Retention period after treatment of posterior crossbite with maxillary expansion: a systematic review

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Objective: The aim of this systematic review was to evaluate the duration of the retention period in growing patients undergoing maxillary expansion and its relation with posterior crossbite stability.

Methods: Search strategies were executed for electronic databases Cochrane Library, Web of Science, PubMed and Scopus, which were completed on January 15, 2016. The inclusion criteria included randomized, prospective or retrospective controlled trials in growing subjects with posterior crossbite; treated with maxillary expanders; retention phase after expansion; post-retention phase of at least 6 months. The exclusion criteria were anterior crossbite, craniofacial anomalies, surgery or another orthodontic intervention; case reports; author's opinions articles, thesis, literature reviews and systematic reviews. The risk of bias of selected articles was assessed with Cochrane risk of bias tool for RCTs and Downs and Black checklist for non-RCTs.

Results: A total of 156 titles/abstracts was retrieved, 44 full-texts were examined, and 6 articles were selected and assessed for their methodological quality. The retention period after maxillary expansion ranged between 4 weeks and 16 months. Fixed (acrylic plate, Haas, Hyrax and quad-helix) or removable (Hawley and Hawley expander) appliances were used for retention.

Conclusions: Six months of retention with either fixed or removable appliances seem to be enough to avoid relapse or to guarantee minimal changes in a short-term follow-up.

Keywords: Crossbite. Maxillary expansion. Retainer.

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INTRODUCTION

Posterior crossbite is a common malocclusion in the deciduous and mixed dentitions, with prevalence rates of 7.5%[1] to 22%,[2] and in the permanent dentition with rates of 10.2% to 14.4%.[3]

The etiology of this malocclusion may be dental, skeletal and/or functional.[4] Few studies have reported the self-correction of posterior crossbite in the deciduous dentition, related to the discontinuation of sucking habits and chronic respiratory childhood diseases.[5,6] However, this condition is usually not self-corrected.[4,7,8]

Studies with adolescents and adults have revealed that patients presenting posterior crossbite have an increased risk to develop craniomandibular disorders, showing more signs and symptoms of these conditions.[2,5] Several authors suggest the early treatment of crossbites to prevent mandibular dysfunction as well as craniofacial asymmetry.[7-10]

Adults can be submitted to maxillary expansion, although there are controversies regarding the nonsurgical treatment.[11,12]

Various methods have been suggested for correction and retention after treatment of posterior crossbite in growing patients: Haas,[8,13-16] Hyrax,[14,15,17,18] quad-helix appliance (QDH),[4,7,14,15,19-21] removable plates,[4,7,9,20-22] grinding[7,10] and edgewise fixed appliances.[23]

The successful treatment of a posterior crossbite is frequently reached not only by the expansion of the maxilla. In growing subjects, the treatment must also achieve the reestablishment of the normal growth rate on a longitudinal basis,[24] as well as improve the oral and general health.[25]

No consensus among authors exists regarding the optimal retention period after maxillary expansion. Some authors recommend that the retention phase should last for 6 weeks,[19] while others advocate 6[4,21] or 8 months.[8] Thus, a systematic review of the literature was deemed appropriate.

The aim of this systematic review was to evaluate the duration of the retention period in growing patients undergoing maxillary expansion and its relation with posterior crossbite stability. The PICOS is shown in Table 1.

MATERIAL AND METHODS

This systematic review was registered on the National Institute of Health Research Database:

www.crd.york.ac.uk/prospero.

The inclusion criteria were randomized controlled trials (RTCs) and controlled trials in human growing subjects; experimental group presenting posterior crossbite; treatment with maxillary expanders; retention phase after expansion; and a minimum 6-month post-retention phase.

The exclusion criteria were subjects presenting anterior crossbite, craniofacial anomalies, previous surgery or another orthodontic intervention; case reports; author's opinions articles, thesis, literature reviews and systematic reviews.

To identify the studies, detailed search strategies were developed and executed in the following electronic databases: Cochrane Library, Web of Science, PubMed and Scopus (Table 2). All electronic searches were conducted between May 28, 2015 and January 15, 2016. No restrictions for language or publication date were used.

The results were compiled into a reference manager (EndNote X5, Thomson Reuters), and duplicate records were excluded.

Two authors independently reviewed titles and abstracts according to the inclusion and exclusion criteria. Any disagreement was solved by consultation with two others authors until mutual agreement was reached and initial selection was completed.

Full texts of articles where it was not possible to decide for inclusion or exclusion only by reading the title and abstract were also screened to confirm their eligibility. Two authors independently read the full texts of the articles previously selected.

After electronic searches and the initial selection process, a supplementary hand search was implemented by checking the references of each selected study. Afterwards, two authors independently performed a structured quality assessment of the selected articles based on risk of bias. The Cochrane risk of bias tools[26] was used for randomized studies, and the Downs and Black checklist[27] for non-randomized studies. Any disagreement on the risk of bias assessment was resolved after consulting other two authors.

The following data from the included articles were extracted and independently compiled by two researchers: author/year; sample description; crossbite type; expander/activation time; activation rate; retainer appliance and retention time; measurements; follow-up time; overcorrection; experimental group *versus* control group (*p* value);

Table 1 - PICOS.

PICOS	Description
Population	Growing subjects presenting posterior crossbite
Intervention	Treated with maxillary expansion
Comparison	Another maxillary expansion procedure, untreated crossbite subjects or untreated subjects without posterior crossbite
Outcomes	Duration of the retention period after maxillary expansion and its relation with posterior crossbite stability
Study design	Randomized controlled trials (RTCs) and controlled trials in human growing subjects

Table 2 - Search strategy in databases.

Database	Search strategy
Cochrane Library	"palatal expansion technic" or "maxillary expansion" in Title, Abstract, Keywords and "retention" or "retainer" or "stability" or "relapse" in Title, Abstract, Keywords and "crossbite" in Title, Abstract, Keywords not "case report" in Title, Abstract, Keywords (Word variations have been searched)
Web of Science (Database=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH)	1) TS=(palatal expansion technic OR maxillary expansion OR maxillary disjunction OR palatal disjunction OR expansion appliance OR maxillary expander OR palatal expander OR maxillary expander) 2) TS=(retention* OR retainer* OR relapse* OR stability*) 3) TS=(crossbite*) 4) #1 AND #2 AND #3 5) TI=(case report OR case series OR adult*) 6) #4 AND NOT #5
PubMed	(palatal expansion technique[MeSH Terms]) OR "maxillary expansion"[Title/Abstract]) OR "maxillary disjunction"[Title/Abstract]) OR "palatal disjunction"[Title/Abstract]) AND "retention"[Title/Abstract]) OR orthodontic retainer[MeSH Terms]) OR "stability"[Title/Abstract]) OR "relapse"[Title/Abstract]) AND "crossbite"[Title/Abstract]) NOT "case report"[Title]) NOT "case series"[Title]) NOT adult[Title]
Scopus	TITLE-ABS-KEY(palatal expansion technique) OR TITLE-ABS-KEY("maxillary expansion") OR TITLE-ABS-KEY("maxillary disjunction") OR TITLE-ABS-KEY("palatal disjunction") AND TITLE-ABS-KEY("retention") OR TITLE-ABS-KEY("retainers") OR TITLE-ABS-KEY("relapse") OR TITLE-ABS-KEY("post retention") OR TITLE-ABS-KEY("stability") OR TITLE-ABS-KEY("changes") AND TITLE-ABS-KEY(crossbite) AND NOT TITLE-ABS-KEY("case report") AND NOT TITLE-ABS-KEY("case series") AND NOT TITLE-ABS-KEY(adult)

relapse after follow-up time; crossbite correction stability after follow-up; conclusion.

In order to verify the percentage of relapse for each transversal measure given by the authors, the difference between the measure immediately after expansion (AE) and the measure after 6-month follow-up (FU) was calculated following the equation: [(AE-FU)x100/AE].

RESULTS

In the databases search, 281 articles were found. After duplicates were excluded, we screened 156 titles and abstracts; and 112 studies were excluded from this review; 44 full texts were screened, and 6 articles were selected according to the eligibility criteria. The search process is shown in the Prisma flow diagram (Fig 1).

Two articles included, which are randomized controlled trials, were assessed with the Cochrane tool and the corresponding graphs are shown in Figures 2 and 3. The non-randomized studies were classified according to their risk of bias, using the Downs and Black checklist, as: low risk,[4] medium[16] and high risk[8,22] (Table 3).

Data extracted from the included articles are displayed in Tables 4A and 4B. The retention period after maxillary expansion ranged from five[22] to sixteen months,[16] and the appliances used were: fixed (acrylic plate expander,[22] Haas,[8,16] Hyrax[17] and quad-helix[4,21]) or removable (hawley[4,22] and Hawley expander[4,21,22]).

The follow-up of these patients ranged from 6 months[4] to 60[16] months, and the relapses of the measurements described reached 0%[4] to 27%[17].

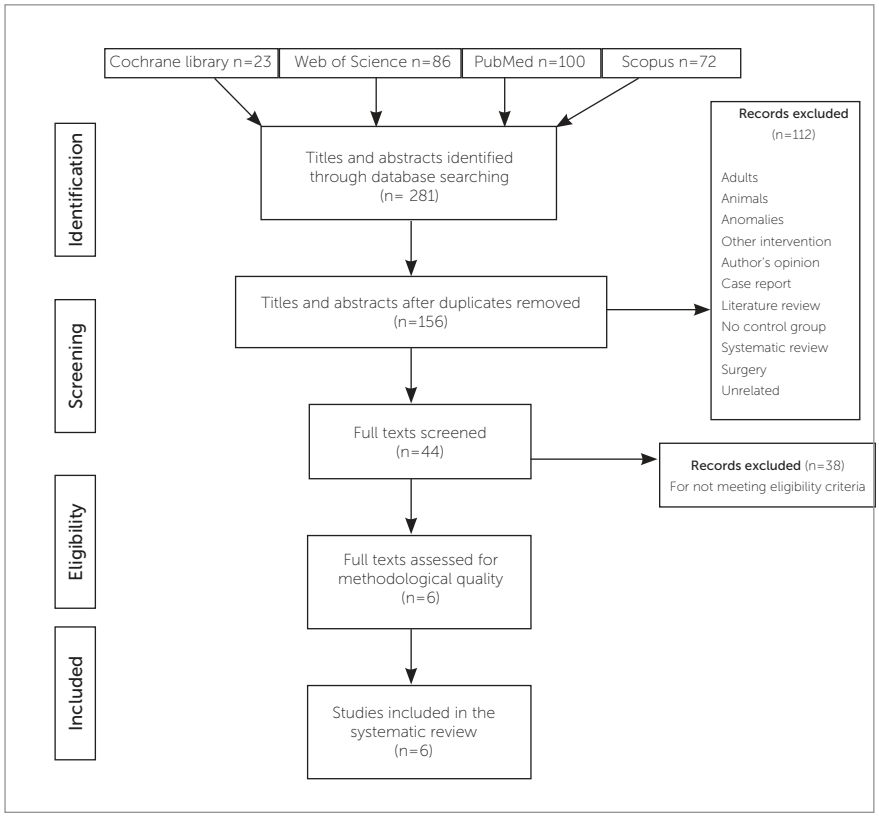

Figure 1 - Prisma flow diagram.

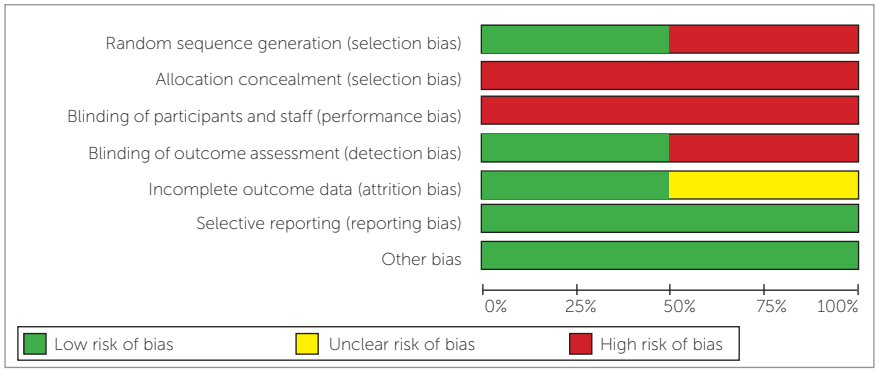

Figure 2 - Risk of bias graph for RCTs studies.

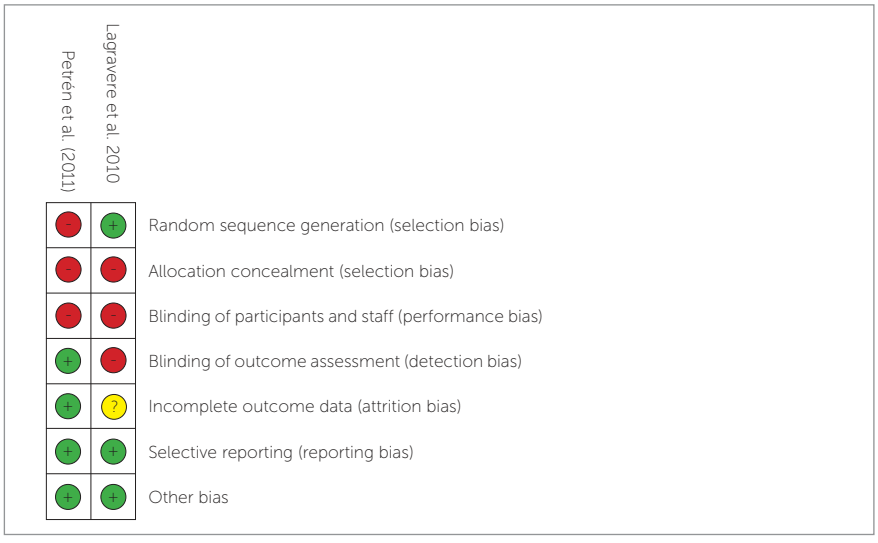

Figure 3 - Risk of bias summary for RCTs studies.

Table 3 - Downs and Black checklist for non-randomized studies.

ALL CRITERIA	DESCRIPTION OF CRITERIA (with additional explanation as required, determined by consensus of raters)	POSSIBLE ANSWERS	Cozzani et al[8]	Godoy et al[4]	Mutinelli et al[16]	Primožič et al[22]
1	Is the hypothesis/aim/objective of the study clearly described? Must be explicit	0/1	1	1	1	1
2	Are the main outcomes to be measured clearly described in the Introduction or Methods sections?	0/1	1	1	1	1
3	Are the characteristics of the patients included in the study clearly described?	0/1	1	1	1	1
4	Are the interventions of interest clearly described?	0/1	1	1	1	1
5	Are the distributions of principal confounders in each group of subjects to be compared clearly described?	0/1/2	0	2	2	0
6	Are the main findings of the study clearly described?	0/1	1	1	1	1
7	Does the study provide estimates of the random variability in the data for the main outcomes?	0/1	1	1	1	1
8	Have all important adverse events that may be a consequence of the intervention been reported?	0/1	1	1	0	1
9	Have the characteristics of patients lost to follow-up been described?	0/1	0	0	0	0
10	Have actual probability values been reported (e.g. 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?	0/1	0	1	1	0
11	Were the subjects asked to participate in the study representative of the entire population from which they were recruited?	0/0/1	0	1	0	0
12	Were those subjects who were prepared to participate representative of the entire population from which they were recruited?	0/0/1	0	1	0	0
13	Were the staff, places, and facilities where the patients were treated, representative of the treatment the majority of patients receive?	0/0/1	0	1	0	0
14	Was an attempt made to blind study subjects to the intervention they have received?	0/0/1	0	0	0	0
15	Was an attempt made to blind those measuring the main outcomes of the intervention?	0/0/1	0	1	0	0
16	If any of the results of the study were based on "data dredging", was this made clear?	0/0/1	1	1	1	1
17	In trials and cohort studies, do the analyses adjust for different lengths of follow-up of patients, or in case control studies, is the time period between the intervention and outcome the same for cases and controls?	0/0/1	1	0	0	1
18	Were the statistical tests used to assess the main outcomes appropriate?	0/0/1	1	1	1	1
19	Was compliance with the intervention/s reliable?	0/0/1	1	0	1	1
20	Were the main outcome measures used accurate (valid and reliable)?	0/0/1	1	1	1	1
21	Were the patients in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?	0/0/1	0	1	0	0
22	Were study subjects in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited over the same time?	0/0/1	1	1	0	0
23	Were study subjects randomized to intervention groups?	0/0/1	0	1	0	0
24	Was the randomized intervention assignment concealed from both patients and health care staff until recruitment was complete and irrevocable?	0/0/1	0	0	0	0
25	Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?	0/0/1	0	0	1	1
26	Were losses of patients to follow-up taken into account?	0/0/1	0	1	0	1
27	Did the study have sufficient power to detect a clinically important effect where the probability value for a difference being due to chance <5%	1 - 5	0	4	4	0
TOTAL		Max. 32	13	25	18	14

0/1= No/Yes; 0/1/2= No/Partially/Yes; 0/0/1= Unable to determine/No/Yes.

Table 4A - Characteristics and data of included studies.

Author/ Year	Sample description	Type of crossbite	Expander/ Activation time	Activation rate	Retainer appliance/ Retention time
Cozzani et al[8] (2007)	» Group A (TG) = 31 (20 F/11M) CB experimental 7.3±1y » Group B (CG) = 30 (13F/17M) CB untreated 8.4y » Group C (CG) = 30 (13F/17M) CB untreated 10.8y	unilateral or bilateral posterior crossbite	Haas Group A (primary second molars and canines) mean 20 days (until permanent first molars correction)	RME once or twice/day 0.25 mm-0.5 mm/day	Haas at least 8m mean 1.1y
Lagravère et al[17] (2010)	» Group TG= 20 (15F/5M) CB experimental 14.05±1.35y » Group CG= 21 (15F/6M) CB untreated 12.86± 1.19y	posterior crossbite	Hyrax (until posterior CB overcorrection)	RME twice/day 0.5 mm	Hyrax/ 6 months
Godoy et al[4] (2011)	» Group QDH= 33 (26F/7M) CB-experimental 8.00±0.79y » Group EP= 33 (18F/15M) CB-experimental 7.82±0.85y » Group CG= 33 (14F/19M) CB-untreated 8.09±0.81y	unilateral posterior crossbite	QDH adjusted for buccal root torque mean 4.24±2.05m EP acrylic covering mean 6.12±3.25m (until CB correction) evaluated every 4 weeks	SME once a month QDH expanded 1 side to pass central fossa; and the other to the molar-band EP-0.25 mm/ week	Plate placed/ To be used 24 hours/ day for 3 months and for 3 more months just at night
Petrén et al[21] (2011)	» Group QDH= 20 (11F/9M) CB-experimental 9.00±1.19y » Group EP= 15 (10F/5M) 5M noncompliance excluded CB-experimental 8.5± 1.02y » Group CG= 20 (9F/11M) NCB- 8.8± 0.5y	unilateral posterior crossbite	QDH adjusted for buccal root torque QDH and EP (until CB correction) CG untreated	SME QDH activated 10 mm, reactivated every 6 weeks/ recemented EP 0.2 mm/week	QDH 6 months EP / 6 months 24 hours/day
Primožič et al[22] (2013)	» Group TG= 30 (17F/13M) CB experimental - 5.3± 0.7 y » Group CG= 30 (17F/13)M NCB- 5.3± 0.7 y	unilateral posterior crossbite, mandibular lateral shift	Acrylic plate expander cemented/ 4 weeks	SSME 0.25 mm/ every 2 days	Acrylic plate expander inactive/ 4 weeks Acrylic removable plate/ 4 months
Mutinelli et al[16] (2015)	» Group TG= 18 (10F/8M) CB experimental- 7.6±1.0y dental Class II » Group CG= 18 (10F/8M) CB-untreated- 13.1±1.6y dental Class II	unilateral or bilateral posterior crossbite	Haas/(primary second molars and canines) mean 28 days (until permanent first molars correction)	RME once or twice/ day 0.2 mm-0.4 mm/day	Haas/ 7 months 1.4y

TG= Treatment group; CG = Control group; F= female; M= male; PFM= Permanent first molar; PSM= Primary second molar; IC= Intercuspid canines; y= years; m= months; RME= Rapid maxillary expansion; QDH= Quad-Helix appliance;
EP= Expansion plate; NCB= Non crossbite group; CB= Crossbite; UPC= Unilateral posterior crossbite.

Table 4B - Characteristics and data of included studies.

Author/ Year	Measurements	Follow-up time	Overcorrection	Experimental group x Control group (P value)	Relapse measurements after follow-up	Crossbite corrected after follow-up	Conclusion
Cozzaniet al[8] (2007)	» Maxillary arch width: » PFM- center of the fossa » PSM-center of the fossa » IC-cusp tip » DC	minimum 1y after appliance removal 2.4±1.7y	yes - primary teeth no - permanent first molar	PFM: ≤0.01 PSM: ≤0.01 IC: ≤0.05	PFM = 0.9% PSM = 6.0% IC = 5.5%	yes	Relapse: PFM < PSM Overexpand PSM PFM was stable for 2y 4m after treatment
Lagravere et al[17] (2010)	» PC- center of pulp chamber in molars and tip of premolars buccal pulp horn » MBA-mesiobuccal root apex of molars » BA-buccal root apex of premolars » AIB-outer cortex of alveolar bone at the vertical level of the root apex » mm » CBCT	Before fixed bonding (12m) long-term post-relapse	yes	all groups P<.001	PC16-PC26 = 27% PC14-PC24 = 39% MBA16-MBA26= 28% BA14-BA24 = 18% AIB16-AIB26 = 51% AIB14-AIB24 = 20%	yes	aprox 4mm (70%) expansion - at T4 at molars Dental expansion> skeletal expansion Midpalatal suture separation on TG. No significant changes at the level of the pterigoid plates TG=CG
Godoy et al[4] (2011)	Maxillary arch width: PSM-center of the fossa IC- cusp tip DC	6m after appliance removal	no	IMD: P<0.001 (QDH=EP; QDH≠ CG; EP≠ CG) ICD: P= 0.354	PSF QDH= 2.2% EP = 1.7% IC QDH = 0.3% EP = 0%	yes 9.1% of the each sample showed relapse	QDH=EP for correct posterior crossbite QDH> breakage EP> lost appliances QDH< treatment time Treatment may be performed in 1y for posterior CB correction and 6m for retention
Petrén et al[21] (2011)	Maxillary arch width: PSM-gingival margin (GM) PSM-mesiobuccal cusp tip (MCT) IC-gingival margin (GM) IC-buccal cusp tip (BCT) DC	QDH and EP group 4y after correction	no	IMD (MCT): P=NR (CG>QDH,EP) ICD (BCT): P=NR (CG>QDH)	PSM QDH = 1.6% EP = 5.6% IC (GM) QDH = 4.9% EP = 5.6% IC (BCT) QDH = 1.2% EP = 0.6%	yes	The long-term stability of crossbite correction in the mixed dentition is favorable. Results: QDH=EP
Primozic et al[22] (2013)	Palatal surface area (mm^2) 3D digital DC	12 months later 18 months later 30 months later	yes	Surface(mm^2): P= NR NS (TG=CG)	Palatal surface area (TG) = - 0.5%	26.7% of the TG showed relapse	Treatment of unilateral CB in the deciduous dentition also create conditions for normal occlusal and craniofacial development. Improves facial symmetry and increase palatal area and volume
Mutinelli et al[16] (2015)	Maxillary arch width: PSM and IC (mm); 3D digital DC	In the permanent dentition 5.3±0.8y	yes - primary teeth no - permanent first molar	IC P= 0.02 PSM P= 0.001	PSM = 1% IC = 5.1%	yes	In patients in canine Class II, early treatment of lateral CB with a modified Haas expander anchored to deciduous teeth is effective and presented stable results until the stage of permanent dentition

TG= Treatment group; CG = Control group; PFM= Permanent first molar; PSM= Primary second molar; IC= Intercuspid canines; DC= Dental cast; y= years; m= months; RME= Rapid maxillary expansion; QDH= Quad-Helix appliance; EP= Expansion plate; IMD= Intermolar distance; ICD= intercanine distance; GM = Gingival margin; MCT= Mesiobuccal cusp tips; BCT= Gingival margin and buccal cusp tips; NCB= Non crossbite group; CB= Crossbite; NS= Not significant; NR= Not reported.

DISCUSSION

The duration of the steady retention after maxillary expansion that guarantees the correction of posterior crossbite is not well established in the literature and this was the main reason that led to this systematic review.

The evidence collected in this systematic review combined low, medium and high risk of bias studies. The main drawback in RCTs and non-RCTs was blinding, which is unfeasible in the assessed type of intervention. In non-RCTs, another main problem was the description of the characteristics of subjects lost to follow-up.

However, the heterogeneity among the studies made the comparison difficult. Dental and skeletal measures varied widely, as follows: intermolar distance measured between the center of the fossae of maxillary permanent first molars,[4,8,16] measured between the mesiobuccal cusp tips and gingival margin,[21] distance between the center of the fossae of maxillary primary second molars,[8] intercanine distance measured between cusp tips,[4,8,21] gingival margin,[21] palatal surface area,[22] and distance of center of pulp chamber in molars and tip of premolar buccal pulp horn, mesial buccal root apex of molars, buccal root apex of premolars, outer cortex of alveolar bone at the vertical level of the root apex.[17]

The appliances used for maxillary expansion in the studies included were Haas,[8,16] Hyrax,[17] QDH,[4,21] removable acrylic expansion plate,[4,21] and cemented acrylic plate.[22] All authors used the same expander appliance for retention of the maxillary expansion,[4,8,16,17,21,22] except the quad-helix group in the study from Godoy et al,[4] who used a removable Hawley retainer for retention.

The control group also differed among the studies. In some studies, subjects presenting posterior crossbite were included in the control group,[4,8,16,17] while other authors selected only patients with no posterior crossbite (normal occlusion or a different malocclusion with no transverse discrepancies) for the control group.[21,22] When these studies featured more than one control group, it was taken into account only the group of subjects with similar occlusion.[17]

Four studies[4,8,16,17] where the control group comprised subjects with posterior crossbite were approved by ethics committees and the authors followed their guidelines. Lagravere et al[17] benefited from a treatment control group with delay of 12 months, and there were no negative consequences for the treatment of patients. However, that may be an ethical issue, since delaying the correction of a problem, which is known to be better solved as early as possible may be considered unethical. This was the reason why Petrén et al[21] did not include a control group of crossbite untreated subjects as their follow-up reached three years after treatment.

Overcorrection of the posterior crossbite is recommended by some authors[4,19,28,29] due to the tooth crown buccal inclination, which is usually a consequence of tooth-supported expanders.[21] The physiology of the relapse demonstrate that molars tend to return to their original buccolingual inclination after retention is discontinued, that would not allow relapse of the posterior crossbite if overexpansion was performed.[11] Four of the included studies[8,16,17,22] expanded the maxilla until the crossbite was overcorrected in all groups, particularly it was performed only in primary teeth for Cozzani et al[8] and Mutinelli et al.[16] In two articles[4,21] however, no overexpansion was produced.

Petrén et al[21] claims that overcorrection might be unnecessary, since their results without overexpansion were found to be stable in a long-term, the rate of relapse was 1.6% in the intermolar cusp distance, even so to avoid buccal tipping of the molars, the appliance was adjusted for buccal root torque.

Authors that used Haas as retainers for at least 7 months[16] and 8 months[8] presented a relapse of 1.0% and 0.9% respectively, in the intermolar distance. These results may suggest that a longer time of retention after maxillary expansion — that is, more than 7 months — would favor stability and less relapse. Moreover, the difference of the mean relapse was only 0.1 mm, which may be clinically irrelevant.

Lagravere et al[17] who used Hyrax as a retainer, observed the highest relapse of measurements, 27% in the molar distance, probably related to patient age, since their sample of the treated group was 14 years. All others authors[4,8,16,21,22] presented younger samples, between 5.1 a 9.7 years old, in the mixed dentition.

When removable appliances were used as retainers for 6 months, a relapse of 3.2%[4] and 1.2%[21] was found in the intermolar distance. Godoy et al[4] instructed the patients to use the removable plate 24 hours a day for 3 months and just at night for 3 more months, while Petrén et al[21] recommended a 24-hour/day use for 6 months. That may have influenced on the first authors' higher rates of relapse.

The overall comparison among fixed and removable retainers when a six-month retention was used, showed a very small range of variation, between 1.2%[21] and 3.2%[4] in the intermolar distance. When comparing treatment groups which had as their expander/retainer the QDH and EP, Petrén et al[21] observed similar results. According to Godoy et al,[4] the greatest disadvantage of EP was lost appliances and subsequent laboratory costs, and QDH's frequent breakage. In spite of this, one of the most cited disadvantages of removable appliances in the literature is the need for patients' compliance.[4,30]

Primozic et al[22] assessed skeletal measures through the palatal surface area. Considering a 30-month follow-up, there was no relapse in this skeletal measure. On the contrary, there was an increment of 6.38%. They found that increase in the experimental group to be similar to or greater than the increase observed in the control group of normal occlusion. According to the authors, that indicates the reestablishment of a normal growth rate and the condition for normal occlusion and craniofacial development.

However, relapse in dental and skeletal measures does not necessarily represent a relapse in the posterior crossbite. Four authors have reported recurrence of posterior crossbite. That relapse is expressed in percentage of patients as reported by authors or calculated according to their data: 0%[16,21] (Haas group for at least 7 months; removable plate group, 6 months of retention), 5%[21] (QDH group, 6 months of retention), 9.1%[4] (QDH and removable plate, 6 months of retention), 26.7%[22] (acrylic cemented plate group, cemented as retention for 1 month and removable for 4 months). Relapse is not a rare event after correction of posterior crossbite.[21,22,30]

Primozic et al[22] showed the biggest recurrence of posterior crossbite after the treatment, amounting of 8 participants, they suggest that part of this relapse could be explained because the subjects expressed a Class III growth trend, inverse overjet and facial asymmetries.

Limitations of this review are: not enough RCTs were found that were able to answer our question; additionally, no study specifically aimed at answering this question, nor did any study assessed or compared different periods of retention in patients wearing the same kind of appliance. Our systematic review clearly shows the need for randomized controlled trials that specifically assess different periods of retention with the same appliances and the stability of correction of the posterior crossbite, so that a protocol may be created for successful treatment maintenance.

The clinical implication of this systematic review is that six months of retention of crossbite correction used 24 hours a day should be able to maintain the results obtained. However, the evidence for this conclusion is moderate.

CONCLUSION

Based on the results from this systematic review, there is moderate evidence to assert that six months of retention with either fixed or removable appliances seem to be enough to avoid relapse or to guarantee minimal changes in a short-term follow-up.

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