

WHAT IS THE BEST TREATMENT FOR IMPACTED MAXILLARY CANINES? EXPOSE AND WAIT OR PERFORM TRACTION? A SYSTEMATIC REVIEW

ABSTRACT

AIM: The aim of this systematic review was to seek evidence in the literature about the best treatment for cases of impacted maxillary canines. **MATERIAL AND METHODS:** This review has been registered at PROSPERO – International prospective register of systematic review under the number CRD42014007033. A systematic review was conducted in the Scopus, PubMed, Medline EBSCO, Embase, Web of Science, Cochrane, Clinical Trials and Greyliterature electronic databases, without limitations on the year of publication and language. Controlled clinical studies were included in this review, which were conducted with orthodontic patients with fixed appliances, without age limit, with the presence of impacted maxillary canines, in whom the procedures of surgical exposure only, or exposure followed by orthodontic traction were performed. Those excluded were computational studies, case reports, reviews of the literature, didactic books, editorial letters, in addition to studies including patients using systemic drugs, syndromic patients, with history of dental trauma, those who had previously used orthodontic appliances and had been submitted to previous previous treatment attempting exposure or traction of the canine. A process of scoring the methodological quality was used to identify which of the studies would be more suitable for evaluation. **RESULTS:** Seventeen articles met the inclusion criteria and the complete texts were evaluated. One article with low methodological quality was not considered and 16 were evaluated by qualitative evidence synthesis. Fourteen articles analyzed the technique of surgical exposure followed by orthodontic traction, 1 article evaluated the exposure technique only, and 1 presented an approach of comparison between the two techniques. **CONCLUSION:** The information analyzed presented good methodological quality ranging from moderate to high, and allowed one to conclude that in spite of presenting satisfactory results for impacted maxillary canines, there was insufficient evidence to support the use of the technique of surgical exposure and independent eruption.

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KEYWORDS

Surgically exposed. Cuspid. Impacted.

INTRODUCTION

In the diagnostic treatment of malocclusions, after the third molars, the canines are the teeth that most frequently found to be impacted, with an incidence of 1 to 3%¹. Although hereditary factors have been shown to influence the etiopathogeny of non erupted teeth, especially in occurrences of palatal displacement, the causes are not yet precisely known². The occurrence of canine impaction results in not only esthetic but functional compromise as well. Although the majority of palatally-displaced canines may be positioned orthodontically in the alveolus, various problems may accompany the directioning of these ectopically positioned teeth.

There are methods described in the literature for directing and treating impacted maxillary canines. Some of these methods may be described as being interceptive and not requiring surgical exposure. Nevertheless, in many clinical situations these techniques are not appropriate, and the impacted canines need to be surgically uncovered and moved into position orthodontically.

Among the treatment strategies for the exposure and traction of impacted canines, the combination between surgical exposure and immediate orthodontic treatment is mentioned, in which brackets are placed during the surgical act, the flap is closed and after this orthodontic force is applied in order

to obtain traction of the teeth in question. Another technique consists of the association between surgical exposure and independent eruption; that is to say, after exposure of the canine, the flap is not closed, and the tooth is kept exposed that that it can erupt independently without the immediate application of orthodontic force³. The two techniques are widely accepted by the orthodontic community, however, doubts persist with respect to which would be the best procedure from the periodontal, esthetic and functional aspect of the canine after exposure.

Based on this premise, the authors' proposal in the present systematic review was to identify and qualify evidence of evaluations in the long term, of the two treatment techniques for impacted maxillary canines. The specific question to be answered is: Which technique presents the best results for the displacement of impacted maxillary canines, surgical exposure and independent eruption, or surgical exposure and immediate orthodontic treatment?

MATERIAL AND METHODS

This systematic review was performed according to Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) statement for reporting systematic reviews that evaluate health care interventions. This review has been registered at PROSPERO - International prospective

register of systematic review under the number CRD42014007033.

SEARCH STRATEGY:

The methodology used in this systematic review was based on the PRISMA guidelines (www.prisma-statement.org). In order to identify relevant articles, without limitations on year of publication and language, a search was conducted in the following electronic databases: Scopus, PubMed, Medline EBSCO, Embase, Web of Science, Cochrane, Clinical Trials and in Greyliterature. The search strategy was suited to each database. The following descriptors/ MeSHterms were used: cuspid, canineteeth, caninetooth, tooth, teeth, impacted, canines, maxillary and the key words: displaced, palatally-displaced, surgically exposed. The details of the search strategy are presented in table 1.

ELIGIBILITY CRITERIA OF THE ARTICLES:

In the present systematic review, controlled clinical studies were included, which were conducted with orthodontic patients with fixed appliances, without age limit, with the presence of impacted maxillary canines (P), in whom the procedures of surgical exposure only, or exposure followed by orthodontic traction (I) were performed, comparing these two techniques, or individualized clinical evaluation (C), with the

purpose of placing the canine correctly in the dental arch (O). In order for the articles to be selected and included in this review from the title and abstracts, they had to meet the following inclusion criteria: be a clinical study, have the presence of impacted maxillary canines, which would be under treatment of inclusion in the maxillary arch. The exclusion criteria were: computational studies, case reports, reviews of the literature, didactic books, editorial letters, in addition to studies including patients using systemic drugs, syndromic patients, with history of dental trauma, those who had previously used orthodontic appliances and had been submitted to previous previous treatment attempting exposure or traction of the canine.

The initial selection was made by reading the titles and abstracts of the articles found. Those that were not related to the topic were excluded, as well as those that presented any of the previously established exclusion criteria. Articles of which the title and abstract did not present sufficient information, were downloaded and analyzed completely, in order to be able to take a decision about their eligibility. Those that presented a title within the topic, but had no abstract available, were also obtained and fully analyzed (in cases of those unavailable for downloading, the authors were asked to send them by e-mail). Articles that appeared more than once in a database searched were considered only once. Two

researchers (T.M. and M.S.) made the selections independently and the results were compared, with the purpose of avoiding discrepancies that could occur during data collection. If discrepancies were found between the two evaluators as regards the

inclusion or exclusion of any study, a third evaluator would be added (M.M.P.) in a consensus meeting in order to eliminate the discrepancies.

Table 1. Database, research methods and number of articles obtained.

DATABASE	RESEARCH METHODS	RESULTS
Scopus	canines AND maxillary AND impacted OR cuspid AND (teeth OR tooth) AND impacted AND maxillary OR (canine teeth OR canine tooth) AND impacted AND maxillary	627
PubMed	"canines" AND maxillary AND impacted OR cuspid AND (teeth OR tooth) AND impacted AND maxillary OR ("canine" teeth OR "canine" tooth) AND impacted AND maxillary	366
Medline	canines AND maxillary AND impacted OR cuspid AND (teeth OR tooth) AND impacted AND maxillary OR (canine teeth OR canine tooth) AND impacted AND maxillary	585
Embase	canines AND maxillary AND impacted OR cuspid AND (teeth OR tooth) AND impacted AND maxillary OR (canine teeth OR canine tooth) AND impacted AND maxillary	526
Web of Science	canines AND maxillary AND impacted OR cuspid AND (teeth OR tooth) AND impacted AND maxillary OR (canine teeth OR canine tooth) AND impacted AND maxillary	337
Cochrane	canines AND maxillary AND impacted OR cuspid AND (teeth OR tooth) AND impacted AND maxillary OR (canine teeth OR canine tooth) AND impacted AND maxillary	11
Clinical Trials	canines AND maxillary AND impacted OR cuspid AND (teeth OR tooth) AND impacted AND maxillary OR (canine teeth OR canine tooth) AND impacted AND maxillary	0
Grey literature	canines AND maxillary AND impacted OR cuspid AND (teeth OR tooth) AND impacted AND maxillary OR (canine teeth OR canine tooth) AND impacted AND maxillary	0

The lists of references of selected articles were evaluated to verify whether there was any study that had not previously been found in the searched databases.

In cases in which additional data were necessary, the corresponding authors of the studies were contacted by e-mail, in order to clear up doubts as regards the eligibility criteria.

To be accepted in this review, the articles had to relate one of the techniques, or the comparison of the two in clinical studies, and with this information mentioned in the title or abstract. By clinical studies, one understands any study conducted with patients, irrespective of whether it was retrospective or prospective.

QUALITATIVE EVALUATION AND RISK OF BIAS:

In order to make a qualitative evaluation of the methodology of the articles included in this systematic review, a procedure of scoring was developed from a modification of the one used by Baratieri et al ⁴. In this modification the maximum score of item G was increased to 2 points. Items D, E, F, G and J were adapted to the study of this review. Item L was removed.

The articles accepted were evaluated with regard to the descriptions of the study: characteristics, measurements and statistical analyses. Afterwards they were scored with

regard to the quality of these items of information. For evaluation of the characteristics of studies the criteria used were as follows: Adequate description of the population, description of the selection criteria, sample size, comparison with control group, randomization declared, adequate description of the treatment technique and description of the results with regard to the initial response to orthodontic force, duration of treatment, periodontal reflections, occlusal stability, oral hygiene and esthetics. For evaluation of the measurements of studies, the criteria used were as follows: Appropriate methodology for the objective of the article, and blinding of examiners and statistics. The following criteria were used for evaluating the statistical analysis: Statistical test suitable for the data and presentation of the P value and interval of confidence. The maximum score of 1 point was attributed to the criteria used for evaluating the characteristics of the study, except for the criterion of the description of the results as regards the initial response to orthodontic force, duration of treatment, periodontal reflections, occlusal stability, oral hygiene and esthetics, which received the maximum score of 2 points, bearing in mind the larger quantity of information evaluated in this criterion, as well as its importance in the synthesis of the results. With regard to this criterion, it was filled in completely with score 2 when at least 3 descriptions of the results

were provided, with score 1 if 2 descriptions were provided and with score 0.5 if one description were provided and with no score if no description were provided.

As regards the other criteria used for the evaluation of characteristics, the description of the study population received the maximum score of 1 point when it provided the descriptions of the patients' age, sex and condition; if only two descriptions of these were provided the score attributed was 0.5 and if one or none of these descriptions were provided, no point was attributed. With respect to the description of the selection criteria, comparison with control group, randomization declared, adequate description of the treatment technique, when these were pointed out by the article, it would receive the maximum score of 1 point for each criterion, and when they were not pointed out, the article would receive no score. With respect to sample size, the maximum score of 1 point was attributed, when the number was above 30 participants; the score of 0.5 when the number was between 20 and 30 participants and no score when the number was lower than 20 participants.

The criteria used for evaluation the measurement of the study received the maximum score of 1 point according to the scoring procedure proposed by Baratieri et al⁴. The appropriate methodology for the objective received the score of 1 point when

the article satisfactorily met the criteria of methodology, half a point when the article partially met the criteria, and no score when it did not meet the criteria. The blinding of examiners received the score of 1 point when this was pointed out and no score when it was not pointed out. With regard to the criteria used for evaluating the statistical analysis of the study, these received the maximum score of 1 point. When the statistical test suited to the data and the significance (P-value) were satisfactorily presented, the article received the score of 1 point and when this was not presented, the article received no score. The score ranged from 0 to 12 and the article was classified according to the methodological quality presented as: high quality (≥ 10), moderate quality (≥ 6 and < 10) and low quality (< 6) (Table 2).

RESULTS

A total of 2,452 articles were found during the search in the electronic databases.

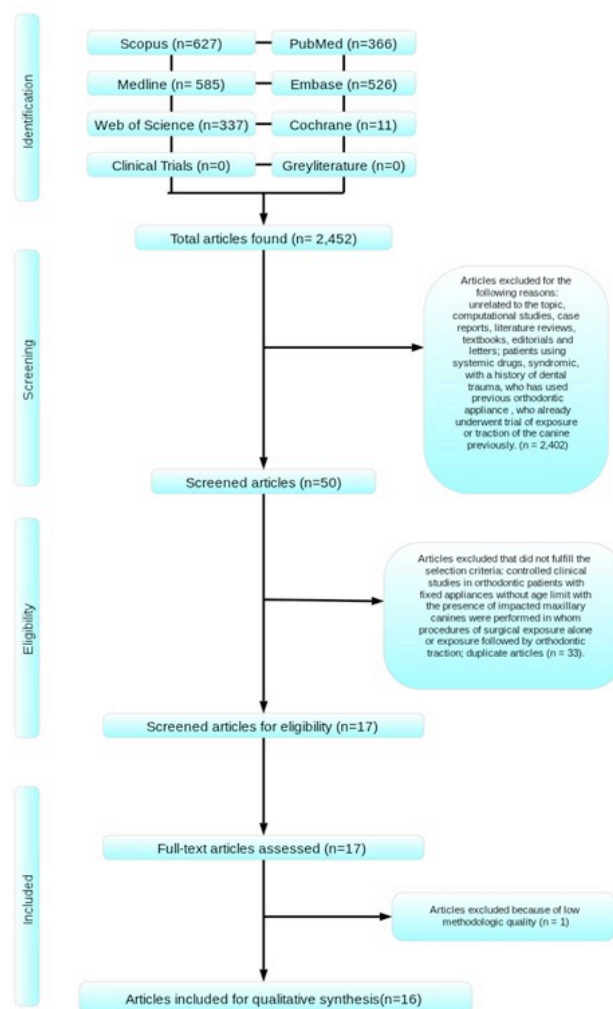
After reading the titles and abstracts, the articles not related to the topic were excluded from this study. Thus, 50 articles were selected. The articles duplicated in the databases were considered only once, so that 17 articles remained. In accordance with the eligibility criteria of this review, 17 articles were included for evaluation of the complete text. Fourteen articles analyzed the technique of surgical exposure followed by orthodontic

traction, 1 article evaluated the exposure technique only, and 1 presented an approach of comparison between the two techniques. Figure 1 illustrates the search results.

Table 2. Qualitative Score Protocol (maximum score, 12 points).

1. Characteristics of Study
A. Adequate description of population (1)
A. Description of selection criteria (1)
A. Sample size (1)
A. Comparison with control group (1)
A. Randomization declared (1)
A. Description of treatment technique (1)
A. Description of results as regards initial response to orthodontic force, duration of treatment, periodontal reflections, occlusal stability, oral hygiene and esthetics (2)
1. Measurements of Study
A. Methodology appropriate for objective of article (1)
A. Blinding of examiners and statistics (1)
1. Statistical Analysis of Study
A. Statistical Test Suited to Data (1)
A. Significance: Presentation of p-Value (1)

Figure 1. Flowchart: results of searches in databases.



As shown in Table 3, the studies were classified according to the methodological quality and scored according to the descriptions presented. The study of Caminiti et al.⁵ was not considered, because it had a low methodological quality. Only 16 articles fulfilled all the selection criteria and had a moderate to high methodological quality,

allowing them to be considered in this systematic review. Of the articles considered, 6 had a high level of evidence⁶⁻¹¹ while 10 had a moderate level of evidence¹²⁻²¹ attributed to them according to the criteria presented in Table 2.

Table 3. Protocol for Qualitative Scoring of Methodology of Articles Analyzed.

	A	B	C	D	E	F	G	H	I	J	K	TOTAL	QUALITY
Caprioglio et al. (2012) ⁵	1	1	1	1	0	1	2	1	0	1	1	10	High
Zasciurinskiene et al. (2008) ⁶	1	1	1	1	0	1	2	1	1	1	1	11	High
Schmidt & Kokich (2007) ⁷	1	1	0.5	1	0	1	2	1	1	1	1	10.5	High
Crescini et al. (2007)	1	1	1	1	0	1	2	1	1	1	1	11	High
Szarmach et al. (2006) ⁹	1	0	0.5	1	0	1	2	1	0	1	1	8.5	Moderate
D'Amico et al. (2003) ¹⁰	1	0	1	1	0	1	2	1	0	1	1	9	Moderate
Caminiti et al. (1998) ¹¹	1	0	1	0	0	1	0.5	1	0	0	0	4.5	Low
Hansson & Rindler (1998) ¹²	1	0	1	1	0	1	2	1	1	1	1	10	High
Blair et al. (1998) ¹³	1	0	0.5	1	1	1	2	1	1	0	1	9.5	Moderate
McDonald & Yap (1986) ¹⁴	0	1	1	1	0	1	2	1	1	1	0	9	Moderate
Boyd (1982) ¹⁵	1	1	0.5	1	0	1	1	1	1	1	1	9.5	Moderate
Wisth et al. (1976) ¹⁶	1	0	1	1	0	1	2	1	0	1	1	9	Moderate
Zafarmand & Gholami (2009) ¹⁷	1	1	0.5	1	0	1	0.5	1	1	1	1	9	Moderate
Woloshyn et al (1994) ¹⁸	0.5	0	1	1	0	1	2	1	1	1	1	9.5	Moderate
Becker et al (1983) ¹⁹	1	0	0.5	1	1	1	2	1	1	0	1	9.5	Moderate
Smailiene et al (2013) ²⁰	1	1	1	1	0	0	2	1	1	1	1	10	High
Tegsjo et al. (1984) ²¹	1	1	1	1	0	1	1	1	0	1	1	9	Moderate

With regard to the criteria as regards description of the population only McDonald and Yap¹⁶ did not obtain a score, because they described only the condition of the patients. Woloshyn et al.²⁰ obtained a score of 0.5 because they did not describe the gender, and the others received the maximum score of 1 point for describing gender, mean age and condition of the patients. In the description of the selection criteria Szarmach et al.¹⁷, D'Amico¹⁵, Hansson and Rindler⁸, Blair et al.¹³, Wisth et al.¹⁹, Woloshyn et al.²⁰ and Becker et al.¹² did not obtain a score because they did

not describe these criteria, while the remainder received the maximum score of 1 point for describing them. did not obtain any score because they did not describe these criteria, while the others received the maximum score of 1 point for describing the criteria. As regards sample size, Schmidt and Kokich⁹, Szarmach et al.¹⁷, Blair et al.¹³, Boyd¹⁴, Zafarmand and Gholami²¹ and Becker¹² received the score of 0.5 for presenting a sample of between 20 and 30 participants, while the other received the maximum score of 1 point, seeing that they presented a sample of

over 30 patients. As far as the comparison with a control group is concerned, all the articles received the maximum score of 1 point for presenting this group. Only Blair et al.¹³ and Becker et al.¹² had randomization declared, and received the maximum score of 1 point, whereas the other articles did not receive any score because they did not present it. In the technical description of the treatment, only Smailiene et al.¹⁰ did not receive any score because they did not comply with this criterion; they only mentioned the technique, but did not describe it, whereas the other articles received the maximum score of 1 point for having described the technique. As regards the criteria of description of the results Zafarmand and Gholami²¹ received score 0.5 for presenting only a description of the results, Boyd¹⁴ and Tegsjø et al.¹⁸ received score 1 for presenting two descriptions of the results, while the other articles received the maximum score of 2 points for presenting 3 descriptions of the results.

All the articles presented an appropriate methodology for the object of the article, and received the maximum score of 1 point. With regard to presenting the criterion of blinding examiners and statistics, Caprioglio et al.⁶, Szarmach et al.¹⁷, D'Amico et al.¹⁵, Wisth et al.¹⁹, Tegsjø et al.¹⁸ did not receive any score because they did not present this, however, the other articles received the maximum score of 1 point for having presented this criterion. In the

presentation of the criteria of an adequate statistical test, Blair et al.¹³ and Becker et al.¹² received no score because of not presenting this, while the other articles received the maximum score of 1 point for having presented adequate statistical treatment in their studies. In the presentation of significance (P-value), only McDonald and Yap¹⁶ received no score because they did not present the P-value, on the other hand, the other articles that received the maximum score of 1 point presented this criterion.

SURGICAL EXPOSURE AND INDEPENDENT ERUPTION:

In the description of the surgical exposure technique associated with independent eruption of impacted maxillary canines, one article was analyzed. The duration of treatment consisted of 2 years and 11 months. After eruption of the canines, orthodontic force necessary to promote an initial response to displacement of the canines was measured as light and continuous, however, no exact source of the value was provided. As far as the periodontal reflections were concerned, the roots of the canines showed a reduction of 1.08 mm ($p=0.025$), and there was a little bone loss ($p=0.025$). As regards oral hygiene, the plaque index did not reveal any significant value (P; NS=not significant) when compared with the adjacent

teeth. The variables occlusal stability and esthetics were not evaluated.

SURGICAL EXPOSURE AND IMMEDIATE ORTHODONTIC TREATMENT:

For the articles that described the combined technique of surgical exposure and immediate orthodontic treatment, the results demonstrated that as far as duration of treatment was concerned, this ranged from 6 to 32.19 ± 11.73 months according to the severity of the cases, since both unilaterally and bilaterally impacted canines were reported. Moreover, the orthodontic force was measured with light and continuous traction with a value ranging between 20 g and 150 g.

As regards the periodontal reflections, the probing depth was shown to be at normal levels, ranging from an increase of 0.18 ($p < 0.0001$) to 1mm ($p < 0.05$); there was an increase in stress on the periodontal tissue¹¹, a lower level of marginal bone that went from 1.5 to 2 mm ($p < 0.05$; ns)⁸, a loss of inserted gingiva of between 0.4 mm ($p < 0.05$) to 0.6 mm ($p \leq 0.2$); the strip of keratinized tissue varied from 0.28 mm ($p < 0.0028$) to 0.5 mm ($p \leq 0.4$) greater. The occlusal stability acquired with treatment was evaluated and there was an insignificant increase in spaces and giroversions; differences at the level of 5% were found as regards the canine guide (46% in the canines previously impacted unilaterally, 42% bilaterally and 74% normally

erupted canines)¹⁵ and a significant number of canines were judged as being extruded²⁰. The oral hygiene indices ranged from 0.12 ($p < 0.001$) to 0.7 ($p < 0.05$), values considered normal. In the evaluation of esthetic perception, it was considered good in 57% of the patients treated¹⁵; there was no difference in color of the treated teeth and those in the control group ($p > 0.05$)¹³. However, in one study it was related that a significant proportion of the canines in the test group were considered discolored ($p < 0.05$)²⁰.

COMPARATIVE STUDY:

One article comparing the two treatment techniques with a control group was found. The duration of treatment was longer in the group subjected to the combined technique of surgical exposure and immediate orthodontic treatment, corresponding to 32.19 ± 11.73 months, whereas it was 28.41 ± 4.96 months for the exposure technique combined with independent eruption. The orthodontic force used to promote the initial response was measured as being light and continuous. Pocket depth was greater in the previously impacted canines, being equivalent to 2.2 ± 0.55 mm, whereas in the control group this value corresponded to 2.01 ± 0.42 mm ($p < 0.05$). Differences in gingival recession and bone support were found between the groups (p ; NS=not significant) and a larger strip of keratinized gingiva was observed in the group

submitted to exposure and independent eruption ($p < 0.05$)¹⁰. Oral hygiene was evaluated as being good in all patients. No

variables were dedicated to occlusal stability and esthetics ($p > 0.05$).

Table 4. Description of studies included.

Author	PARTICIPANTS		Condition	INTERVENTION
	Total	Mean Age		Type of treatment
Caprioglio et al. (2012)	33(24F/9M)	16.3 yrs	Availability for submission to research and presence of all records.	Surgical exposure followed by Orthodontic traction
Zasciurinskiene et al. (2008)	32(22F/10M)	12 - 42 yrs	Patients treated by one of the authors (DS) during a period of 4 years and underwent surgery with closed eruption technique according to Kokich and Mathews.	Surgical exposure followed by Orthodontic traction
Schmidt e Kokich (2007)	22	23.7 yrs	Patients identified consecutively in 5 Orthodontic consulting practices with at least one previous palatally- impacted canine.	Surgical exposure and Independent eruption
Crescini et al. (2007)	125(94F/31M)	12.8-52 yrs	Patients with permanent maxillary canine impaction in bone associated with contralateral canine erupted normally and with indication of direct orthodontic traction of impacted canine to center of alveolar crest.	Surgical exposure followed by Orthodontic traction
Szarmach et al. (2006)	24(19F/5M)	18.4±3.66	Patients w/permanent maxillary canines impacted unilaterally.	Surgical exposure followed by Orthodontic traction
D'Amico et al. (2003)	61(38F/23M)	12.8 yrs	Children chosen from list of children referred to clinic specialized in Orthodontics because of retained maxillary canines.	Surgical exposure followed by Orthodontic traction
Hansson and Rindler (1998)	42(27F/15M)	19- 59 yrs	Majority of patients treated by one of the authors in private dental office and others seen by one of various orthodontists in Public Health Dental Service orthodontic clinic in Orebro.	Surgical exposure followed by Orthodontic traction
Blair et al. (1998)	25(22F/3M)	14.4 yrs	30 canines treated, 15 on each side of mouth, 29 being considered successfully treated and one 1 with clinically bad position.	Surgical exposure followed by Orthodontic traction
McDonald and Yap (1986)	64	Not mentioned	Patients who participated in a combined oral surgery and orthodontic clinical practice, with 20 canines impacted bilaterally and 44 unilaterally.	Surgical exposure followed by Orthodontic traction
Boyd (1982)	20(13F/7M)	14-27 yrs	Each patient with a palatally-impacted maxillary canine and non impacted maxillary canine before orthodontic treatment; each patient treated orthodontically and the impacted canine surgically exposed.	Surgical exposure followed by Orthodontic traction
Wisth et al. (1976)	34(19F/5M)	14.3 yrs	14 impacted canines on left side and 20 on right side, patients with Angle's Class I occlusion without space problems.	Surgical exposure followed by Orthodontic traction
Zafarmand and Golami (2009)	20(10F/10H)	13-20 yrs (men) and 15-18 yrs (women)	Patients with one palatally- impacted maxillary canine and one normally erupted canine.	Surgical exposure followed by Orthodontic traction
Woloshyn et al. (1994)	32	22.11 yrs	Patients with palatally-impacted canines unilaterally and who underwent a minimum of three months post-treatment, from files of 6 private orthodontic practices.	Surgical exposure followed by Orthodontic traction
Becker et al. (1983)	23(14F/9M)	14.48 yrs	Patients treated Orthodontically due to unilateral impaction of one maxillary canine.	Surgical exposure followed by Orthodontic traction
Smailiene et al. (2013)	45(35F/8M)	18.6 ± 3.45 (group 1) 19.7 ± 4.37 (group 2)	Patients with palatally- impacted maxillary canines unilaterally.	Group 1- Surgical exposure and Independent eruption Group 2- Surgical exposure followed by Orthodontic traction
Tegsjo et al. (1984)	54(28F/22M)	12.9 yrs	Patients with exposure of palatally-impacted maxillary canines performed unilaterally	Surgical exposure followed by Orthodontic traction

DISCUSSION

This systematic review was centered/focused on the long term results as a result of the treatment of impacted maxillary canines using the techniques of surgical exposure only, and exposure followed by orthodontic traction. This study included only controlled clinical studies conducted in orthodontic patients who had fixed appliances, without limit on age, and with the presence of impacted maxillary canines. In the controlled clinical studies included⁵⁻²¹, one sought to compare the results of treatments using one of the mentioned technique for the displacement of impacted canines to the correct position in the dental arch (Table 4).

In the individualized evaluation of the techniques the article that approached the technique of surgical exposure combined with independent eruption revealed some pertinent information for analysis, such as the duration of treatment (2 years and 11 months), periodontal reflections, such as the reduction in canine roots (1.08 mm), probing depth (0.2 mm) and small bone loss when compared with the control group (untreated contralateral canine)⁹. Nevertheless, some variables were not described, such as occlusal stability and esthetics, minimizing comparisons, which added to the scarcity of studies with reference to the technique, did not show sufficient evidence to explain the procedure and its use.

The articles that showed the technique of exposure surgery associated with immediate orthodontic treatment revealed a mean duration of treatment of 6 to 32.19±11.73 months^{6-8,10-12,16,17,19}, light^{8,11,13} and continuous^{10,16,20} orthodontic force of 3-4 oz⁶, between 20 and 30g¹², 30g¹⁹, and 150g⁷. The periodontal reflections were described, but there were no significant alterations when compared with the control group, and this was so with oral hygiene as well. The occlusal stability evaluated demonstrated a significant number of extruded canines as being a relevant alteration²⁰. In general, esthetics were good in 57% of the patients treated¹⁵, in spite of a percentage of canines presenting a degree of discoloration²⁰.

In the comparison between the two techniques, it is valid to point out that differences were observed in the duration of treatment, which was lower in the technique of surgical exposure and independent eruption; a result that generated a certain amount of surprise on being evaluated, seeing that it is stated in the literature that orthodontic forces produce faster results. However, this fact may be justified as a result of the orthodontic force applied frequently exceeding the limit of force considered for induced tooth movement, or also the fact that when cases of badly positioned canines occur, greater preference is given to the post-exposure traction technique.

The independent eruption technique also presented better periodontal reflections, such as a larger strip of inserted gingiva after the canines were established in position, a fact that may be justified by the non application of force that exceeds the physiological limit. Bone support and oral hygiene showed no differences between the groups. The evaluation could not be complete, since the variables of occlusal stability and esthetics were not assessed.

As far as the duration of treatment is concerned, in the individualized evaluation of the technique, the duration of treatment was longer in the exposure only technique, while the other results showed no significant differences when compared between the techniques. It was not possible to compare occlusal stability and esthetics because they were not described in the study of exposure only. In the comparative evaluation, the duration of treatment was shown to be longer in the technique of exposure followed by traction, and there were not significant differences between the other results. Bearing in mind the restricted number of articles evaluating the technique of surgical exposure and independent eruption, it is indispensable to conduct further studies that prioritize its use as a clinical intervention, in order to favor better evaluations that provide an evidence-based position. In general, the articles presented good methodological quality,

ranging from moderate to high, which had a repercussion on the quality of the information analyzed.

CONCLUSION

By conducting this systematic review, it could be inferred that: (1) The information analyzed in this study demonstrated good methodological quality, and allowed one to conclude that in spite of presenting satisfactory results for the treatment of impacted maxillary canines, there was not sufficient evidence to support the use of the technique of surgical exposure and independent eruption, as the technique that presents the most favorable results, considering the reduced number of studies evaluating this technique; (2) The technique of surgical exposure and immediate Orthodontic treatment has been most used in clinical interventions and its repercussion on the alignment of impacted maxillary canines, did not show significant differences when the results were compared with those of the control group; (3) Further researches are necessary in order to make it possible to understand the technique that presents the best results for the displacement of canines to their correct position in the dental arch.

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