid orthodontic tooth movement is promising 5 and feasible for clinical practice
	(Kişnişci et al. 2002)	. reduce the overall orthodontic treatment time by means of . dentoalveolar distraction osteogenesis	CT : Distraction 11 subjects	. Flap + corticotomy + dentoalveolar Distraction . Distractor: 0,8mm activation/day	0.8mm/day 10.05 days	distraction osteogenesis for rapid orthodontic tooth movement is promising and feasible for clinical practice

DAD = Dento-Alveolar Distraction; CDR = Canine Distraction Rate; CT = Clinical trial; RCT = randomized controlled trial

TABLE S3: Effects of LILT on OTMR, RA and OTD

Studies	**Main Objective**	**Stugy design** **Number of patients**	**Technique**	**- OTMR (canine)** **- Calculated acceleration (%)**	**AR**	**OTD** **Calculated Reduction rate**	**outcome**
(Camachoa and Cujarb 2010)	Effect of LILT on duration of non-extraction orthodontic treatment	Prospective Parallel Cohort Study 60 subjects . experimental group (N=30) . control Group (N=30)	Photon Laser III . **830 nm**, . energy 80 J . 22 s buccally and 22 s palatally for each tooth . 24 h after the 1st control and thereafter at every appointment			476 days vs 565 days Red= - 18%	Laser therapy accelerate OTM
(Kansal et al. 2014)	Efficacy of LILT on the rate of canine movement during canine retraction phase	Comparative CT -10 subjects -1st premolar extraction cases -split-mouth	Laser application : . 1st day, 3rd, 7th, 14th, 21th, 28th, 35th, 42nd, 49th, 56th day - during the canine retraction phase . **904 nm**, for 10 s . 12 mW , . 4.2 J/cm2.	0.056mm/day vs 0.053mm/day Acc = 5.66%			No statistically significant difference in the rate of tooth movement during canine retraction between the LG and the CG

(Nimeri et al. 2014)	Changes in root morphology in a group of orthodontic patients who had received photobiomodulation for tooth movement acceleration	CT 20 subjects . 15F ; 5M . Class I	Ortho Pulse exposure : . **850 nm** (near infra-red) . intensity : < 100 mW/cm2 . continuous wave		1.03 mm/w for the maxilla, 0.92 mm/w for the mandible		The Orthopulse photobiomodulation device can be used clinically for acceleration of tooth movement
(Dalaie et al. 2015)	Effect of low level laser irradiation on the rate of canine OTM	RCT -12 subjects -	. GA-AL- AS diode laser, . **880 nm**, continuous wave . 100 mW, 5 j/cm2, . 8 points of application, 80 seconds, each .	**Maxilla** 5.79 mm for 67 days (2.59mm/month) vs 5.72mm for 67days (2.56/month) Acc = 1.22% **Mandibule** 5.58mm for 67 days (2.50mm/month) vs 5,15mm for 67 days (2,31mm/month) Acc = 8.34 %			No solid evidence to support the efficacy of laser for expediting tooth movement

(Shaughnessy et al. 2016)	Test if intraoral PBM increases the rate of tooth alignment and reduces the time required to resolve anterior dental crowding.	Comparative CT 19 subjects . test Group (N=11) . Control Group (N=8)	Orthopulse exposure . buccal side of the gums . **850-nm** continuous wave . daily energy : 9.5 J/cm2 .		Alignment rate 1,27mm/w vs 0.44mm/w Acc = 188.64% Time for alignment 48 days vs 104 days		PBM increased the average rate of tooth movement by 2.9-fold, resulting in a 54% average decrease in alignment duration versus control
(Limpanichkul et al. 2006)	Test the hypothesis that mechanical forces combined with low-level laser therapy stimulate the rate of orthodontic tooth movement	Double –Blind RCT 12 subjects . maxillary bicuspid extraction cases . split mouth	GaAlAs diode laser . **860 nm** continuous wave . Power output 100 mW . Power density 1.11 W/cm2 . energy dose 2.3 J/point . energy density 25 J/cm2	0.32mm, 0.73 mm, 1.29mm VS 0.38mm, 0.74mm, 1.24mm			no effect on the rate of orthodontic tooth movement for any time periods, between one and three months.
(Youssef et al. 2008)	Determine the differences in the velocity of movement of the canines retraction while applying LLLT assess a visual scale of pain level during the experiment	CT 15 subjects . 4 bicuspid extraction cases . mouth split	GaAlAs laser . **809-nm** . 100-mW output . on lingual and buccal PDL of canine	2.027mm/month vs 1.019 mm/month Acc = 98.92%			Low-laser is an effective tool to accelerate orthodontic tooth movement

(Doshi-Mehta et Bhad-Patil 2012)	To evaluate of the efficacy of low-intensity laser therapy in reducing orthodontic treatment duration and pain	Comparative CT	GaAlAs diode laser . **810 nm**, continuous mode . power output 0.25nW 1às exposure	At 3 months 1.46mm/month vs 0.65mm/month Acc = 125.62% At end of retraction 1.15mm/month vs 0.81mm/month Acc = 41.98%			Low-intensity laser therapy is a good option to reduce treatment duration and pain
(Kau et al. 2013)	To determine if photobiomodulation reduces the treatment time in the alignment phase of orthodontic treatment.	CT 90 subjects	GaAlAs diode laser . **850-nm** wavelength . surface of the cheek was . 60 mW/cm2 for 20 or 30 min/day or 60 min/week to . total energy densities of 72, 108, or 216 J/cm2, respectively		1.12mm/week vs 0.49mm/week Acc = 128,57%		Photobiomodulation produced clinically significant changes in the rates of tooth movement as compared to the control group during the alignment phase of orthodontic treatment.
(Dominguez, Gomez, et Palma 2015)	Evaluate tooth movement, RANKL, OPG, RANKL/OPG ratio in GCF in compression side and pain level during initial orthodontic tooth treatment to determine the efficacy of low-level laser therapy (LLLT)	Comparative CT . 10 subjects . 1st premolar extraction cases . split-mouth	Laser diode . **670 nm**, . 200 mW, and . 6.37 W/cm2, . on the distal, buccal, and lingual sides . 9 min on days 0, 1, 2, 3, 4, and 7	3.73mm/45 days (2.5mm/month) vs 2.71mm/45 days (1.80mm/month) Acc = 38.89%			LLLT delivered in repeated doses (six times in the initial 2 weeks) leads in some extent to a slight orthodontical improvement

(Cruz et al. 2004)	Effects of 780-nm diode laser irradiation on human canines' retraction during an orthodontic movement	Comparative CT 11 subjects . Maxillary first bicuspid extraction . split mouth	Diode laser : . **780 nm**, . 10 seconds . 20 mW, . 5 J/cm2, . 4 days of each month	4.39mm/60 days (2.195mm/month) vs 3.30mm/60 days (1,65mm/month) Acc = 33.03%			LILT does accelerate human teeth movement and could therefore considerably shorten the whole treatment duration
(Heravi, Moradi, et Ahrari 2014)	Effect of an 810 nm gallium-aluminum-arsenide (Ga-Al-As) laser on tooth movement velocity and pain perception during canine retraction	Comparative CT : Laser vs Conventional 20 patients . 1st premolar extraction case . Split-mouth	GaAlAs laser . **810 nm**, . 200 mW, . 21.4 J/cm2/point (10 points) . exposure: days 3, 7, 11 15 (first month) . adjustments at days 28 . exposure : days 3, 7, 11 15	1.10 mm/month vs 1.22mm /month Acc = -9.84%			LLLT neither accelerated orthodontic tooth movement , nor affected the degree of mesiodistal inclination of canines over retraction
(Sousa et al. 2011)	Effect of low-level laser irradiation on the speed of orthodontic tooth movement of canines	Comparative CT : Laser vs Conventional 13 patients . 1st premolar extraction case . Split-mouth	Diode Laser : . **780 nm**, . 20 mW, 10 sec, . 5 J/cm2 . for 3 days for 4 months	1.03mm/month vs 0.8mm/month Acc = 28.75%			The diode laser used within the protocol guidelines increased the speed of tooth movement. This might reduce orthodontic treatment time

OTMR = Orthodontic Tooth movement; AR = Alignment Rate; OTD = Orthodontic Treatment Duration; CT = Clinical Trial; LILT: Low Intensity Laser Therapy;

TABLE S4: Effects of Vibration of OTMR and AR

studies	**objectives**	**Study design** **Number of patients**	**technique**	**OTMR (canine)** **Calculated acceleration(%)**	**AR**	**Outcome**
(Pavlin et al. 2015)	Effect of low-level cyclic loading on the rate of OTM	RCT 45 subjecs .experimental group : 23 . Controle group : 21	Cyclic loading application 20mn/day	1.16mm/month vs 0.79mm/month Acceleration : 60%		The application of cyclic loading (vibration) of 0.25 N (25 g) at the frequency of 30 Hz significantly increases the rate of OTM
(Woodhouse et al. 2015)	Effect of supplemental vibrational force on rate of orthodontic tooth alignment	RCT 81 subjects . 1st premolar extraction cases . non functional device group : N=25 . device group : N=29 . fixe appliance only : N=27	Acceledent : .Vibration application 20mn/day		0.032mm/day vs 0.035mm/day vs 0.043mm/day	No evidence that supplemental vibrational force can significantly increase the rate of initial tooth movement or reduce the amount of time required to achieve final alignment
(Leethanakul et al. 2016)	Investigate the levels of IL-1b in GCF canine movement after the application of vibratory stimuli combined with orthodontic force	CT 15 subjects 1st premolar extrcation cases split-mouth	Electric tooth brush : Vibration application on the mesio-labial surface canine for a minimum of 5 minutes 3 times a day for 2 months.	0.95 mm/month vs 0.59mm/month Acc = 61.02%		Vibratory stimuli using an electric toothbrush enhanced the secretion of IL-1b in GCF and accelerated orthodontic tooth movement

(Miles et al. 2012)	Assess the rate of tooth movement and discomfort experienced by orthodontic patients using a vibrational appliance (Tooth Masseuse)	RCT 66 subjects	- use a vibrational appliance for a minimum of 20 minutes per day - 10 weeks with MB on .014 NiTi wire - LII measurement		65% reduction vs 69% reduction	No clinical advantage in using the vibrational appliance or the early resolution o crowding or the alleviation o pain during initial alignment

OTMR = Orthodontic Tooth movement; AR = Alignment Rate; OTD = Orthodontic Treatment Duration; CT = Clinical Trial

TABLE S5: Effect of PGE1 and relaxin on OTMR

studies	**Main Objective**	**Study design** **Number of patients**	**technique**	**- OTMR (canine)** **- Calculated acceleration (%)**	**outcome**
(Yamasaki et al. 1984)	Effects of locally administered PGE on maxillary canine OTM	Comparative CT 9 subjects . 1st bicuspid extraction cases . split mouth	. buccal submucosal injections . **10 pg PGE** on right side . lidocaine only on left side	2.14mm/month vs 1.3mm/month Acc = 64.	PGE1 can accelerate OTM without side-effect
(McGorray et al. 2012)	Compare Relaxin and a placebo with regard to tooth movement and stability in human subjects	RCT 40 subjects . Relaxin group : 20 . Placebo group : 20	Weekly injections of . Placebo or . **50 µg relaxin** . for 8 weeks	0.83mm/month vs 0.83mm/month Acc = 0%	No difference in tooth movement over the 8 weeks of study

OTMR = Orthodontic Tooth movement; CT = Clinical Trial; RCT = randomized controlled trial; PGE = Prostaglandin E; Acc = acceleration