

Supplementary file S2: Characteristics of included studies of the second systematic review

Agarwal 2017 [31]

Characteristics of included studies		
Methods	<p>Study design: RCT, Parallel groups</p> <p>Location: India</p> <p>Setting: Department of Paedodontics and Preventive Dentistry, Institute of Dental Studies and Technologies</p>	
Participants	<p>Children requiring local anaesthesia for the dental treatment</p> <p>Sample size: 120</p> <p>Age: 3-14 years old</p> <p>Mean age: 8.8 years old</p>	
Interventions	<p>Group A: EMLA (lidocaine 2.5% and prilocaine 2.5%) cream group without Audio Visual (AV) aids (n=30)</p> <p>Group B: EMLA cream group with AV aids (n=30)</p> <p>Group C: Benzocaine (20%) gel without AV aids (n=30)</p> <p>Group D: Benzocaine gel with AV aids (n=30)</p> <p>Sony Vaio laptop with earphones used as AV aids and DVD used were nursery rhymes and cartoon movies</p>	
Outcomes	Pain during LA: 0-10 Visual Analogue Scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Participants were randomly allocated
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators/participants to the intervention

Blinding of outcome assessors for all outcomes	Unclear risk	It is unclear whether assessor was blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Santos 2020 [39]

Characteristics of included studies		
Methods	<p>Study design: RCT, Parallel groups</p> <p>Location: Brazil</p> <p>Setting: The Pediatric Postgraduate Clinic of Federal University of Santa Catarina</p>	
Participants	<p>Children requiring extraction of primary molars</p> <p>Sample size: 48</p> <p>Age: 5-10 years old</p> <p>Mean age: 7.17 years old</p>	
Interventions	<p>Group A (Control): received placebo solution 1 hour before LA (n=16)</p> <p>Group B: received paracetamol 200 mg/mL 1 hour before LA (n=16)</p> <p>Group C: received ibuprofen 100 mg/mL 1 hour before LA (n=16)</p> <p>All analgesics were taken orally</p>	
Outcomes	<p>Pain after extraction at 2, 6, 24 hours: 0-100 Visual Analogue Scale</p>	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	A randomised block design with permuted blocks of 4 and 6 patients each was used
Allocation concealment	Low risk	"Allocation was concealed with a pre-specified computer-generated randomization list, placed in numbered opaque sealed envelopes by a person not involved on the research"
Blinding of participants and personnel for	Low risk	Participants and operator were blind

all outcomes		
Blinding of outcome assessors for all outcomes	Low risk	Assessor was blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The trial authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Ramirez-Carrasco 2017 [32]

Characteristics of included studies		
Methods	Study design: RCT, Parallel groups Location: Mexico Setting: The Pediatric Dentistry Clinic at the Autonomous University of San Luis Potos	
Participants	Children requiring local anaesthesia for the dental treatment for the first time Sample size: 40 Age: 5-9 years old Mean age: 7.5 years old	
Interventions	Group A (Control): children were told to use headphones to block out the dental drill's noise. No sound was transmitted (n=20). Group B (Case): children were listed to a classic directive hypnosis intervention (n=20).	
Outcomes	Pain during LA: 0-10 Face, Legs, Activity, Cry, Consolability scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Participants were randomly assigned
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators/participants to the intervention

Blinding of outcome assessors for all outcomes	Low risk	Assessors were blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Versloot 2008 [24]

Characteristics of included studies		
Methods	<p>Study design: RCT, Parallel groups</p> <p>Location: Netherlands</p> <p>Setting: Secondary dental care practice specialised in treating children</p>	
Participants	<p>Children requiring local anaesthesia for two subsequent treatment sessions</p> <p>Sample size: 147</p> <p>Age: 4-11 years old</p> <p>Mean age: 6.4 years old</p>	
Interventions	<p>Group A (Control): received traditional syringe injection via infiltration for maxillary teeth and IANB for mandibular teeth (N=76)</p> <p>Group B (Case): received Wand injection via infiltration for maxillary teeth and periodontal ligament for mandibular teeth (N=71)</p>	
Outcomes	<p>Pain during LA: 0-10 Modified version of the visual analogue scale</p> <p>Anxiety during dental treatment: 1-5 the Dental Subscale of the Children's Fear Survey Schedule CFSS-DS</p>	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	Randomisation list generated by SPSS (SPSS Inc, 12.0, Chicago, USA)
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for	High risk	It was not possible to blind the operators/participants to the intervention

all outcomes		
Blinding of outcome assessors for all outcomes	High risk	All treatments were videotaped and analysed by two independent observers
Incomplete outcome data for all outcomes	Unclear risk	“For 20 children only their first treatment session could be included due to rescheduling of the second appointment”
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Obadiah 2020 [38]

Characteristics of included studies		
Methods	Study design: RCT, Parallel groups Location: India Setting: Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical sciences, Saveetha University	
Participants	Children requiring local anaesthesia for extraction or pulpotomy Sample size: 60 Age: 4-13 years old Mean age: 8.43 years old	
Interventions	Group A (Case): Children were provided with the Bubble toy and deep breathing exercise was taught to the children (n=30) Group B (Control): children were not taught about this breathing exercise and were not provided with any soap solutions (n=30)	
Outcomes	Pain during LA: 0-10 Wong-Baker FACES scale Anxiety at dental examination and during LA: 1-5 the Facial Index Scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Participants were randomly allocated
Allocation concealment	Unclear risk	Method of allocation concealment was not reported
Blinding of participants and personnel for	High risk	It was not possible to blind the operators/participants to the intervention

all outcomes		
Blinding of outcome assessors for all outcomes	Unclear risk	It is unclear whether assessors were blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Baghdadi 1999 [45]

Characteristics of included studies		
Methods	<p>Study design: RCT, Crossover</p> <p>Location: Syria</p> <p>Setting: Department of Pediatric Dentistry, Damascus University</p>	
Participants	<p>Children requiring local anaesthesia for restoring of two primary/permanent antimere molars with lesions of similar size</p> <p>Sample size: 28</p> <p>Age: 6-12 years old</p> <p>Mean age: 10.21 years old</p>	
Interventions	<p>Group A (Control): received conventional LA (2% lidocaine with 1:80,000 epinephrine and restoration</p> <p>Group B (Experimental): received Electronic dental anaesthesia (EDA) and restoration</p> <p>EDA is a device that provides anaesthesia but with no needles and injections and it works on the gate control theory of pain</p>	
Outcomes	<p>Pain during stages of restoration: 0-3 the Sound, Eye, and Motor (SEM) scale and 0-3 Color Scale</p>	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Participants were randomly divided
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for	High risk	It was not possible to blind the operators/participants to the intervention

all outcomes		
Blinding of outcome assessors for all outcomes	Unclear risk	It is unclear whether assessor was blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Smolarek 2020 [66]

Characteristics of included studies		
Methods	<p>Study design: RCT, Parallel groups</p> <p>Location: Brazil</p> <p>Setting: The dental practice office at an elementary school called Integral Care Centre for Child and Adolescent and paediatric dental clinics from the Department of Dentistry at Ponta Grossa State University (UEPG), Ponta Grossa, Parana</p>	
Participants	<p>Children requiring local anaesthesia for restoring of the upper posterior teeth</p> <p>Sample size: 105</p> <p>Age: 5-8 years old Mean age: 6.56 years old</p>	
Interventions	<p>Group A: received conventional anaesthesia (CA) (n=35)</p> <p>Group B: received vibrational anaesthesia (VBA) using DentalVibe (n=35)</p> <p>Group C: received computer-controlled local anaesthesia delivery (CCLAD) (n=35)</p>	
Outcomes	<p>Pain during LA: 0-10 Wong-Baker FACES, 0-10 Visual Analogue Scales for pain</p> <p>Anxiety before treatment, at dental office and immediately after LA: 0-8 The Venham Picture Test modified (VPTm) Scale</p>	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	Computer-generated tables with blocked randomisation were used
Allocation concealment	Low risk	"accomplished by distributing the obtained codes in numbered black opaque envelopes"

Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators/participants to the intervention
Blinding of outcome assessors for all outcomes	Unclear risk	It is unclear whether assessors were blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Massignan 2020 [37]

Characteristics of included studies		
Methods	Study design: RCT, Parallel groups Location: Brazil Setting: Pediatric Postgraduate Clinic of Federal University of Santa Catarina	
Participants	Children requiring local anaesthesia for extraction of primary molars Sample size: 43 Age: 6-10 years old Mean age: 7.42 years old	
Interventions	Group A (Control): received lidocaine 2% by infiltration (n=22) Group B (Intervention): received articaine 4% by infiltration (n=21)	
Outcomes	Pain after extraction at 2 and 6 hours: 0-10 the Faces Pain Scale-Revised (FPS-R)	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	"The randomisation sequence was generated using WebSite Randomization.com (http://www.randomization.com)"
Allocation concealment	Low risk	sequentially numbered, opaque, sealed envelopes were considered

Blinding of participants and personnel for all outcomes	Low risk	Participant and the clinician were blind
Blinding of outcome assessors for all outcomes	Low risk	Assessor was blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Smail-Faugeron 2019 [64]

Characteristics of included studies		
Methods	Study design: RCT, Parallel groups and Split mouth Location: France Setting: Paediatric dentistry departments of three French universities (Nice, Paris and Rennes)	
Participants	Children requiring local anaesthesia for restoring of 1st permanent molars Sample size: 158 Age: 7-15 years old Mean age: 9 years old for split mouth and 10.4 years old for parallel groups	
Interventions	Split mouth RCT: one permanent first molar was randomly allocated to the intraosseous anaesthesia (IOA) and the other permanent first molar belonging to the same dental arch in the same child was allocated to the conventional infiltration anaesthesia (CIA) (n=30). Parallel-arm RCT: one patient with one permanent molar first was randomly allocated to one of the techniques (IOA or CIA) (n=128).	
Outcomes	Pain during LA and restoration: 0-10 Visual Analogue Scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	A computer-generated, permuted-block randomisation sequence, with two block sizes randomly varied were used

Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	High risk	Participants were blind but it was not possible to blind clinicians to the intervention.
Blinding of outcome assessors for all outcomes	Low risk	Assessors were blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Alanazi 2019 [58]

Characteristics of included studies		
Methods	<p>Study design: RCT, Crossover</p> <p>Location: Saudi Arabia</p> <p>Setting: Department of Paediatric Dentistry, Riyadh Elm University</p>	
Participants	<p>Children requiring bilateral maxillary buccal infiltration analgesia for the dental treatment in the posterior teeth</p> <p>Sample size: 60</p> <p>Age: 6-7 years old</p> <p>Mean age: 6.57 years old</p>	
Interventions	<p>Group A (Control): received traditional LA via maxillary buccal infiltration</p> <p>Group B (Test): received traditional LA via maxillary buccal infiltration and the cold and vibration device (Buzzing device as distraction)</p>	
Outcomes	Pain during LA: 0-10 Wong-Baker FACES scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Participants were randomly divided
Allocation concealment	Unclear risk	Allocation concealment method was not reported

Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators/participants to the intervention
Blinding of outcome assessors for all outcomes	High risk	Assessor was not blind to the treatment
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Versloot 2005 [23]

Characteristics of included studies		
Methods	Study design: RCT, Parallel groups Location: Netherlands Setting: A specialist clinic	
Participants	Children requiring local anaesthesia for the dental treatment Sample size: 125 Age: 4-11 years old Mean age: 6.2 years old	
Interventions	Group A: received traditional LA via infiltration for maxillary teeth and IANB for mandibular teeth (n=58) Group B: received Wand LA via infiltration for maxillary teeth and periodontal ligament for mandibular teeth (n=67)	
Outcomes	Pain during LA: 0-10 Modified version of the visual analogue scale Anxiety during dental treatment: 1-5 the Dental Subscale of the Children's Fear Survey Schedule CFSS-DS	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	A randomisation list generated by SPSS (SPSS, 11.0; Chicago, IL, USA) was used
Allocation concealment	Unclear risk	Allocation concealment method was not reported

Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators/participants to the intervention
Blinding of outcome assessors for all outcomes	High risk	“All treatments were videotaped and analysed by two independent observers”
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Arcari 2018 [34]

Characteristics of included studies		
Methods	Study design: RCT, Parallel groups Location: Italy Setting: Two private practice dental offices	
Participants	Children requiring local anaesthesia for restoring of primary molars (class I/ II) Sample size: 90 Age: 3-10 years old Mean age: 6.2 years old	
Interventions	Group A (Control): received nitrous oxide-oxygen (40% N ₂ O and 60% O ₂) relative analgesia and LA (n=42) Group B (Study): received nitrous oxide-oxygen (40% N ₂ O and 60% O ₂) relative analgesia (n=48)	
Outcomes	Pain during restoration: 0-10 Wong-Baker FACES scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Participants were randomly assigned
Allocation concealment	Unclear risk	Method of allocation concealment not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators/participants to the intervention

Blinding of outcome assessors for all outcomes	High risk	Assessors were not blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Baghlaf 2015 [28]

Characteristics of included studies		
Methods	<p>Study design: RCT, Parallel groups</p> <p>Location: Saudi Arabia</p> <p>Setting: The pediatric dentistry specialty clinics, King Abdulaziz University</p>	
Participants	<p>Children requiring local anaesthesia for pulpotomy of primary mandibular 2nd molars</p> <p>Sample size: 91</p> <p>Age: 5-9 years old</p> <p>Mean age: Not reported</p>	
Interventions	<p>Group A: received traditional IANB (Inferior alveolar nerve block) (n=31)</p> <p>Group B: received IANB with a CCLAD (Inferior alveolar nerve block with computer-controlled local anaesthetic delivery (CCLAD IANB)) (n=30)</p> <p>Group C: received ILA with a CCLAD STA system (Intraligamental anaesthesia with computer-controlled local anesthetic delivery (CCLAD interligamental)) (n=30)</p>	
Outcomes	Pain during LA: 0-10 Wong-Baker FACES scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Participants were randomly assigned using a block randomisation technique
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators to the intervention

Blinding of outcome assessors for all outcomes	High risk	Assessors were not blind
Incomplete outcome data for all outcomes	Low risk	The authors reported on incomplete data “nine participants were excluded due to failure of the anaesthesia technique, or uncontrolled bleeding of the pulp, extraction or they refused to apply the rubber dam”
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Sridhar 2019 [36]

Characteristics of included studies		
Methods	Study design: RCT, Parallel groups Location: India Setting: The Department of Paedodontics and Preventive Dentistry	
Participants	Children requiring maxillary buccal infiltration anaesthesia for dental treatment Sample size: 66 Age: 7-11 years old Mean age: 8.75 years old	
Interventions	Group A (control): not used the bubble breath exercise (n=33) Group B: used the bubble breath exercise (n=33)	
Outcomes	Pain during LA: 0-10 Wong-Baker FACES scale Anxiety at the 1st appointment before dental examination and the 2nd appointment before local anaesthesia: 1-5 the Facial Image Scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	“Block randomization method with a block size of four was used”
Allocation concealment	Low risk	“The treatment group codes so generated (A or B) were entered into cards and placed in envelopes that were sequentially numbered. The envelopes were rendered opaque by covering the

		cards with aluminium foil and then sealed”
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators/participants to the intervention
Blinding of outcome assessors for all outcomes	High risk	Assessors were not blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Attar 2015 [52]

Characteristics of included studies		
Methods	Study design: RCT, Split mouth Location: Saudi Arabia Setting: The paediatric clinic in the Department of Preventive Dentistry Riyadh Colleges of Dentistry and Pharmacy	
Participants	Children requiring local anaesthesia for pulpotomy of two primary antimere molars Sample size: 39 Age: 4-8 years old Mean age: 6.27 years old	
Interventions	Group A (Control): received treatment with the aid of audio-visual (AV) glasses Group B (Exposure): received treatment with the aid of an iPad video game	
Outcomes	Pain at 5 mins before LA, during LA and stages of pulpotomy and 5 mins post-operatively: 0-3 Wong-Baker FACES scale Anxiety before dental treatment: 1-5 The Modified Dental Anxiety Scale (MDAS)	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Participants were randomly allocated

Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators/participants to the intervention
Blinding of outcome assessors for all outcomes	Unclear risk	It is unclear whether assessor was blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Atabek 2015 [50]

Characteristics of included studies		
Methods	<p>Study design: RCT, Crossover</p> <p>Location: Turkey</p> <p>Setting: The Department of Pedodontics, Faculty of Dentistry, Gazi University</p>	
Participants	<p>Children requiring bilateral maxillary infiltration anaesthesia for restoring maxillary primary molars</p> <p>Sample size: 50</p> <p>Age: 8-12 years old</p> <p>Mean age: 9 years old</p>	
Interventions	<p>Group A (Control): received topical anaesthetic solution of 10 % lidocaine pump spray</p> <p>Group B (Case): received three-in-one injection comfort system (ICS) which provides tissue retraction, illumination of the area, and pain blockage</p>	
Outcomes	Pain during LA: 0-10 Wong-Baker FACES scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Randomisation method was not reported
Allocation concealment	Unclear risk	Allocation concealment method was not reported

Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators/participants to the intervention
Blinding of outcome assessors for all outcomes	Low risk	Assessor was blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Dak-Albab 2016 [54]

Characteristics of included studies		
Methods	Study design: RCT, Crossover Location: Syria Setting: Pediatric Dentistry department in the Dental College, Damascus University	
Participants	Children requiring two mandibular nerve block analgesia for symmetric dental treatment Sample size: 30 Age: 8-12 years old Mean age: Not reported	
Interventions	Technique A: received benzocaine 20% topical gel and LA Technique B: received vibration using DentalVibe and LA	
Outcomes	Pain during LA: 0-10 Face, Legs, Activity, Cry, Consolability scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Participants were randomly allocated
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators/participants to the intervention

Blinding of outcome assessors for all outcomes	Low risk	Assessor was blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Ram 2006 [48]

Characteristics of included studies		
Methods	Study design: RCT, Crossover Location: Israel Setting: Two established paediatric dental clinics in Jerusalem and Tel Aviv	
Participants	Children requiring two local analgesia for similar operative procedures in the same arch Sample size: 62 Age: 5-13 years old Mean age: 8.4 years old	
Interventions	Group A: received lidocaine HCl 2% with 1: 100 000 epinephrine Group B: received articaine HCl 4% with 1: 200 000 epinephrine	
Outcomes	Pain during LA: 0-10 Wong-Baker FACES scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Participants were randomly allocated
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	Unclear risk	It is unclear whether participants and clinicians were blind
Blinding of outcome assessors for all outcomes	Low risk	Assessor was blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes

Other sources of bias	Unclear risk	The authors did not report which LA agent was given by infiltration or mandibular block injections
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Garrocho-Rangel 2018 [56]

Characteristics of included studies		
Methods	Study design: RCT, Crossover	
	Location: Mexico	
	Setting: The paediatric dentistry clinic, San Luis Potosi University	
Participants	Children requiring two local analgesia for restoring two upper or lower primary molars	
	Sample size: 36	
	Age: 5-8 years old	
	Mean age: 6.2 years old	
Interventions	Group A (Control): received treatment without using the Video Eyeglasses/Earphones System (VEES)	
	Group B (Experimental): received treatment with using the VEES	
Outcomes	Pain during LA and restoration: 0-10 Face, Legs, Activity, Cry, Consolability scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	A randomisation block scheme was used
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators/participants to the intervention
Blinding of outcome assessors for all outcomes	High risk	Assessor was not blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Yildirim 2020 [60]

Characteristics of included studies		
Methods	Study design: RCT, Crossover	
	Location: Turkey	
	Setting: Faculty of Dentistry, Istanbul Okan University	
Participants	Children requiring two mandibular nerve block analgesia for dental treatment their bilateral mandibular primary or permanent molars	
	Sample size: 60	
	Age: 6-12 years old	
	Mean age: 8.37 years old	
Interventions	Group A (Control): received topical anaesthesia (TA) spray containing 10% lidocaine with a cotton pellet for 60s	
	Group B (Case): received Comfort-in™ injection system (CIS) which uses the “liquid jet” system to inject the anaesthetic solution rapidly (one-third of a second) from a 0.15-mm hole with high pressure	
Outcomes	Pain during LA: 0-5 Wong-Baker FACES scale and 0-10 Face, Legs, Activity, Cry, Consolability scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	A computer-assisted program was used
Allocation concealment	Low risk	“The operator was asked to select the side to do the first treatment before the researcher revealed the pre-anaesthesia method to be applied, to avoid possible operator bias”
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators/participants to the intervention
Blinding of outcome assessors for all outcomes	Unclear risk	It is unclear whether assessor was blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Alinejhad 2018 [55]

Characteristics of included studies		
Methods	Study design: RCT, Crossover	
	Location: Iran	
	Setting: The Department of Pediatrics of the Faculty of Dentistry at Shahid Sadoughi University of Medical Sciences	
Participants	Children requiring local anaesthesia for pulpotomy of primary mandibular 2 nd molars	
	Sample size: 40	
	Age: 6-10 years old	
	Mean age: Not reported	
Interventions	Group A: received 2% lidocaine with epinephrine 1:100,000 by IANB	
	Group B: received 4% articaine with epinephrine 1:100,000 by buccal infiltration	
Outcomes	Pain during LA: 0-4 Visual Analogue Scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Participants were randomly allocated
Allocation concealment	Unclear risk	Allocation concealment method not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators to the intervention
Blinding of outcome assessors for all outcomes	High risk	Assessors were not blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Gumus 2020 [59]

Characteristics of included studies	
Methods	Study design: RCT, Split mouth
	Location: Turkey

	Setting: The Pediatric Dentistry Clinic of the Erciyes University, Faculty of Dentistry	
Participants	Children requiring two local analgesia for dental treatment of bilateral maxillary primary molars Sample size: 100 Age: 5-8 years old Mean age: 6.5 years old for girls and 6.42 years old for boys	
Interventions	Group A: received a cartridge containing 2 mL of LA solution was placed in the CALSET composite heater and warmed to body temperature (37 °C) Group B: received a cartridge containing a LA solution was immersed in a 21 °C water bath, half an hour prior to the procedure	
Outcomes	Pain during LA: 0-10 Wong-Baker FACES scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	"MS Excel 2013 (Microsoft Corporation, Redmond, WA, USA) software was used to randomly determine which side(right/left) of the maxilla was to be infiltrated with the anaesthetic solution and at which temperature (21 °C or 37 °C) in the first session"
Allocation concealment	Unclear risk	Allocation concealment method not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators to the intervention
Blinding of outcome assessors for all outcomes	Unclear risk	It is unclear whether assessors were blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Tung 2018 [35]

Characteristics of included studies	
Methods	Study design: RCT, Parallel groups

	Location: USA	
	Setting: Herman Ostrow school of dentistry, university of Southern California	
Participants	Children requiring a maxillary infiltration injection or mandibular inferior alveolar block and long buccal anaesthesia for operative dental treatment	
	Sample size: 150	
	Age: 7-14 years old	
	Mean age: 11.1 years old for groups A and C and 10.7 years old for group B	
Interventions	Group A: received an injection without stimulation (n=50)	
	Group B: received an injection with manual stimulation (n=50)	
	Group C: received an injection with Dental Vibe (n=50)	
Outcomes	Pain during LA: 0-10 Wong-Baker FACES scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	"Using a table of randomly generated numbers, the subjects were assigned to one of three groups"
Allocation concealment	Low risk	Participants were randomised prior to attendance
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators/participants to the intervention
Blinding of outcome assessors for all outcomes	High risk	Assessors were not blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Shilpapiya 2015 [53]

Characteristics of included studies	
Methods	Study design: RCT, Crossover

	Location: India	
	Setting: The Department of Pedodontics and Preventive Dentistry of Ragas Dental College and Hospital	
Participants	Children requiring bilateral local anaesthesia for dental treatment	
	Sample size: 30	
	Age: 6-12 years old	
	Mean age: 7.5 years old	
Interventions	Group A: received an injection without DentalVibe	
	Group B: received an injection with DentalVibe	
Outcomes	Pain during LA: 0-10 Universal Pain Assessment Tool	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Method of randomisation was not reported
Allocation concealment	Unclear risk	Method of allocation concealment not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators/participants to the intervention
Blinding of outcome assessors for all outcomes	Unclear risk	It is unclear whether assessors were blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Unclear risk	No population characteristics other than age

Alamoudi 2015 [27]

Characteristics of included studies	
Methods	Study design: RCT, Parallel groups
	Location: Saudi Arabia
	Setting: Faculty of Dentistry, King Abdulaziz University
Participants	Children requiring local anaesthesia for pulpotomy of primary mandibular 2 nd molars

	<p>Sample size: 91</p> <p>Age: 5-9 years old</p> <p>Mean age: Not reported</p>
Interventions	<p>Group A: received traditional IANB (Inferior alveolar nerve block) (n=31)</p> <p>Group B: received IANB with a CCLAD (Inferior alveolar nerve block with computer-controlled local anaesthetic delivery (CCLAD IANB) (n=30)</p> <p>Group C: received ILA with a CCLAD STA system (Intraligamental anaesthesia with computer-controlled local anaesthetic delivery) (n=30)</p>
Outcomes	Pain during stages of pulpotomy: 1-4 the Sounds, Eyes, and Motor (SEM) scale

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	"Block randomisation technique was applied to assign participants to one of the three study groups"
Allocation concealment	Unclear risk	The authors referred to allocation concealment but did not explain the method
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators/participants to the intervention
Blinding of outcome assessors for all outcomes	Low risk	Assessors was blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Unclear risk	No baseline characteristics reported

Mumtaz 2021 [20]

Characteristics of included studies

Methods	<p>Study design: RCT, Parallel groups</p> <p>Location: India</p> <p>Setting: The Department of Pedodontics and Preventive Dentistry</p>
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Participants	Children requiring local anaesthesia for extraction of mandibular primary molars Sample size: 70 Age: 8-10 years old Mean age: Not reported
Interventions	Group A: received 1.5ml of 2 % lignocaine with 1:100000 epinephrine via inferior alveolar nerve block (n=35) Group B: received 1.5 ml of 4 % articaine with 1:10000 epinephrine via buccal and lingual infiltration (n=35)
Outcomes	Pain during extraction: 0-10 Visual Analogue Scale

Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Participants were randomly allocated
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators/participants to the intervention
Blinding of outcome assessors for all outcomes	Unclear risk	It is unclear whether assessors were blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Unclear risk	No baseline characteristics reported

Abdelmoniem 2016 [30]

Characteristics of included studies	
Methods	Study design: RCT, Parallel groups Location: Egypt Setting: Pediatric Dentistry and Dental Public Health Department, Faculty of Oral and Dental Medicine, Cairo University
Participants	Children requiring inferior alveolar nerve block for extraction of mandibular primary molar Sample size: 90

	Age: 4-9 years old Mean age: 7.18 years old for group A and 7.02 years old for group B and 7.65 years old for group C	
Interventions	Group A: received passive distraction by listening to the same song on headphones (n=30) Group B: received active distraction by moving legs up and down alternatively as a game (n=30) Group C: received passive-active distraction group (n=30)	
Outcomes	Pain during LA: 0-10 Wong-Baker FACES scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Participants were randomly allocated
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operators/participants to the intervention
Blinding of outcome assessors for all outcomes	Unclear risk	It was not reported
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Huet 2011 [25]

Characteristics of included studies	
Methods	Study design: RCT, Parallel groups Location: France Setting: Department of Pediatric Dentistry at Rennes University Hospital
Participants	Children requiring local anaesthesia for dental treatment

	Sample size: 29 Age: 7-12 years old Mean age: Not reported
Interventions	Group A: received LA with hypnosis (n=14) Group B: received LA without hypnosis (n=15)
Outcomes	Pain during LA: 0-10 Modified Objective Pain Score (mOPS) Scale Anxiety at during the initial interview, on arrival in the waiting room, in the dentist's chair and at the time of the dental anaesthesia: 0-100 The Modified Yale Preoperative Anxiety Scale (mYPAS)
Risk of bias	
Bias	Authors' judgement Support for judgement
Random sequence generation	Low risk Participants were randomly allocated by lottery
Allocation concealment	Unclear risk Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	High risk It was not possible to blind operator/participants to the intervention
Blinding of outcome assessors for all outcomes	High risk Assessor was not blind
Incomplete outcome data for all outcomes	Low risk The authors reported on incomplete data "One child excluded because of unusable data" from the intervention group
Selective outcome reporting	Low risk The authors reported all expected outcomes
Other sources of bias	Low risk No other bias

Bernhardt 2001 [22]

Characteristics of included studies	
Methods	Study design: RCT, Parallel groups Location: USA Setting: Department of Orthodontics, College of Dentistry
Participants	Children requiring separator placement for orthodontic treatment Sample size: 41

	Age: 9-16 years old Mean age: 12.1 years old for group A and 13.5 years old for group B and 12.8 years old for group C	
Interventions	Group A: received 400 mg ibuprofen 1 hour preoperatively and 400 mg ibuprofen 6 hours after the initial dose (n=13) Group B: received 400 mg ibuprofen 1 hour preoperatively and placebo 6 hours after the initial dose (n=14) Group C: received placebo 1 hour preoperatively and 400 mg ibuprofen 6 hours after the initial dose (n=14) All analgesics were taken orally	
Outcomes	Pain after separator placement: 0-100 Visual Analogue scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Participants were randomly allocated
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	Low risk	Operator and participants were blind to the intervention
Blinding of outcome assessors for all outcomes	Low risk	Assessors were blind
Incomplete outcome data for all outcomes	Low risk	The authors reported on incomplete data "22 of whom took additional medication and were excluded from the study. These 22 patients were evenly distributed among the 3 groups"
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Law 2000 [21]

Characteristics of included studies	
Methods	Study design: RCT, Parallel groups Location: USA Setting: Department of Orthodontics, College of Dentistry

Participants	Children requiring separator placement for orthodontic treatment Sample size: 63 Age: a maximum age of 16 years old Mean age: 13 years old
Interventions	Group A: received 400 mg ibuprofen 1 hour preoperatively and placebo immediately after the appointment (n=22) Group B: received placebo 1 hour preoperatively and 400 mg ibuprofen immediately after the appointment (n=19) Group C: received placebo 1 hour preoperatively and placebo immediately after the appointment (n=22) All analgesics were taken orally
Outcomes	Pain after separator placement: 0-100 Visual Analogue scale

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Participants were randomly allocated
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	Low risk	Operator and participants were blind to the intervention
Blinding of outcome assessors for all outcomes	Low risk	Assessors were blind
Incomplete outcome data for all outcomes	Low risk	The authors reported on incomplete data "28 subjects did not receive separators at their next appointment and 17 subjects forgot to take the pretreatment dose before their appointment"
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Alshami 2021 [41]

Characteristics of included studies

Methods	Study design: RCT, Parallel groups Location: Saudi Arabia Setting: Princess Nourah bint Abdulrahman University's dental clinic
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Participants	Children requiring local anaesthesia for extraction of symptomatic primary molars Sample size: 56 Age: 5-13 years old Mean age: 9.4 years old
Interventions	Group A: received 7.5–15 ml/kg ibuprofen preoperatively (n=28) Group B: received placebo preoperatively (n=28) All analgesics were taken orally
Outcomes	Pain at baseline and after extraction at 3 and 24 hours: 0-10 Wong-Baker FACES scale Anxiety at baseline and after extraction at 3 and 24 hours: 1-5 the Modified Child Dental Anxiety scale

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Participants were randomly allocated
Allocation concealment	Low risk	"Once participants underwent consent, they were assigned an ID number which placed them in a randomised group"
Blinding of participants and personnel for all outcomes	Low risk	Operator and participants were blind to the intervention
Blinding of outcome assessors for all outcomes	High risk	Assessor was not blind
Incomplete outcome data for all outcomes	Low risk	The authors reported on incomplete data "One participant was removed from the analysis because they had three extractions, while the other participants had only one or two"
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Helmy 2022 [44]

Characteristics of included studies

Methods	Study design: RCT, Parallel groups Location: Egypt
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	Setting: The Pediatric Dentistry and Dental Public Health Department, Faculty of Dentistry, Alexandria University	
Participants	Children requiring local anaesthesia for extraction of mandibular primary molars Sample size: 50 Age: 5-7 years old Mean age: 6.10 years old	
Interventions	Group A: received Computer-controlled Intraligamentary anaesthesia (CC-ILA) (n=25) Group B: received Inferior alveolar nerve block (IANB) (n=25)	
Outcomes	Pain during LA and extraction: 1-4 the Sounds, Eyes, and Motor (SEM) scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	A computer-generated list of random numbers was used
Allocation concealment	Low risk	"Each child was given a serial number written in identical sheets of paper with the group to which each child is allocated and placed inside opaque envelopes carrying their respective names"
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operator to the intervention
Blinding of outcome assessors for all outcomes	Low risk	Assessor was blind
Incomplete outcome data for all outcomes	Low risk	The authors reported on incomplete data "One participant was removed from the analysis because they had three extractions, while the other participants had only one or two"
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Vidigal 2021 [43]

Characteristics of included studies	
Methods	Study design: RCT, Parallel groups

	<p>Location: Brazil</p> <p>Setting: The Dental School, University of Sao Paulo</p>
Participants	<p>Children requiring local anaesthesia for extraction or pulpotomy of mandibular primary molars</p> <p>Sample size: 52</p> <p>Age: 3-5 years old</p> <p>Mean age: Not reported</p>
Interventions	<p>Group A: received Tell-Show-Do Technique (TSD-T) (n=26)</p> <p>Group B: received Hiding Dental-Needle Technique (HDN-T) (n=26)</p> <p>LA was given by IANB with 1.8 ml of Lidocaine 2% with 1:100.000 epinephrine.</p>
Outcomes	<p>Pain during LA: 1-5 Wong-Baker FACES scale</p> <p>Anxiety before and during LA: 1-5 the Facial Image scale</p>

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	A statistical program MedCalc Software, version 12.4.0.0 was used
Allocation concealment	Low risk	"The sequence of numbers generated was distributed in opaque envelopes by an external researcher. The envelopes were opened only by the operator at the time of the block mandibular anesthesia."
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operator/participants to the intervention
Blinding of outcome assessors for all outcomes	Low risk	Assessors were blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Characteristics of included studies	
Methods	<p>Study design: RCT, Crossover</p> <p>Location: Iran</p> <p>Setting: Department of Pediatric Dentistry, Shiraz University of Medical Sciences</p>
Participants	<p>Children requiring bilateral buccal infiltration of local anaesthesia for extraction of maxillary primary canine on both sides</p> <p>Sample size: 50</p> <p>Age: 8-10 years old</p> <p>Mean age: 8.94 years old</p>
Interventions	<p>Group A: received a topical anaesthetic agent (Benzocaine) on one side for 1 min and plus ice</p> <p>Group B: received a topical anaesthetic agent (Benzocaine) on the other side for 1 min</p>
Outcomes	Pain during LA: 0-100 Visual Analogue Scale and 0-3 the Sounds, Eyes, and Motor (SEM) scale

Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	"Random number table have been used for block randomization. The number was chosen by tracing a line starting from random number till reaching to a block which was chosen as designated number."
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operator/participants to the intervention
Blinding of outcome assessors for all outcomes	Low risk	Assessor was blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Unclear risk	No baseline characteristics reported

Characteristics of included studies		
Methods	Study design: RCT, Split mouth Location: India Setting: Department of Paediatric and Preventive Dentistry, Sri Aurobindo College of Dentistry	
Participants	Children requiring bilateral buccal infiltration of local anaesthesia for dental treatment of posterior maxillary teeth Sample size: 30 Age: 5-10 years old Mean age: Not reported	
Interventions	Group A: received infiltration of 1.8 mL of 2% lignocaine in addition to 1:100,000 adrenaline and external cold and a vibrating device (Buzzing device as distraction) Group B: received infiltration of 1.8 mL of 2% lignocaine in addition to 1:100,000 adrenaline	
Outcomes	Pain during LA: 1-5 RMS Pictorial Scale and 0-10 the revised Face, Legs, Activity, Cry, Consolability scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	The usage of flip coin method was considered
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operator/participants to the intervention
Blinding of outcome assessors for all outcomes	Unclear risk	It is unclear whether assessor was blind
Incomplete outcome data for all outcomes	Low risk	The authors reported on incomplete data "This study was successfully completed by thirty children with a total of four dropouts"
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Characteristics of included studies		
Methods	Study design: RCT, Crossover	
	Location: India	
	Setting: The Outpatient Department of Paediatric Dentistry	
Participants	Children requiring local anaesthesia for extraction of maxillary primary molars	
	Sample size: 30	
	Age: 9-12 years old	
	Mean age: Not reported	
Interventions	Group A: received LA gel application	
	Group B: received Ice application	
	Group C: received Laser biostimulation with 0.3 W power at a wavelength of 810 nm and probe tip kept 2 mm away from the surface in pulsed mode for 1 minute	
Outcomes	Pain during LA: 0-10 Wong-Baker FACES scale and 1-4 the Sounds, Eyes, and Motor (SEM) scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	The lottery method was used
Allocation concealment	Low risk	Sequentially numbered, opaque, and sealed envelopes were used
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operator/participants to the intervention
Blinding of outcome assessors for all outcomes	Unclear risk	It is unclear whether assessor was blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Unclear risk	No baseline characteristics reported

Al-Halabi 2018 [33]

Characteristics of included studies	
Methods	Study design: RCT, Parallel groups

	<p>Location: Syria</p> <p>Setting: Department of Pediatric Dentistry, Faculty of Dentistry, Damascus University</p>
Participants	<p>Children requiring inferior alveolar nerve block</p> <p>Sample size: 101</p> <p>Age: 6-10 years old</p> <p>Mean age: 7.4 years old</p>
Interventions	<p>Group A: received IANB with basic behaviour guidance techniques and without distraction aids (n=34)</p> <p>Group B: received IANB with audio-visual (AV) eyeglasses 'virtual reality (VR) Box' and wireless headphone (n=33)</p> <p>Group C: received IANB with tablet device and wireless headphone (n=34)</p>
Outcomes	Pain during LA: 0-5 Wong-Baker FACES scale

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	A randomization website 'Random.org' was used
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operator/participants to the intervention
Blinding of outcome assessors for all outcomes	High risk	Assessor was not blind
Incomplete outcome data for all outcomes	Low risk	The authors reported on incomplete data "one patient was excluded due to behavioral problems"
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Unclear risk	No baseline characteristics reported

Primosch 2001 [46]

Characteristics of included studies

Methods	Study design: RCT, Crossover
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	Location: USA Setting: Department of Pediatric Dentistry, Faculty of Dentistry, University of Florida
Participants	Children requiring bilateral palatal anaesthesia for restoring maxillary molars Sample size: 40 Age: 7-15 years old Mean age: 10.75 years old
Interventions	Phase 1: received topical anaesthesia benzocaine 20% gel versus Orabase-B (sodium carboxymethylcellulose oral adhesive with benzocaine 20%) Phase 2: received topical anaesthesia Orabase-B versus EMLA 5% cream (lidocaine 2.5% and prilocaine 2.5% manually mixed in Orabase Plain “(sodium carboxymethylcellulose oral adhesive)
Outcomes	Pain during LA: 0-100 Visual Analogue scale

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Participants were randomly allocated
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operator to the intervention
Blinding of outcome assessors for all outcomes	High risk	Assessor was not blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Unclear risk	No baseline characteristics reported

Daneshvar 2021 [62]

Characteristics of included studies

Methods	Study design: RCT, Crossover Location: Iran
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	Setting: Department of Pediatric Dentistry, School of Dentistry, Guilan University of Medical Sciences	
Participants	Children requiring local anaesthesia for pulpotomy of bilateral primary mandibular 2 nd molars Sample size: 40 Age: 5-8 years old Mean age: 6.72 years old	
Interventions	Group A: received 4% articaine with epinephrine 1:100,000 by infiltration Group B: received 2% lidocaine with epinephrine 1:80,000 by IANB	
Outcomes	Pain during Pulpotomy: 1-5 the Facial Image Scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	Random number table in Excel was used
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	Unclear risk	Insufficient information to make the judgement
Blinding of outcome assessors for all outcomes	Unclear risk	Insufficient information to make the judgement
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Unclear risk	No baseline characteristics reported

Kamath 2013 [26]

Characteristics of included studies	
Methods	Study design: RCT, Parallel groups Location: India Setting: The Narayana Hrudayalaya Dental Clinics
Participants	Children requiring local anaesthesia for the dental treatment Sample size: 160

	<p>Age: 4-10 years old</p> <p>Mean age: 7.6 years old for males and 7.2 years old for females in group A and 7.8 years old for males and 7.6 years old for females in group B</p>	
Interventions	<p>Group A (Control): used deep breathing (n=80)</p> <p>Group B (Intervention): used distraction technique Writing In The Air Using Leg (WITAIL) (n=80)</p> <p>LA was given by IANB with Lignocaine 2%</p>	
Outcomes	<p>Pain during LA: 0-10 the Modified Toddler- Preschooler Post-operative Pain Scale (TPPPS) for children aged 4-5 years old and 0-10 the FACES Pain Scale–Revised (FPS-R) for children aged 6-10 years old</p>	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	The usage of flip coin method was considered
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operator/participants to the intervention
Blinding of outcome assessors for all outcomes	Unclear risk	It is unclear whether assessor was blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Unclear risk	No baseline characteristics reported

Asvanund 2015 [51]

Characteristics of included studies	
Methods	<p>Study design: RCT, Crossover</p> <p>Location: Thailand</p> <p>Setting: The pediatric dental clinic at the Golden Jubilee Medical Center, Salaya campus, Nakornpathom and dental clinic at Nong Don Community Hospital, Saraburibprovince</p>

Participants	Children requiring local anaesthesia for dental treatment of bilateral carious molars Sample size: 49 Age: 5-8 years old Mean age: 7 years old
Interventions	Group A: received an injection without wearing audio-visual (AV) eyeglasses Group B: received an injection with wearing AV eyeglasses LA was given by IANB for mandibular teeth and by infiltration for maxillary teeth with 1.5 ml of mepivacaine with 1:100,000 epinephrine
Outcomes	Pain during LA: 0-10 the Faces Pain Scale-Revised (FPS-R)

Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Participants were randomly allocated
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operator/participants to the intervention
Blinding of outcome assessors for all outcomes	High risk	Assessors were not blind
Incomplete outcome data for all outcomes	Low risk	The authors reported on incomplete data "two who failed to return for a second visit and one refused to wear AV eyeglasses for the second visit"
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Mittal 2015 [29]

Characteristics of included studies	
Methods	Study design: RCT, Parallel groups Location: India Setting: Department of Pedodontics and Preventive Dentistry

Participants	Children requiring local anaesthesia for extraction of primary molars Sample size: 100 Age: 8-13 years old Mean age: 9.14 years old
Interventions	Group A (Control): received buccal and palatal infiltration using traditional syringe (n=50) Group B (Intervention): received buccal and palatal infiltration using Wand (n=50)
Outcomes	Pain during LA: 0-100 Visual Analogue scale and 1-4 the Sounds, Eyes, and Motor (SEM) scale

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	Random sampling using chit method was considered
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operator/participants to the intervention
Blinding of outcome assessors for all outcomes	Unclear risk	It is unclear whether assessors were blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Unclear risk	No baseline characteristics reported

Oztas 2005 [47]

Characteristics of included studies

Methods	Study design: RCT, Crossover Location: Turkey Setting: Not reported
Participants	Children requiring local anaesthesia for pulpotomy of contralateral primary mandibular 2 nd molars Sample size: 25

	Age: 6-10 years old	
	Mean age: Not reported	
Interventions	Group A (Control): received traditional IANB (Inferior alveolar nerve block)	
	Group B (Study): received periodontal ligament injection by Wand	
Outcomes	Pain during preparation, LA and pulpotomy: 0-3 the Eland Color Scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Unclear risk	Method of randomisation was not reported
Allocation concealment	Unclear risk	Allocation concealment method was not reported
Blinding of participants and personnel for all outcomes	High risk	It was not possible to blind the operator/participants to the intervention
Blinding of outcome assessors for all outcomes	Unclear risk	It is unclear whether assessors were blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Unclear risk	No baseline characteristics reported

Wambier 2018 [57]

Characteristics of included studies	
Methods	Study design: RCT, Crossover
	Location: Brazil
	Setting: The School of Dentistry
Participants	Children requiring topical anaesthesia for sealant placement on the contralateral permanent mandibular 1st molars under rubber dam
	Sample size: 82
	Age: 8-12 years old
	Mean age: 10.4 years old
Interventions	Group A (Control): received placebo gel

	Group B (Study): received the light-cured anaesthetic gel	
Outcomes	Pain during clamp placement: 0-5 Facial Expression Wong-Baker Scale, 0-10 Numeric Rating Scale (NRS) and 0-10 Face, Legs, Activity, Cry, Consolability (FLACC) Scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	A software (www.sealedenvelop.com) was used
Allocation concealment	Low risk	Opaque, consecutively numbered and sealed envelopes were used
Blinding of participants and personnel for all outcomes	Low risk	The operator and participants were blind to the intervention
Blinding of outcome assessors for all outcomes	Unclear risk	It is unclear whether assessors were blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Raslan 2021 [42]

Characteristics of included studies	
Methods	<p>Study design: RCT, Parallel groups</p> <p>Location: Syria</p> <p>Setting: Department of Paediatric Dentistry, Tishreen University</p>
Participants	<p>Children requiring local anaesthesia for extraction of primary molars</p> <p>Sample size: 66</p> <p>Age: 6-8 years old</p> <p>Mean age: 7.37 years old</p>
Interventions	<p>Group A: received Paracetamol 160 mg/5 ml 30 mins preoperatively (n=22)</p> <p>Group B: received placebo 30 mins preoperatively (n=22)</p>

	Group C: received 100 mg/5 ml ibuprofen 30 mins preoperatively (n=22)	
	All analgesics were taken orally	
Outcomes	Pain after extraction at 3, 4 and 5 hours: 0-10 Wong-Baker FACES scale	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation	Low risk	A randomized table was used
Allocation concealment	Low risk	"Group identifiers were included in dark and sealed envelopes with session numbers identical to those assigned to patients by the randomization table"
Blinding of participants and personnel for all outcomes	Low risk	The operator and participants were blind to the intervention
Blinding of outcome assessors for all outcomes	Low risk	Assessor was blind
Incomplete outcome data for all outcomes	Low risk	The authors evaluated all included participants
Selective outcome reporting	Low risk	The authors reported all expected outcomes
Other sources of bias	Low risk	No other bias

Supplementary file S3: GRADE assessment for the certainty of evidence of the second systematic review

Summary of findings:

Computer Driven LA compared to Conventional LA for children and adolescents having routine dental treatment

Patient or population: children and adolescents having routine dental treatment

Setting: Dental clinic

Intervention: Computer Driven LA

Comparison: Conventional LA

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with Conventional LA	Risk with Computer Driven LA				
Intra-operative Pain	-	SMD 0.03 SD lower (0.33 lower to 0.27 higher)	-	607 (7 RCTs)	⊕⊕⊕○ Moderate	See footnotes

*The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

CI: confidence interval; SMD: standardised mean difference

GRADE Working Group grades of evidence

High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.

Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.

Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.

Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. Certainty of the evidence downgraded by 1 level for high risk of bias.

Summary of findings:

Intra-ligament LA compared to Conventional LA for relieving pain in children and adolescents having routine dental treatment

Patient or population: relieving pain in children and adolescents having routine dental treatment

Setting: Dental clinic

Intervention: Intra-ligament LA

Comparison: Conventional LA

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with Conventional LA	Risk with Intra-ligament LA				
Intra-Operative Pain	-	SMD 1.79 SD lower (2.37 lower to 1.2 lower)	-	111 (2 RCTs)	⊕⊕○○ Low ^{a,b}	

*The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: confidence interval; SMD: standardised mean difference

GRADE Working Group grades of evidence

High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.

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Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.

Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

- a. Certainty of the evidence downgraded by 1 level for high risk of bias.
- b. Certainty of the evidence downgraded by 1 level for serious imprecision.

Summary of findings:

Intra-osseous LA compared to Conventional LA for relieving pain in children and adolescents having routine dental treatment

Patient or population: relieving pain in children and adolescents having routine dental treatment

Setting: Dental clinic

Intervention: Intra-osseous LA

Comparison: Conventional LA

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with Conventional LA	Risk with Intra-osseous LA				
Intra-Operative Pain	-	SMD 0.14 SD lower (0.52 lower to 0.24 higher)	-	188 (1 RCT)	⊕⊕○○ Low ^{a,b}	

*The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: confidence interval; SMD: standardised mean difference

GRADE Working Group grades of evidence

High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.

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Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

- a. Certainty of the evidence downgraded by 1 level for high risk of bias.
- b. Certainty of the evidence downgraded by 1 level for serious imprecision.

Summary of findings:

4% Articaine compared to 2% Lidocaine for LA for relieving pain in children and adolescents having routine dental treatment

Patient or population: LA for relieving pain in children and adolescents having routine dental treatment
Setting: Dental clinic
Intervention: 4% Articaine
Comparison: 2% Lidocaine

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	N _e of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with 2% Lidocaine	Risk with 4% Articaine				
Intra-Operative Pain	-	SMD 1.04 SD lower (2.18 lower to 0.1 higher)	-	204 (2 RCTs)	⊕⊕○○ Low ^{a,b}	

*The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: confidence interval; SMD: standardised mean difference

GRADE Working Group grades of evidence

High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

- a. Certainty of the evidence downgraded by 1 level for high risk of bias.
- b. Certainty of the evidence downgraded by 1 level for serious imprecision.

Summary of findings:

Different methods of topical anaesthesia compared to Conventional topical anaesthesia for LA for relieving pain in children and adolescents having routine dental treatment

Patient or population: LA for relieving pain in children and adolescents having routine dental treatment
Setting: Dental clinic
Intervention: Different methods of topical anaesthesia
Comparison: Conventional topical anaesthesia

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	N _e of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with Conventional topical anaesthesia	Risk with Different methods of topical anaesthesia				
Intra-Operative Pain	-	SMD 0.64 SD lower (1.38 lower to 0.09 higher)	-	160 (2 RCTs)	⊕⊕○○ Low ^{a,b}	See footnotes

*The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: confidence interval; SMD: standardised mean difference

GRADE Working Group grades of evidence

High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

- a. Certainty of the evidence downgraded by 1 level for high risk of bias.
- b. Certainty of the evidence downgraded by 1 level for serious imprecision.

Summary of findings:

Mechanoreceptor and thermal receptor stimulation compared to for relieving pain in children and adolescents having routine dental treatment

Patient or population: for relieving pain in children and adolescents having routine dental treatment

Setting: Dental clinic

Intervention: mechanoreceptor and thermal receptor stimulation

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with	Risk with mechanoreceptor and thermal receptor stimulation				
Intra-Operative Pain	-	SMD 1.38 SD lower (2.02 lower to 0.73 lower)	-	930 (10 RCTs)	⊕⊕⊕○ Moderate ^a	See footnotes

*The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: confidence interval; SMD: standardised mean difference

GRADE Working Group grades of evidence

High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.

Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.

Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.

Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. Certainty of the evidence downgraded by 1 level for high risk of bias.

Summary of findings:

Behavioural Interventions compared to for relieving pain and anxiety in children and adolescents having routine dental treatment

Patient or population: relieving pain and anxiety in children and adolescents having routine dental treatment

Setting: Dental clinic

Intervention: Behavioural Interventions

Comparison:

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with	Risk with Behavioural Interventions				
Intra-Operative pain	-	SMD 0.5 SD lower (0.83 lower to 0.18 lower)	-	1130 (13 RCTs)	⊕⊕⊕○ Moderate ^a	See footnotes
Anxiety	-	SMD 0.17 SD lower (0.45 lower to 0.11 higher)	-	178 (3 RCTs)	⊕⊕⊕○ Moderate ^b	See footnotes

*The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: confidence interval; SMD: standardised mean difference

GRADE Working Group grades of evidence

High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.

Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.

Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.

Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. Certainty of the evidence downgraded by 1 level for high risk of bias.

b. Certainty of the evidence downgraded by 1 level for high risk of bias.

Summary of findings:

Pre-emptive oral analgesics compared to Oral placebo solution for relieving pain in children and adolescents having routine dental treatment

Patient or population: relieving pain in children and adolescents having routine dental treatment

Setting: Dental clinic

Intervention: Pre-emptive oral analgesics

Comparison: Oral placebo solution

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with Oral placebo solution	Risk with Pre-emptive oral analgesics				
Post-Operative Pain	-	SMD 0.77 SD lower (1.21 lower to 0.33 lower)	-	208 (3 RCTs)	⊕⊕⊕○ Moderate ^a	

*The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: confidence interval; SMD: standardised mean difference

GRADE Working Group grades of evidence

High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.

Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.

Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.

Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. Certainty of the evidence downgraded by 1 level for high risk of bias.