Undergraduate dental students' use perception of different endodontic instruments for mechanical – chemical preparation: a systematic review of laboratory studies

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ABSTRACT

This literature review aimed to compare undergraduate dental students' perceptions regarding the use of nickel–titanium (NiTi) and stainless steel instruments for the mechanical-chemical preparation of root canals, focusing on quality and time. PubMed, LILACS, Scopus, Embase, SciELO, and CENTRAL electronic databases were accessed to verify and select related studies published as of January 2021. Laboratory studies comparing the use of NiTi instruments with stainless steel instruments by undergraduate dental students were evaluated. Two reviewers independently selected the studies, collected the data, and analyzed the risk of bias. Out of the 92 potentially relevant studies, 10 met the inclusion criteria for a full-text analysis and were subsequently included in the systematic review. The risk of bias was considered high in all studies. Undergraduate dental students demonstrated a greater preference for and better perception of NiTi instruments. NiTi instruments also resulted in less time for and better quality of the mechanical-chemical preparation. These were associated with a lower incidence of accidents, such as canal ledges, transportations, and deviations, as well as a higher incidence of instrument fractures.

Descriptors: Stainless Steel. Endodontics. Students, Dental. Root Canal Preparation. Systematic Review.

1 INTRODUCTION

Undergraduate dentistry programs teach endodontics to help dental students develop manual skills, beginning with preclinical training in cases ranging from lower to greater complexity. Carrying out procedures in this area of dentistry is reported to be the most technically difficult[1]. Out of all the stages of endodontic therapy, the mechanical-chemical preparation of root canals is reported to be the most challenging by undergraduate students[2].

Given the characteristics of the nitinol alloy, such as its tremendous flexibility, the use of nickel–titanium (NiTi) instruments is associated with a lower rate of transportation and better maintenance of the original shape of the canal, a lower incidence of accidents during the procedure[3,4], and less apical extrusion compared with the use of manual stainless steel instruments[5]. As such, Brazilian professionals prefer the use of NiTi instruments in their clinical practice. A recent survey found that 88% of dentists (66% specialists in endodontics) report the use of mechanized instrumentation[6].

Therefore, with the implementation of NiTi endodontic instruments on the rise, the contributions of the continued teaching and practice of preparations with stainless steel instruments is called into question. These instruments are associated with a greater incidence of ledges, longer instrumentation times, and risk of perforations and deviations[4,7]. Meanwhile, despite the reported advantages of NiTi instruments, their use in practical undergraduate activities remains minimal, mainly owing to their higher costs[6,8].

The root canal instrumentation stage for successful endodontic treatments and education that reflects technological advances are both relevant to the patient's comfort and successful treatment and to the future professional's informed development. This systematic review aimed to compare undergraduate dental students' perceptions on the use of NiTi instruments and stainless steel instruments, focusing on the quality of and time spent for the mechanical-chemical preparation of root canals.

2 METHOD

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines[9] and was registered in the International Prospective Register of Systematic Reviews (Registration no. CRD42021242066).

PICO question

The following research question was formulated to address the literature and outline the search strategy: Is there a difference in undergraduate dental students' perceptions on the use of NiTi instruments and stainless steel instruments regarding the quality of and time for the mechanical-chemical preparation of root canals? The research question applied the PICO strategy (population [P], intervention [I], comparison [C], and outcome [O]) as follows: P = undergraduate dental students; I = use of NiTi instruments; C = use of stainless steel instruments; and O = perception of the use of the instrument with respect to the quality of and time for mechanical-chemical preparations.

Search strategy

The literature search was performed in the Medical Literature Analysis and Retrieval System Online (MEDLINE) databases via PubMed, Latin American and Caribbean Health Sciences Literature (LILACS), Scopus, Embase, Scientific Electronic Library Online (SciELO), and Central Register of Controlled Trials (CENTRAL) to verify and select laboratory studies related to the research

question that had been published by January 2021. We set no restrictions as to language or year of publication.

The search strategy used to locate studies related to the subject was based on a search in the PubMed/MEDLINE database: ((((Students, Dental[MeSH Terms]) OR (Dental Student*)) OR (Undergraduate Student*)) AND ((((((titanium nickelide) OR (Ti-Ni)) OR (nickel-titanium alloy)) OR (nickel-titanium)) OR (nickel-titanium endodontic file)) OR (nickel-titanium endodontic instrument))) AND ((((Stainless Steel[MeSH Terms]) OR (Stainless Steel)) OR (Stainless Steel endodontic file)) OR (Stainless Steel endodontic instrument)). This search strategy was then adapted to the other databases, and duplicates were identified and eliminated from the search results.

Selection criteria

Two independent reviewers (J.A.S. and B.N.P.) carefully reviewed the titles and abstracts of all the results found and then selected those that met the inclusion criteria for further review, namely laboratory studies that compared the use of NiTi instruments with the use of stainless steel instruments by undergraduate dental students. The Kappa index was utilized to calculate inter-examiner agreement, yielding a value of 0.97.

All studies meeting the inclusion criteria were selected and read in full for an evaluation based on the exclusion criteria, namely studies that did not consider the outcomes of use perception on the quality of or time for mechanical-chemical preparation in endodontic treatments and that had used deciduous teeth. Studies that were not found in full were also excluded. For both steps, the examiners evaluated the studies independently, and any disputes were first settled by discussion. If the discussion persisted, a third author (S.B.L.) was consulted.

Data extraction

The two reviewers (J.A.S. and B.N.P.) collected the following data from the selected studies: publication data (authors, year, and country of origin); sample characteristics (institution, graduation year and operators' experience, number of operators, number of root canals per group, and characteristics of the experimental models); methodology (instruments used and assessment method); and outcomes.

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Risk-of-bias analysis

The risk-of-bias assessment was performed based on the Cochrane Handbook for Systematic Reviews of Interventions version 6.2[10]. Since this review included only laboratory studies, the criteria were adapted to allow for a critical analysis. In addition to the general risk of bias, our assessment considered five domains: randomization of the groups, use of NiTi instruments according to the manufacturer's instructions, standardization of the chemical protocol in different experimental groups, blinding, and examiners' calibration.

Based on an adaptation of the Risk of Bias 2.0, the studies were classified as follows: low risk, some concerns, and high risk. For Higgins *et al*. (2021)[10], studies with a "high risk of bias" in at least one domain or "some concerns" in multiple domains are classified as having a high risk of bias. For a study to be classified with a low risk of bias, all domains must be assessed as having a "low risk of bias."

3 RESULTS

The results of this systematic review are based on information provided by the study authors. Additional information was requested

from seven authors[11-17] for the risk-of-bias assessment. They were contacted by email, and two responded to the requests[11,15].

Study selection

The search strategy resulted in 92 potentially eligible studies. Figure 1 presents the PRISMA flowchart and describes the study selection process. After removing the duplicates, we selected 63 studies for analysis. We found that 52 of these did not meet the inclusion criteria, as 42 did not assess undergraduate students, 23 did not use NiTi instruments, 32 did not use stainless steel instruments, and 17 were not *in vitro* studies. Therefore, 11 articles were selected. One article was not found for a full-text analysis and was excluded. Thus, 10 studies were included in this systematic review.

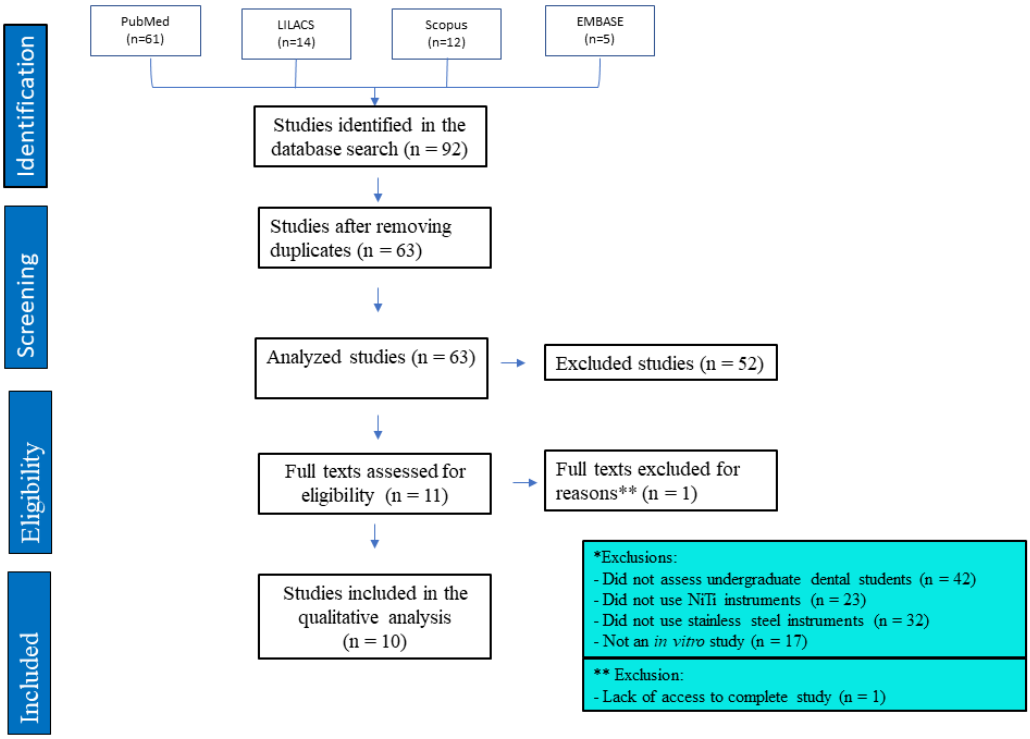

Figure 1. Flowchart of the study

Characteristics of the studies

Nine of the included studies were in English and one was in Portuguese. All were published between 1995 and 2018. The studies included extracted permanent human teeth[11,14,15,17,18,20] or simulated root canals[12,13,16,19].

The most often tested mechanized systems were ProTaper (Dentsply Maillefer)[16,17,20] and Wave One (Dentsply Maillefer)[17,20], respectively, whereas the most often used manual instruments were Flexofile® (Dentsply Maillefer)[11,13,14] and K-files (Dentsply Maillefer)[14,16,19].

Most studies observed undergraduate dental students with no experience in root canal preparation with mechanized systems who underwent training with both instruments, except for the study by Jungnickel *et al.* (2018)[20], which examined operators who had prior experience with ProTaper instruments. The characteristics and results of the selected studies are presented in Tables 1 and 2, respectively.

Table 1. Summary of collected data on the characteristics of the studies included in this systematic review

Study, country	No. of root canals per group	Experimental model	Number of operators	Operators' experience, university	Applied tools	Method to assess preparation quality and perception	Assessed variables
Himel *et al.* (1995), USA	81	Simulated canals with 40º curvature	76 students	Without prior knowledge, University of Tennessee	K-file nitinol (Quality Dental Products) K-file (Caulk/Dentsply Supply Co.)	Photography	Quality (CT, ledge, zip, structural wear) Preparation time
Gluskin, Brown and Buchanan (2001), USA	27	Extracted human teeth, no curvature information	27 students	Novice, University of the Pacific School of Dentistry	Greater Taper™ (Dentsply/Tulsa Dental) Flexofiles® and Gates Glidden burs (Dentsply/Maillefer)	Radiography	Quality (instrument fracture, canal transportation and changes in canal area) Preparation time
Sonntag *et al.* (2003), Germany	105	Simulated canals with 40º curvature	21 students	No practical experience in canal preparation, Philipps University	FlexMaster® (VDW, Munich, Germany) Flexicut® (VDW)	Photography Questionnaire	Quality (fracture, CT, canal transportation, apical foramen status, zips, elbows, ledge) Preparation time Use perception (easy to learn and sense of security)
Faria, Rocha, and Perez (2006), Brazil	15	Simulated canals with 40º curvature	5 students	Pre-clinical students with good practical performance in manual techniques but without practical experience in automated techniques, Federal University of Pará and University Center of the State of Pará	Flexofile® and Gates Glidden® (Dentsply-Maillefer, Ballaigues, Switzerland) Quantec® (Analytic Technology)	Radiography	Quality (apical deviation)
Georgelin-Gurgel *et al.* (2008), France	52	Extracted human teeth with curvature <20º	26 students	Inexperienced third-year students, Dental Faculty of Toulouse	HeroShaper® (MicroMega) Helifile® (MicroMega)		Quality (working length, instrument fracture, and apical foramen)
Leonardi *et al.* (2012), Brazil	21	Extracted human teeth with curvature <20º	42 students	Second-year students with no experience in pre-clinical endodontics, Universidade Positivo	Flexofile® and K-file (Dentsply-Maillefer) Profile.04 (Dentsply-Maillefer	Radiography Cone-beam computed tomography	Quality (instrument fracture, ledge, deviation, and changes in canal cross-sectional area) Preparation time
Alves *et al.* (2013), Brazil	60	Extracted human teeth with moderate curvature 4 < radius <8	2 students	No experience preparing curved canals, Federal University of Goiás	K-Flex (Dentsply-Maillefer) K3 (SybronEndo) BioRace (FKG Dental)	Radiography Cone-beam computed tomography	Quality (instrument fracture, canal transportation, and perforation) Preparation time
Alrahabi (2015), Saudi Arabia	90	Simulated canals with 40º curvature	30 students	Third-year students with no experience in root canal preparation/ Taibah University Dental College	K-file (Dentsply Maillefer) ProTaperUniversal (Dentsply Maillefer)	Photography	Quality (instrument fracture, ledge, and changes in canal area) Preparation time
Kwak *et al.* (2016), South Korea	81	Extracted human teeth with curvature <20º	81 students	Second-year students with no experience in preparation with NiTi, Pusan National University	ProTaperUniversal (Dentsply Maillefer) Wave One (Dentsply Maillefer) Stainless steel	Questionnaire	Quality (instrument fracture) Preparation time Use perception
Jungnickel *et al.* (2018), USA	20	Extracted human teeth with curvature <20º	4 students	Fourth-year students with prior experience with PTU, Cornell University	ProTaperUniversal (Dentsply Sirona) ProTaperNext (Dentsply Sirona) WaveOne (Dentsply Sirona) K-flex (Kerr Dental, Orange)	Radiography	Quality (lateral sealing, instrument fracture, and working length) Treatment time

Table 2. Results of studies included in the systematic review

Study	Use perception	Preparation quality	Preparation time
Himel *et al.* (1995)	Not applicable	NiTi: more working length maintenance, no ledges Stainless steel: ledges in 30.4%, greater structural removal	No statistically significant difference: NiTi, 32.9 min.; stainless steel: 38.8 min.
Gluskin, Brown, and Buchanan (2001)	Not applicable	NiTi: 2 instrument fractures, better canal centering Stainless steel: no instrument fractures, greater structural removal	NiTi: 5.9 ± 3.1 min. Stainless steel: 23.2 ± 9.0 min.
Sonntag *et al.* (2003)	NiTi: easier to learn and a sense of security	NiTi: 14 instrument fractures, more working length maintenance Stainless steel: 2 instrument fractures, higher incidence of aberrations and canal transportations	NiTi: 12 ± 5.6 min. Stainless steel: 24 ± 9.1 min.
Faria, Rocha, and Perez (2006)	Not applicable	No statistically significant difference NiTi: 5 deviations Stainless steel: 6 deviations	Not applicable
Georgelin-Gurgel *et al.* (2008)	Not applicable	NiTi: 8 instrument fractures Stainless steel: no instrument fractures No significant difference for other negative events	Not applicable
Leonardi *et al.* (2012)	Not applicable	No statistically significant difference for root canal cross-sectional area No instrument fractures, ledges, deviations	NiTi: 21.2 ± 10.0 min. Stainless steel: 25.4 ± 9.2 min.
Alves *et al.* (2013)	Not applicable	NiTi: 7 instrument fractures Stainless steel: no instrument fractures, higher incidence of root canal transportation	NiTi: 17 ± 6 min. (Bio Race) 30 ± 11 min. (K3) Stainless steel: 43 ± 15 min.
Alrahabi (2015)	Not applicable	NiTi: higher incidence of instrument fractures Stainless steel: greater incidence of ledges, structural removal, and canal transportation	NiTi: 7.33 ± 0.20 min. Stainless steel: 17.24 ± 0.42 min.
Kwak *et al.* (2016)	NiTi: best results for flexibility and sense of security (PTU), 71% preference and greater sense of screw-in effect (WO) Stainless steel: worst results for ease of use, flexibility, cutting efficiency, sense of security, and instrumentation time	NiTi: 4 instrument fractures (PTU and WO)	NiTi: 4.75 ± 1.9 min. (PTU) 2.25 ± 1.5 min. (WO)
Jungnickel *et al.* (2018)	Not applicable	No statistically significant difference for working length maintenance and no instrument fractures NiTi: no statistical difference in lateral sealing quality between PTU, PTN, and WO Stainless steel: Worst lateral sealing quality	NiTi: 9.43 min. (PTU) 7.25 min. (PTN) 5.64 min. (WO) Stainless steel: 10.89 min.

All 10 studies evaluated the quality of the root canal preparation based on working length maintenance, changes in canal shape, and incidence of instrument fractures, canal ledges, or transportation. Nine studies used radiographic images[11,13-15,18,20], photographs[12,16,19], or cone-beam computed tomography[14,15]. All images were captured in two moments: before and after the root canal preparation.

Five[11,12,15,16,18] of the eight studies that observed instrument fractures reported a higher incidence of the event in preparations with rotary NiTi systems. Meanwhile, two[14,20] did not observe fractures in the analyzed groups, which can be explained by the students' previous experience with the ProTaper Universal system[20]. There was a higher incidence of fractures in root canals prepared with the ProTaper Universal system compared with the reciprocating system (WaveOne)[17].

Four studies investigated ledge formation during root canal preparation. A higher incidence of the event was detected in canals prepared with stainless steel instruments in two studies[16,19]. However, Sonntag *et al.* (2003)[12] and Leonardi *et al.* (2012)[14] found no statistically significant difference between groups.

NiTi instruments demonstrated a higher percentage of working length maintenance in the evaluations by Himel *et al.* (1995)[19] and Sonntag *et al.* (2003)[12]. This was analyzed by four studies, and two[18,20] did not find differences between groups.

Canal centering was assessed in 50% of the studies. Preparation with NiTi instruments resulted in more centralized canals in three studies[11,12,15], whereas two did not find a statistical difference for apical foramen displacement[13,18]. Greater removal of dentin structure and widening of the root canal toward the risk zone were identified by three studies[11,16,19] in manual instrumentation. Leonardi *et al.* (2012)[14] observed that the preparations followed the original canal shape with both systems.

Preparation time was analyzed in 80% of the studies[11,12,14-17,19,20]. Preparing root canals took less time with rotary and reciprocating NiTi instruments, except in one study[19], which found no statistically significant difference between groups.

Questionnaires were applied to assess the operators' use perception[11,17]. The evaluation criteria included ease of use and teaching, sense of security, flexibility, cutting efficiency, and screw-in effect. Dental students with no experience with NiTi instruments presented better evaluations for mechanized preparations than for manual preparations with stainless steel. NiTi offered greater ease of learning and use, as well as a greater sense of security, flexibility, and cutting efficiency. The students also noted shorter instrumentation times compared with manual preparation.

Risk-of-bias analysis

Table 3 summarizes the risk-of-bias assessment of the included studies. All of the 10 articles presented a high risk of bias.

4 DISCUSSION

The mechanical-chemical preparation involves cleaning and modeling root canals and determining factors for a successful endodontic treatment[21]. Assessing *in vivo* endodontic therapy is made complex by different factors that influence clinical and radiographic success, such as pulp condition, presence of apical periodontitis, extent of lesion, tooth group and number of canals, complications, and apical extension of obturation[22]. In addition, *in vitro* studies may provide more objective information about the quality of root canal preparation without the influence of factors related to the patient, the clinical situation, or the treatment itself (number of sessions). Therefore, this systematic review only included studies that examined *in vitro* root canal preparations.

Table 3. Risk-of-bias assessment according to an adaptation of the Cochrane risk-of-bias tool for randomized trials

Study	Randomization of teeth or root canals	Use of NiTi instruments per the manufacturer's instructions	Standardization of auxiliary chemical protocol in the different experimental groups	Blinding of examiners	Examiners' calibration	General risk of bias
Himel *et al.* (1995)	High risk	High risk	High risk	High risk	High risk	High risk
Gluskin, Brown, and Buchanan (2001)	High risk	Low risk	Low risk	Low risk	Low risk	High risk
Sonntag *et al.* (2003)	Low risk	Low risk	Low risk	Low risk	High risk	High risk
Faria, Rocha, and Perez (2006)	High risk	High risk	Low risk	High risk	High risk	High risk
Georgelin-Gurgel *et al.* (2008)	High risk	Low risk	Low risk	High risk	Low risk	High risk
Leonardi *et al.* (2012)	High risk	High risk	Low risk	High risk	High risk	High risk
Alves *et al.* (2013)	High risk	Low risk	Low risk	Low risk	Low risk	High risk
Alrahabi (2015)	High risk	Low risk	Low risk	High risk	High risk	High risk
Kwak *et al.* (2016)	High risk	Low risk	Low risk	Not applicable	Not applicable	High risk
Jungnickel *et al.* (2018)	High risk	Low risk	Low risk	Low risk	Low risk	High risk

Of the various methods employed in the studies to assess preparation quality, radiography and photography are similar in that they provide two-dimensional images of the analyzed structures. Computed tomography is believed to allow for a better assessment of the internal morphology of the root canal before and after preparation as the area of interest can be observed in three dimensions[23]. The ability to diagnose errors during mechanical-chemical preparation via radiography and computed tomography was compared, and no significant difference was found. One case classified as a canal transportation based on a periapical radiograph was identified as a perforation on the tomographic image[15].

Among the adverse events that occurred during root canal preparation, the fracture of NiTi instruments is reported as one of the greatest limitations of the system. Fractures may be caused by cyclic fatigue or torsion related to the operator's lack of knowledge and experience[11,15-18]. The results of the studies in this systematic review corroborate this argument: fracture was the most frequent error in rotary instrumentation. Furthermore, only two studies[12-16] reported fractures in stainless steel instruments.

Sonntag *et al.* (2003)[12] found that the

fracture rates of rotary instruments exceed the clinically acceptable level due to the improper use of the instruments. They evaluated manual instrumentation prior to preparation with rotary instruments and compared it with rotary instrumentation followed by manual instrumentation. Given the incidence of the event in both groups, they concluded that prior experience with the manual system does not improve the quality of preparation with NiTi rotators. The use of simulated canals with accentuated curvatures may also have contributed to this result; any unfavorable anatomy of the root canal system makes mechanical-chemical preparation difficult. NiTi instruments fracture with less use as the radius of curvature decreases and the angle increases[24].

The lack of adverse events in the study by Leonardi *et al.* (2012)[14] was explained by instrumentation limited to incisors without curvatures. Preparing canals with greater curvature is more complex, and the probability of accidents during instrumentation increases. Therefore, the degree of curvature of the canals analyzed by the studies of this systematic review must be considered[25]. Four studies[14,17,18,20] used dental samples with curvatures less than 20º, and another four[12,13,16,19] analyzed preparations performed in simulated root canals with a curvature of 40º[26]. In the studies that evaluated the instrumentation for canals with an accentuated curvature, the authors reported greater ledge formation, canal transportations, loss of working length, and excessive removal of dental structures with the use of stainless steel instruments.

Stainless steel instruments are more rigid compared with NiTi instruments, resulting in more difficulty when preparing curved canals[27]. The formation of ledges with stainless steel instruments can occur because of the use of non-precurved instruments or files under the working length, which cause canal blockages that result in incomplete cleaning and preparation, thus impairing the results of the endodontic treatment[16].

The results regarding root canal transportation and structural wear of the dentin after instrumentation[11,12,15,16,19] confirm previous results[5,28] that found a higher incidence of root canal transportations and excessive wear in manual stainless steel instrumentation. Mechanical-chemical preparation with NiTi instruments, even by inexperienced operators, allows for greater maintenance of the original canal shape and does not cause excessive removal of structural dentin[11,12].

The root canal is widened so that it can be cleaned and prepared for the purpose of adequate obturation; however, excessive wear of the dentin weakens the root and can cause accidents, such as perforations[19,29]. Stainless steel instruments are more rigid and have a greater tendency to straighten canal curvature, resulting in greater widening toward the inner wall of the root canal[11,15,16].

One of the most common methods for assessing the success of the technical aspects of endodontic therapy is by maintaining the working length between 0 and 2 mm below the radiographic apex, as observed in most canals prepared with NiTi instruments in the studies by Himel *et al.* (1995)[19] and Sonntag *et al.* (2003)[12]. Although prior experience with manual preparation does not have an impact on improving the quality of preparation with NiTi instruments, maintaining the working length is associated with enhancing the students' experience[12]. Since more experience has a positive impact on quality and on reducing preparation time[15,20], intensive preclinical training with rotary instrumentation is required for dental students[18].

Alves *et al.* (2013)[15] and Jungnickel *et al.*

(2018)[20] used samples with a smaller number of operators; however, they prepared a greater number of canals compared with the other studies in this systematic review. Mechanical-chemical preparation for a greater number of canals may be influenced by the operators' experience relative to quality and preparation time.

Performing root canal preparation in less time results in less operator fatigue and better patient comfort, in addition to streamlining care and improving the cost–benefit ratio[11,30]. The results found in the studies in this systematic review revealed that NiTi instruments reduce preparation time, which may be caused by the greater ease in cutting the dentin. Additionally, systems with fewer instruments resulted in faster preparations[12,15,17,20].

The results found[12,17] in relation to the students' usage perception of NiTi instruments corroborate the findings of Abu-Tahun *et al.* (2016)[33], in which 100% of the students reported a preference for rotary instruments, indicating the ease these offered in completing the preparation as a possible reason for their satisfaction. Moreover, they pointed to the need to introduce rotary NiTi instruments in undergraduate education. Root canal preparation techniques must be updated to ensure continued education. However, many universities are slow to recognize the need to teach new technologies. Furthermore, greater experience has a positive impact on the quality and on reducing instrumentation time, thus requiring intense preclinical training prior to the introduction of rotary NiTi instruments in the clinical practice of an undergraduate education in dentistry.

Despite the better results with NiTi instruments, manual files can provide a better tactile sensation, and a combination of manual and rotary instruments[31] should be recommended. In addition, the results presented in this systematic review should be considered with caution as all the studies presented a high general risk of bias. This indicates that greater methodological attention should be applied in relation to the randomization of groups and calibration and blinding of examiners.

5 CONCLUSION

Undergraduate dental students reported greater ease of use and learning and a greater sense of security with NiTi instruments compared with stainless steel instruments. Moreover, preparations with NiTi instruments are made in less time with a lower incidence of accidents, such as canal ledges, transportations, and deviations, but are also associated with a higher incidence of instrument fracture.

RESUMO

Percepção de uso e preparo químico mecânico realizado com diferentes instrumentos endodônticos por estudantes de graduação em Odontologia: uma revisão sistemática de estudos laboratoriais

O estudo revisou a literatura existente com o objetivo de comparar a percepção de uso, qualidade e tempo do preparo químico mecânico de canais radiculares realizado por estudantes de graduação em Odontologia com instrumentos de níquel-titânio (NiTi) e aço inoxidável. Para isso, as bases de dados eletrônicas PubMed, LILACS, Scopus, Embase, SciELO e CENTRAL foram acessadas para verificar e selecionar estudos relacionados com a questão de pesquisa publicados até janeiro de 2021. Estudos laboratoriais que compararam o uso de instrumentos de NiTi com aço inoxidável por alunos de graduação em Odontologia foram avaliados. Dois revisores independentemente selecionaram os estudos, coletaram os dados e analisaram o risco de viés. Dos 92 estudos potencialmente relevantes, 10 atenderam aos critérios de inclusão para análise de texto completo e, posteriormente, incluídos na revisão sistemática. O risco de viés foi considerado alto em todos os estudos. Instrumentos de NiTi apresentaram maior preferência e melhor percepção por estudantes de graduação em Odontologia, menor tempo e melhor

qualidade do preparo químico mecânico, com menor ocorrência de acidentes como degraus, transporte e desvios de canal, apesar de estarem associados à maior ocorrência de fratura de instrumentos.
Descritores: Aço Inoxidável. Endodontia. Estudantes. Preparo de Canal Radicular. Revisão Sistemática.

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