



FABRÍCIO RUTZ DA SILVA

**PERIAPICAL STATUS AND QUALITY OF ROOT FILLINGS IN
ELDERLY POPULATIONS: A SYSTEMATIC REVIEW**

**CONDIÇÃO PERIAPICAL E QUALIDADE DAS OBTURAÇÕES DE
CANAIS EM IDOSOS: UMA REVISÃO SISTEMÁTICA**

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**UNIVERSIDADE ESTADUAL DE CAMPINAS
FACULDADE DE ODONTOLOGIA DE PIRACICABA**

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Orientador: Prof. Dr. Eduardo Hebling

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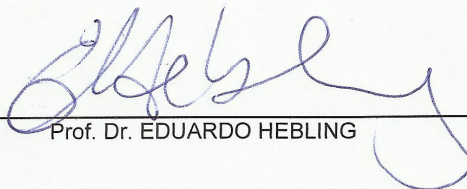
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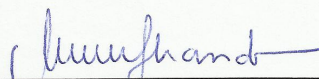
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RESUMO

O aumento da longevidade humana faz com que estudos envolvendo indivíduos idosos tenham grande importância para os gestores e profissionais de serviços de saúde. O objetivo desse estudo foi avaliar a relação entre a qualidade das obturações dos canais radiculares e a presença de lesão apical em pacientes idosos. Os dados foram obtidos por meio de uma revisão sistemática de estudos que avaliaram a qualidade das obturações dos canais radiculares e sua relação com a saúde periapical. Os critérios de inclusão foram: a) estudos em humanos; b) amostra incluindo indivíduos com idade igual ou maior que 60 anos; c) definição de critérios claros e bem estabelecidos para a avaliação da qualidade das obturações endodônticas; d) definição de critérios claros e bem estabelecidos para a avaliação da saúde periapical; e) estabelecimento de relação entre a qualidade dos tratamentos endodônticos e a presença de lesões periapicais; f) artigos publicados em Inglês entre 01 janeiro de 1986 e 01 julho de 2013 nas bases de dados PubMed e ISI Web of Knowledge. A pesquisa produziu um total de 1.376 títulos de artigos potencialmente relevantes, dos quais 667 eram repetidos e 16 eram duplicados. Os resumos de 693 estudos foram lidos, sendo 608 destes excluídos e 85 selecionados para análise de texto completo. Catorze (14) artigos foram incluídos. Os resultados desta revisão mostraram que existem vários critérios para avaliação da qualidade das obturações dos canais radiculares e da saúde periapical, o que dificulta a comparação entre os estudos. Além dessas variáveis, as mudanças anatômicas causadas pelo envelhecimento, a presença de lesões no momento da obturação, o interstício de tempo para a avaliação do periápice, o tipo de radiografia utilizada para avaliação da qualidade das obturações e da saúde periapical e a falta de padronização na realização dos tratamentos endodônticos foram outros fatores identificados. A saúde do periápice, representada pela frequência de periodontite apical, está intimamente relacionada à qualidade das obturações dos canais radiculares em pacientes idosos.

Palavras-chave: Idoso; periodontite apical; obturação do canal radicular; endodontia; revisão sistemática.

ABSTRACT

The increase in human longevity causes that studies involving elderly individuals have great importance for managers and professionals of health services. The aim of this study was to evaluate the relationship between the quality of root canals (RC) and the presence of apical periodontitis in elderly patients. The data were obtained by a systematic review of studies that evaluated the quality of root canals and its relation with apical health. Inclusion criteria were: a) studies in humans; (b) sample including individuals with 60 years or older; (c) definition of clear criteria and well established for the evaluation of the quality of the root canals; (d) definition of clear criteria and well established for the evaluation of apical health; e) establishment of a relation between the quality of root canals and the presence of apical periodontitis; f) articles published in English from 1986 (January, 1st) to 2013 (July, 1st) in PubMed and ISI Web of Knowledge databases. The search produced a total of 1,376 potentially relevant titles of articles, of which 667 were repeated and 16 were duplicates. The summaries of 693 studies were read, being 608 of these excluded and 85 selected for analysis of full text. Fourteen articles were included. The results of this review showed that there were several criteria for assessing the quality of root canal obturations and the apical health, which makes the comparison between the studies. In addition to these variables, the anatomic changes caused by aging, the presence of lesions at the time of the closures, the interstice of time for the assessment of apical periodontitis, the type of radiography used for evaluation the quality of root canal obturations and apical periodontitis, and the lack of standardization of the endodontic treatments were other factors identified. The apical health, represented by the frequency of apical periodontitis, is intimately related to the quality of root canal obturations in elderly patients.

Keywords: Elderly; apical periodontitis; root canal obturation; endodontics; systematic review.

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Dedico este trabalho à minha esposa **EDNA** e a meus pais **JOSÉ** e **ROSENI**.

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"Não há alternativa, é a única opção: unir otimismo da vontade e o pessimismo da razão. Contra toda expectativa, contra qualquer previsão, há um ponto de partida, há um ponto de união: **sentir com inteligência, pensar com emoção**".

HUMBERTO GESSINGER

Escritor e Músico

INTRODUÇÃO

A presença de infecções por microorganismos e a evolução para uma septicemia representam um perigo à saúde dos seres humanos. Em pacientes idosos, há um risco ainda maior de choque séptico (Angus *et al.* 2001, Flaatten 2004, Martin *et al.* 2006). Por isso, torna-se imperativo a remoção de quaisquer focos de contaminação por microorganismos em pacientes com idade mais avançada.

Entre os possíveis focos infecciosos dentários, àqueles de origem endodôntica, como a periodontite apical (PA), representam um risco em potencial. A periodontite apical (PA) é uma patologia inflamatória dos tecidos periradiculares causada por uma infecção microbiana persistente no canal radicular do dente afetado (Takehashi *et al.* 1965, Sundqvist 1992). A presença de PA indica que houve uma desinfecção insuficiente dos canais radiculares (Georgopoulou *et al.* 2005).

Os indivíduos idosos possuem maior proporção de tratamentos endodônticos e PA do que indivíduos de menor idade (Frisk & Hakeberg 2005).

A presença de PA foi relacionada aos dentes obturados, especialmente aqueles cujas obturações são consideradas inadequadas (Jiménez-Pinzón *et al.* 2004). Contudo, o julgamento da qualidade das obturações ainda é um assunto controverso. Os critérios utilizados pelos pesquisadores são bastante variados (Chugal *et al.* 2003, Boltacz-Rzepkowska & Pawlicka 2003, Sunay *et al.* 2007, Moura *et al.* 2009, Adebayo *et al.* 2012), dificultando a comparação entre os trabalhos publicados.

A análise da saúde periapical vive o mesmo dilema: não há uma unanimidade de critérios. Apesar da maioria das pesquisas utilizar o *Periapical Index* (PAI), proposto por Ørstavik *et al.* (1986), existem outras formas de se avaliar o periápice, como a densitometria óssea (Delano *et al.* 1998), a subtração radiográfica (Yoshioka *et al.* 2002) ou mesmo adoção de outros critérios, como aqueles propostos por Strindberg (1956).

Além das variáveis já apresentadas, outras devem ser observadas: as mudanças anatômicas ocasionadas pelo envelhecimento da polpa (Goodis *et al.* 2001, Morse 1991); a presença de lesão no momento do tratamento endodôntico; quanto tempo se passou desde a obturação do sistema de canais radiculares e a avaliação do periápice; e a qualidade da restauração realizada após o tratamento endodôntico (Gillen *et al.* 2011).

Partindo desse cenário, este estudo foi delineado em um artigo de revisão sistemática no qual se buscou evidências da relação entre a qualidade das obturações endodônticas e a saúde do periápice, representada pela periodontite apical, em amostras contendo pacientes idosos.

CAPÍTULO 1

Original Research:

Periapical status and quality of root fillings in elderly populations: a systematic review

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ABSTRACT

The aim of this study was to investigate the relationship between root fillings and

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the presence of apical periodontitis in studies with samples containing elderly patients. The data were obtained by means of a systematic review of studies that evaluated the quality of root fillings and their relationship with periapical health. 1,376 potentially relevant articles were selected, of which 667 were repeated and 16 were duplicates. 693 abstracts were analyzed, with 608 of these being excluded and 85 selected for reading in full. Fourteen (14) articles were included, totaling data of 135,566 teeth. Of these, 13,704 (10.1%) had endodontic fillings, with 6,455 (47.1%) being considered adequate and 7,249 (52.9%) inadequate. Among the teeth with apical periodontitis, 2,084 (32.3%) had adequate endodontic fillings and 3,749 (51.6%) had inadequate fillings. There was a significant correlation between the quality of endodontic fillings considered adequate and lower frequency of apical periodontitis in elderly patients.

Key words: apical periodontitis, elderly, endodontics, epidemiology, review

Introduction

The quality of endodontic treatment and periapical health are important parameters in the prognosis of future dental treatment needs (1). The increase in longevity of the world population and the success of preventive dentistry will lead to a growth of the expectation of maintenance of dentition in the elderly patients. This fact may result in an increase of the endodontic treatment needs in this population (2). The relationship between the quality of root fillings (RF) and the frequency of periapical lesions had been demonstrated (3, 4).

Apical periodontitis (AP) is a local inflammatory response to infection of endodontic origin (5). Dental pulp infection generally occurs as a sequel to dental caries, trauma, operative procedures, or in situations in which bacteria and their toxins are able to penetrate into the intimate areas of the pulp tissue (6). Failure of root canal treatment is generally believed to be caused by inadequate treatment procedures and ineffective control or elimination of bacterial infection (7).

The prevalence of AP has also been related to the increase in age (8), suggesting that this relationship would be more evident due to the increase in the number of dentate elderly persons (9). Little epidemiological data on the endodontic and periapical status of the elderly have been gathered. These endodontic parameters are important to predict tooth survival and the future need for dental treatment (3).

Outcomes from cross-sectional epidemiological surveys showed evidences that older subjects have a lower number of remaining teeth and higher ratio of RF and AP in their teeth compared with younger adults (10). Longitudinal studies also confirmed these results demonstrated that, on average, the number of teeth decreased with age, but the number of root filled teeth increased in studied elderly populations (11, 12). However, contrary to these cross-sectional and longitudinal studies, other longitudinal study in elderly women with follow-up of 24 years showed that the prevalence of AP did not increase with age, probably as a result of root canal treatment and extractions. This study also showed that the frequency of RF teeth and teeth with AP decreased over time for comparable age groups (13).

In different populations, several epidemiological studies have reported high frequency of AP associated with RF teeth, especially those related with inadequate endodontic treatments (1-10). However, the outcomes of these cross-sectional studies considered samples from different age. Cohort studies containing exclusively elderly patients are scant.

Considering the importance of epidemiological studies, the aim of this study was to investigate the relationship between root fillings and the presence of apical periodontitis in studies with samples containing elderly patients, by means of a systematic review of the literature

Materials and methods

The selection of articles used in the study was performed in two stages: (I) abstracts and titles were selected; and (II) the complete texts of the selected titles were obtained and read to determine the set of the final sample. To identify studies included in or considered for this revision, a search strategy was developed for the electronic databases, using key words from a list of Descriptors in Health Sciences (DeCS) and in Medical Subject Headings (MeSH), and their combinations. The following key words were used: periapical periodontitis; periapical abscess; periapical granuloma; radicular cyst; endodontic treatment; pulpectomy; root canal filling; root canal obturation and root canal therapy.

The inclusion criteria for the selection of titles were: a) studies in humans; b) samples including individuals aged 60 years or older; c) definition of clear and well established criteria for evaluating the quality of root fillings; d) definition of clear and well established criteria for evaluating periapical health; e) establishment of the relationship between the quality of endodontic treatments and presence of periapical lesions, f) articles published in English between January 01, 1986 and July 01, 2013 in the PubMed and ISI Web of Knowledge databases (**Figure 1**).

The initial search was performed by two independent researchers, who located and selected the articles. The selection of studies based on the title and abstract was done independently and in duplicate. After reading the title of the article, the researchers either selected it or not for the systematic review. If the article did not meet the inclusion criteria, it was excluded by the title. If the title of the article did not provide sufficient information for selecting or excluding it, the researchers had to read the abstract and opt between selecting or excluding the article by the abstract. If there were repetition of one and the same study, its copy would be excluded. In addition, the researchers observed cases in which the same article appeared more than once in the same database, and classified it as repeated. This procedure was followed in all the databases.

After a systematic search and selection of the article, a first meeting of consensus was held to clear doubts and disagreements between the researchers.

The next stage was to seek, and read the selected articles in full, and then evaluate whether they would be included in the sample. Each researcher filled out a standardized form in the ExcelTM (Microsoft Corporation, Redmond, WA, USA) software, with the following data about the article: author, year and country in which the study was conducted; type of study, type of radiographic technique used in the study, number of participating individuals; number of teeth evaluated; gender of the sample; frequency of AP in teeth with adequate and inadequate RF; frequency of adequate RF with AP and inadequate RF without AP. The lists of references of the selected articles were also checked independently by the two researchers, who proceeded with the search to identify studies with potential relevance not found in the electronic search.

A second consensus meeting was held between the researchers to clear up doubts and disagreements among the titles read, and filling out of the formula. The studies that met the established criteria were considered in the final analysis. Possible disagreements during the entire process were resolved by means of consensus.

In addition to the electronic databases searched, the lists of references of literature reviews were revised, but no additional studies were included. Efforts were made to try and find studies with elderly persons, which related the quality of the endodontic treatments and presence of AP.

The quality of the articles was evaluated by means of the *Quality Assessment Tool for Quantitative Studies* (14) by two independent evaluators, and disagreements were resolved by consensus. This validated tool was developed for the evaluation of systematic reviews on health promotion and public health interventions; in addition to randomized clinical trials, quasi-experimental studies and uncontrolled studies (15). It evaluates the articles in six different parameters: biases, study designs, confounding factors, blinding, methods of sample collection, and sample losses. The final score 1 classifies the study as strong; 2, as moderate and 3, as weak (14, 15).

Raw data were entered into ExcelTM software (Microsoft Corporation, Redmond, WA, USA). The analyses were carried out in an SAS SystemTM (SAS Institute Inc, Cary, North Caroline, USA). The frequency of root-filled teeth was calculated, and the periapical status on all teeth and on the treated teeth was assessed. Chi-square and independent *t*-tests ($\alpha=5\%$) were used to examine associations between both prevalence and frequency of AP in RF teeth and the standard of the root filling.

Results

Of a total of 1,376 potentially relevant records found in the two databases, 667 were repeated and 16 were duplicates. Therefore, the abstracts of 693 were read. A total of 608 references were excluded based on the titles and/or abstracts;

85 were selected for analysis of the full text, of which 14 were selected for inclusion in this systematic review (**Figure 2**).

Among the articles included, there was diversity of countries who have worked with the theme proposed in this review: two were conducted in Denmark (9, 16), two in France (17, 18), two in Spain (1, 19), two in Turkey (20, 21), one in Ireland (22), one in Japan (23), one in Brazil (24), one in Senegal (25), one in Kosovo (26), and one in Croatia (27) (**Tables 1 and 2**).

In the evaluation of the quality of RF, various criteria were used in the selected studies: three studies used the distance of the endodontic filling from the root apex (16, 21, 23); three studies used the filling density and its distance from the apex (17, 18, 25); three studies defined the parameter as being the presence of filling material in the root canal (1, 9, 19); four studies preferred criteria proposed by other authors (20, 22, 26, 27) and in one article the authors created their own guidelines (24) (**Table 1**).

In the evaluation of the periapical status, represented by the presence of AP, the majority of the studies included in this present review (1, 9, 16-19, 21-23, 25-27) used the *Periapical Index* (PAI) system proposed by Ørstavik *et al.* (28) (**Table 1**).

The articles selected for this study contained data on a total of 135,566 teeth. Of these, 13,704 (10.1%) had RF, with 6,455 (47.1%) of these fillings being considered adequate and 7,249 (52.9%) inadequate. Among the adequate root

fillings, 2,084 (32.3%) were diagnosed with AP. Among the inadequate root fillings, 3,740 (51.6%) had AP. The frequency of AP ranged from 0.5% (22) to 13.8% (17). The frequency of teeth with RF ranged from 1.5% (21) to 20.5% (23). In comparison with the total number of teeth with RF considered adequate, the percentage ranged from 26.5% (16) to 56.9% (24). Whereas, for those teeth with RF classified as inadequate, the range was from 43.1% (24) to 73.5% (16). The ratio between quality of RF teeth and presence of AP showed results with great amplitude. When the frequency of AP in adequate RF teeth was evaluated in comparison with the total number of RF teeth, the range was from 0.1% (26) to 41.6% (23). In inadequate RF teeth with AP, this frequency ranged from 16.8% (24) to 58.5% (16).

Evaluation of the quality of the articles by means of the *Quality Assessment Tool for Quantitative Studies* (14, 15) had 100% consensus for each item between the evaluators. The evaluation showed the following results (**Figure 3**): three studies (17, 19, 24) obtained the final score 1, thus being classified as strong; four articles (9, 16, 23, 25) were classified as moderate (score 2); and the majority of the articles included (1, 18, 20, 21, 22, 26, 27) were classified as weak (score 3).

Discussion

The result of the evaluation of the articles included by means of the *Quality Assessment Tool for Quantitative Studies* (14, 15) reflected the difficulty authors

have in controlling the multiple variables present in the researches. In none of the 14 articles included in this systematic review was there blinding on the part of the evaluators and participants included in the sample, and it was for this reason that none of these articles was considered strong for this criterion (**Figure 3**). When analyzing these results, we must take into consideration that the researchers could not have been blinded, because the researchers depended on the evaluation of radiographic images, and for this purpose, these researchers were previously calibrated, and therefore knew the objective of the research. The non blinding of individuals participating in the researches did not influence the results of the studies, because the evaluation of the quality of fillings and periapical condition were performed by means of radiographic image analysis and not symptoms related by the participating patient him/herself, which could generate biases. On the other hand, the data collection method was considered strong for all the researches included in this review, which characterizes the attention of the authors in the descriptions of the methodologies used in their researches.

Considering all the six parameters proposed by the *Quality Assessment Tool for Quantitative Studies*, only three studies were classified as strong (17, 19, 24). The research conducted by Boucher *et al.* (17) obtained moderate classification for the criteria “biases” and “blinding”, and was classified strong in the other four parameters. The moderate quantification in the criterion “biases” was attributed because the study used a convenience sample, which would not represent the conditions of the target population of the study. Estrela *et al.* (24)

also had two parameters evaluated as moderate (“blinding” and “sample losses”), and the other four were classified as strong. This occurred because the authors did not cite any sample loss, which is understandable, seeing that periapical radiographs of endodontic treatments performed in the post graduation clinic of endodontics were used. Therefore, there were no losses from the sample. Whereas, the study of Jiménez-Pinzón, *et al.* (19) had three criteria evaluated as moderate (“biases”, “confounding factors”, and “blinding”); and the other three were considered strong. In this study, the authors also used a convenience sample, therefore, non representative of the conditions of the target population of the study. This fact was responsible for the “moderate” classification obtained in the requisite of “biases”. For the criterium “confounding factors”, the moderate classification was as a result of the mentioned article being limited to citing only some information about the composition of the sample, such as, the percentage of men and women, and division by ages. Other important variables in characterization of the sample could have been included, such as, the general health conditions and the age at which endodontic treatment was performed.

Pak *et al.* (29) observed that the frequency of pulp diseases could be higher than that presented by a large portion of the studies. According to these authors, not all pulp diseases produce evident periapical alterations, and not every lesion of endodontic origin is located at the apex of the tooth, and initial radiographic alterations may not be detected. According Goodis *et al.* (30), in elderly patients, this becomes more evident, because due to the histological and physiological

alterations, a loss of sensitivity of the tooth may occur, leading to the patient not seeking the dentist.

Furthermore, Pak *et al.* (26) considered that the use of panoramic radiographs instead of periapical radiographs may contribute even further to biases. Other authors were in agreement with this affirmation (3, 29). Moreover, Estrela *et al.* (31) affirmed that even the use of intraoral radiographs may not be effective for the diagnosis of small periapical lesions. A high percentage of cases classified as healthy by means of periapical radiographs were, however, shown to have AP when examined histologically and by cone beam computed tomography (CBCT) (31). Thus, some researchers have suggested the use of CBCT when conducting future studies, thereby minimizing the technical limitations of conventional radiographs (32, 33). In all the articles included in this review, evaluation of the radiographs was performed by experienced and calibrated professionals.

From the eleven studies that used the *Periapical Index* (PAI) system (28) as criterium for diagnostic of AP, some studies used the $PAI \geq 2$ as a parameter for defining the presence of AP (1, 17, 19, 21, 23, 25-27), and others used $PAI \geq 3$ (9, 16, 22). As regards the studies that did not use the PAI as criterium for diagnostic of AP (18, 20, 24), Lupi-Pegurier *et al.* (18) and Estrela *et al.* (24) used their own criteria; whereas Sunay *et al.* (20) used criteria established by de Moor *et al.* (38) (**Table 1**). Wu *et al.* (34), as a limitation of the PAI, cited the fact of the wide variation in distance between the cortical bone and the root apex according to the

dental group. Furthermore, some authors have questioned the use of subjective methods, based only on the observation of radiographic images (35, 36). Camps *et al.* (37) cited that the PAI allows only semi-qualitative results to be obtained, and does not allow comparison between groups. According to these authors, as a result of this, there will always be non significant differences between groups, even with a large sample. To minimize the risk of false-negative results, these authors suggested the use of the gray value correction method, because the variations in the gray value of a periapical lesion would be associated with the histological alterations.

Another point may raise some concern regarding the reliability of the PAI system. In the analysis of multi root teeth by PAI, some researchers included only the highest score (22, 23, 25, 26), others preferred to use the lowest (1, 19) and some did not mention this information (9, 16, 17, 18, 20, 21, 24, 27). This difference in the diagnostic parameters is another factor that makes it difficult to compare the data between the selected articles in this present review.

The ratio between quality of RF teeth and presence of AP showed results with great amplitude. When the frequency of AP in adequate RF teeth was evaluated in comparison with the total number of RF teeth, the range was from 0.1% (26) to 41.6% (23). In inadequate RF teeth with AP, this frequency ranged from 16.8% (23) to 58.5% (16) (**Table 2**). In the analysis of these data, apart from the small amount of information mentioned in the selected articles, considering that these studies were performed using samples including elderly persons (not

exclusively), and the great variability of criteria used in the articles included in this review, it was concluding that inadequate root filling was associated with an increased prevalence of AP.

Normally, the teeth of elderly patients present a higher degree of difficulty with regard to performing endodontic treatments, either by the changes in their morphology, histology, and pulp physiology in comparison of the teeth in samples of younger age groups (24, 30). These changes involve partial or complete occlusion of the pulp changes by the formation of tertiary dentin or pulp fibrosis, which reduces the vascular supply and consequently the response to aggressor agents (26). Due to these particularities, it was hoped to find significant differences between the frequencies of adequate and inadequate RF in elderly patients. This fact emphasizes the importance of the development of an appropriate endodontic treatment in the prevention of AP occurrence.

The adequate endodontic treatment, the success of preventive dentistry, and the increase in longevity of the world population will lead to a growth of the expectation of maintenance of dentition in the elderly patients. This fact may result in an increase of the endodontic treatment needs in this population (2). Thus, currently and in the future, more people will live longer and with more teeth in the oral cavity. Actions and public policies for the prevention of oral diseases should be directed to the elderly population, aiming at the equity and equality of opportunities in the maintenance of their oral health and teeth.

Conclusions

Based on the results of this systematic review, it was concluded that there are no studies that relate the quality of RF and periapical status, represented by the absence/presence of AP, in samples formed exclusively of elderly persons. When studies that include elderly patients in the sample were used, inadequate root filling was associated with an increased prevalence of AP. There is a wide diversity of criteria for the analysis of the quality of RF teeth and the periapical status. Further studies are needed to evaluate the effect of these facts on a possible increased demand for endodontic treatment in the elderly population.

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Figure 1: Flowchart of the inclusion criteria of this study

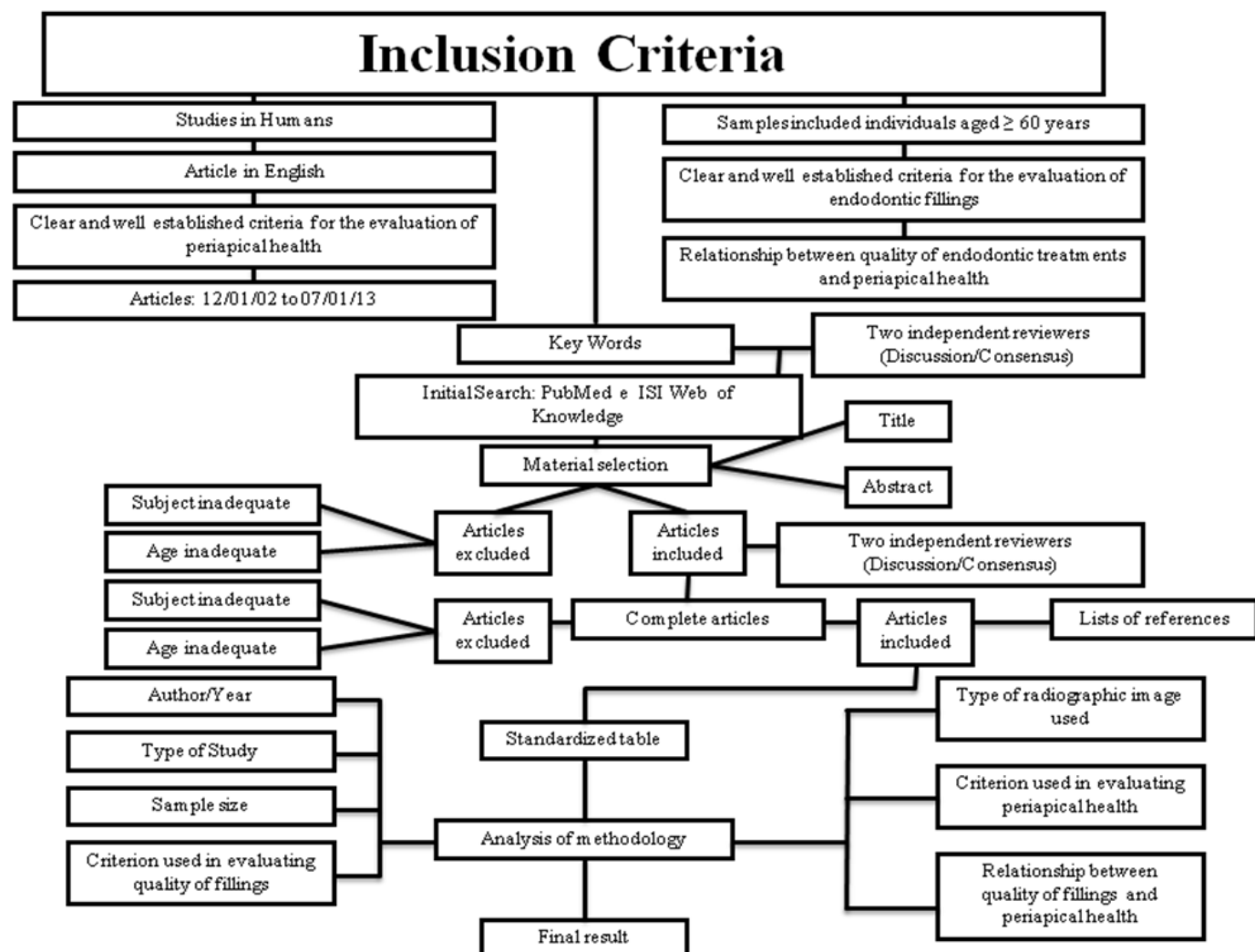


Figure 2: Flowchart of the systematic review

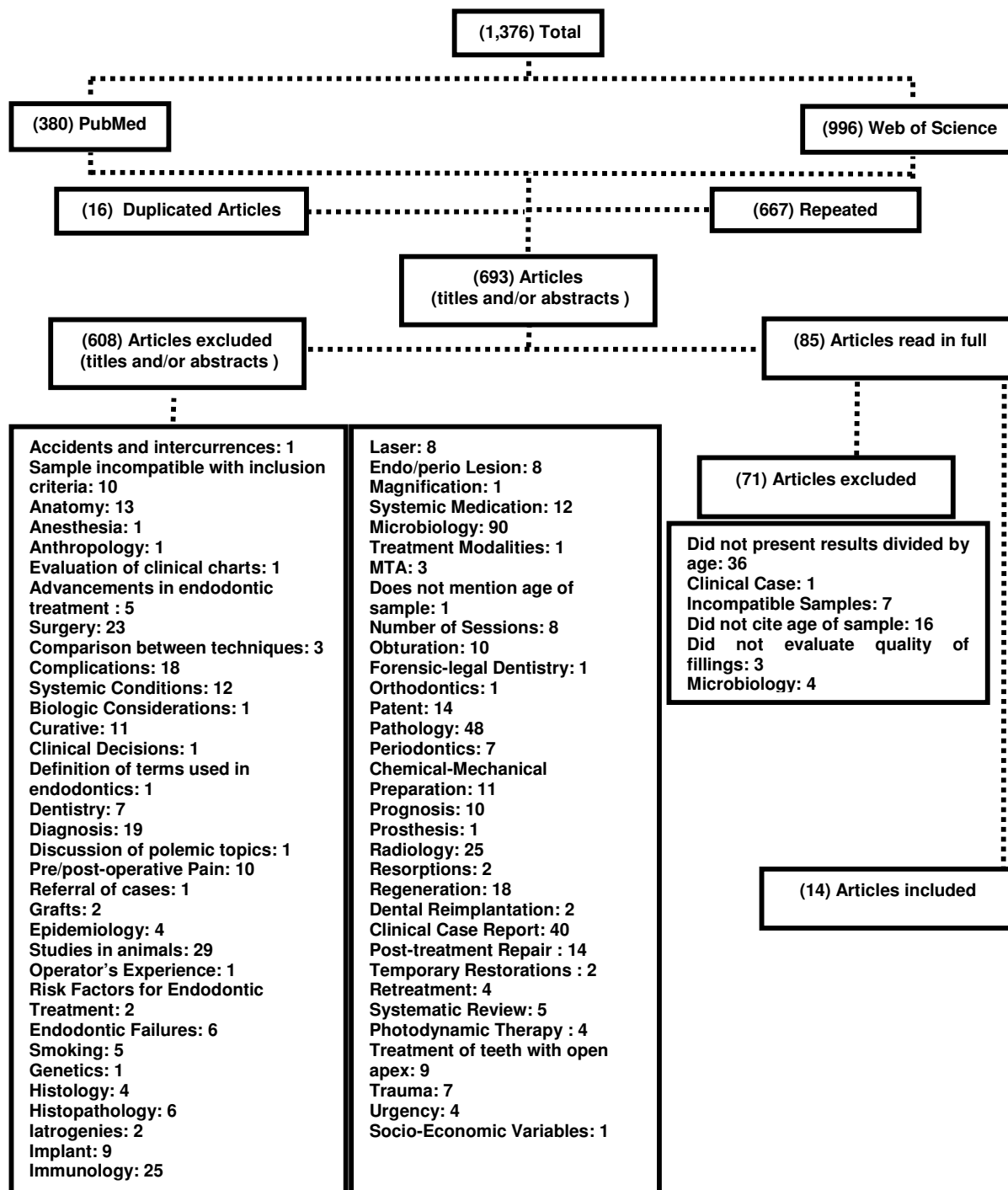


Table 1: Criteria used to assess the root filling (RT) and apical periodontitis (AP) status.

Authors	Country	RF Criteria	AP Criteria
Boucher <i>et al.</i> 2002 (17)	France	Filling density and its distance from the apex	PAI=1: healthy; PAI \leq 2: AP
Estrela <i>et al.</i> 2008 (24)	Brazil	Criteria proposed by the authors themselves	Criteria proposed by authors themselves
Jiménez-Pinzón <i>et al.</i> 2004 (19)	Spain	Presence of filling material in the root canal	PAI=1: healthy; PAI \leq 2: AP
Kamberi <i>et al.</i> 2010 (26)	Kosovo	Criteria proposed by other authors	PAI=1: healthy; PAI \leq 2: AP
Kirkevang <i>et al.</i> 2000 (16)	Denmark	Filling distance from the apex	PAI=1: healthy; PAI \leq 3: AP
Kirkevang <i>et al.</i> 2001 (9)	Denmark	Presence of filling material in the root canal	PAI=1: healthy; PAI \leq 3: AP
Loftus <i>et al.</i> 2005 (22)	Ireland	Criteria proposed by other authors	PAI=1: healthy; PAI \leq 3: AP
López-López <i>et al.</i> 2012 (1)	Spain	Presence of filling material in the root canal	PAI=1: healthy; PAI \leq 2: AP
Lupi-Pegurier <i>et al.</i> 2002 (18)	France	Filling density and its distance from the apex	Criteria proposed by authors themselves
Matijević <i>et al.</i> 2011 (27)	Croatia	Criteria proposed by other authors	PAI=1: healthy; PAI \leq 2: AP
Özbas <i>et al.</i> 2011 (21)	Turkey	Filling distance from the apex	PAI=1: healthy; PAI \leq 2: AP
Sunay <i>et al.</i> 2007 (20)	Turkey	Criteria proposed by other authors	Criteria proposed by authors themselves
Touré <i>et al.</i> 2008 (25)	Senegal	Filling density and its distance from the apex	PAI=1: healthy; PAI \leq 2: AP
Tsuneishi <i>et al.</i> 2005 (23)	Japan	Filling distance from the apex	PAI=1: healthy; PAI \leq 2: AP

PAI = Periapical Index system (Ørstavik *et al.*, 1986 [28]).

Figure 3: Evaluation of articles using the *Quality Assessment Tool for Quantitative Studies*.

Items of quality scale	Articles													
	Boucher <i>et al.</i> 2002 (17)	Estrela <i>et al.</i> 2008 (24)	Jiménez-Pinzón <i>et al.</i> 2004 (19)	Kamberl <i>et al.</i> 2010 (26)	Kirkevang <i>et al.</i> 2000 (16)	Kirkevang <i>et al.</i> 2001 (9)	Loftus <i>et al.</i> 2005 (22)	López-López <i>et al.</i> 2012 (1)	Lupi-Pergurier <i>et al.</i> 2002 (18)	Matijević <i>et al.</i> 2011 (27)	Özbas <i>et al.</i> 2011 (21)	Sunay <i>et al.</i> 2007 (20)	Toure <i>et al.</i> 2008 (25)	Tsuneishi <i>et al.</i> 2005 (23)
Bias	2	1	2	3	2	1	1	2	3	3	2	3	3	2
Design of study	1	1	1	1	1	1	3	3	3	1	3	1	1	3
Confounding factors	1	1	2	3	1	1	1	1	3	3	3	2	1	1
Blinding	2	2	2	2	3	3	3	3	2	2	3	3	2	2
Collection methods	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Losses	1	2	1	1	2	2	1	1	1	2	1	1	1	1
Final Score (Consensus)	1	1	1	3	2	2	3	3	3	3	3	3	2	2

Table 2: Comparison of the frequency of apical periodontitis (AP) and root fillings (RF) between the studies selected for this review that included elderly in the sample *.

Author (s) (Reference) (Country/Year)	Study/ RX	Sample			Frequency of AP n (%)				Frequency of teeth with RF n (%)		Frequency of RF status n (%)				Frequency of RF in teeth with AP n (%)				
		Subjects (Teeth)	Age (mean)	Gender	Subjects with ≥ 1	In all teeth	In all teeth with RF	Untreated teeth	Subjects with ≥ 1	In all teeth	Teeth with adequate RF		Teeth with inadequate RF		In all teeth	Teeth with adequate RF		Teeth with inadequate RF	
											In all teeth	In all teeth with RF	In all teeth	In all teeth with RF		In all teeth	In all teeth with RF	In all teeth	In all teeth with RF
Boucher <i>et al.</i> (17) (France, 2002)	CS/OPG	208 (5,312)	18-70+ (NRC)	M/F	NRC (NRC)	735 (13.8)	553 (54.2)	182 (3.4)	NRC (NRC)	1,021 (19.2)	NRC (NRC)	NRC (NRC)	NRC (NRC)	NRC (NRC)	553 (10.4)	NRC (NRC)	NRC (NRC)	NRC (NRC)	NRC (NRC)
Estrela <i>et al.</i> (24) (Brazil, 2008)	CS/P	NRC (NRC)	18-60 (NRC)	M/F	NRC (NRC)	NRC (NRC)	521 (38.0)	NRC (NRC)	NRC (NRC)	1,372 (NRC)	781 (NRC)	781 (56.9)	591 (NRC)	591 (43.1)	521 (NRC)	129 (NRC)	129 (9.4)	392 (NRC)	392 (28.6)
Jiménez-Pinzón <i>et al.</i> (19) (Spain, 2004)	CS/P	180 (4,453)	18-60+ (37)	M/F	110 (61.1)	186 (4.2)	60 (64.5)	126 (2.8)	73 (40.6)	93 (2.1)	NRC (NRC)	NRC (NRC)	NRC (NRC)	NRC (NRC)	60 (1.4)	NRC (NRC)	NRC (NRC)	NRC (NRC)	NRC (NRC)
Kamberi <i>et al.</i> (26) (Kosovo, 2010)	CSET/OPG	193 (4,131)	18-60+ (35)	M/F	NRC (NRC)	509 (12.3)	44 (46.3)	465 (11.2)	NRC (NRC)	95 (2.3)	29 (0.7)	29 (30.5)	66 (1.6)	66 (69.5)	44 (1.1)	6 (0.1)	6 (0.1)	38 (0.9)	38 (40.0)
Kirkevang <i>et al.</i> (16) (Denmark, 2000)	CSET/P	614 (NRC)	20-60+ (NRC)	M/F	NRC (NRC)	NRC (NRC)	404 (52.3)	NRC (NRC)	NRC (NRC)	773 (NRC)	NRC (NRC)	205 (26.5)	NRC (NRC)	568 (73.5)	NRC (NRC)	NRC (NRC)	72 (9.3)	NRC (NRC)	332 (58.5)
Kirkevang <i>et al.</i> (9) (Denmark, 2001)	CS/P	614 (15,984)	20-60+ (NRC)	M/F	260 (42.3)	538 (3.4)	404 (52.3)	134 (0.8)	319 (52.0)	773 (4.8)	NRC (NRC)	NRC (NRC)	NRC (NRC)	NRC (NRC)	404 (2.5)	NRC (NRC)	NRC (NRC)	NRC (NRC)	NRC (NRC)
Loftus <i>et al.</i> (22) (Ireland, 2005)	CS/RP	302 (7,424)	16-98 (NRC)	M/F	100 (33.1)	38 (0.5)	38 (25.0)	114 (1.5)	96 (31.8)	152 (2.0)	72 (1.0)	72 (47.4)	80 (1.1)	80 (52.6)	38 (0.5)	10 (0.1)	10 (6.6)	28 (0.4)	28 (18.4)
López-López <i>et al.</i> (1) (Spain, 2012)	CS/RP	397 (9,390)	18-70+ (52)	M/F	135 (34.0)	259 (2.8)	144 (23.8)	115 (1.3)	233 (58.7)	604 (6.4)	NRC (NRC)	NRC (NRC)	NRC (NRC)	NRC (NRC)	144 (1.5)	NRC (NRC)	NRC (NRC)	NRC (NRC)	NRC (NRC)
Lupi-Pegurier <i>et al.</i> (18) (France, 2002)	CS/RP	344 (7,561)	20-60+ (NRC)	M/F	NRC (NRC)	553 (7.3)	450 (31.5)	103 (1.7)	NRC (NRC)	1,429 (18.9)	446 (5.9)	446 (31.2)	983 (13.0)	983 (68.8)	450 (5.9)	NRC (NRC)	NRC (NRC)	NRC (NRC)	NRC (NRC)
Matijević <i>et al.</i> (27) (Croatia, 2011)	CS/RP	1,462 (38,440)	15-60+ (NRC)	M/F	NRC (NRC)	3,251 (8.5)	1,772 (54.0)	1,479 (3.9)	1,125 (77.0)	3,279 (8.5)	NRC (NRC)	NRC (NRC)	NRC (NRC)	NRC (NRC)	1,772 (4.6)	NRC (NRC)	NRC (NRC)	NRC (NRC)	NRC (NRC)
Sunay <i>et al.</i> (20) (Turkey, 2007)	CS/OPG	375 (8,863)	16-82 (NRC)	M/F	NRC (NRC)	374 (4.2)	240 (2.8)	134 (1.5)	176 (47.0)	449 (5.2)	188 (2.1)	188 (41.9)	261 (2.9)	261 (58.1)	209 (2.4)	22 (0.2)	22 (4.9)	218 (2.5)	218 (48.6)
Özbas <i>et al.</i> (21) (Senegal, 2011)	CS/P	438 (11,542)	10-79 (NRC)	M/F	NRC (NRC)	189 (1.6)	68 (37.9)	121 (1.0)	NRC (NRC)	179 (1.5)	NRC (NRC)	NRC (NRC)	NRC (NRC)	NRC (NRC)	68 (0.59)	15 (0.1)	15 (8.4)	53 (0.5)	53 (29.6)
Touré <i>et al.</i> (25) (Senegal, 2008)	CS/P	208 (6,234)	18-70+ (32)	M/F	124 (59.6)	290 (4.7)	93 (56.4)	197 (3.2)	74 (35.6)	165 (2.7)	NRC (NRC)	NRC (NRC)	NRC (NRC)	NRC (NRC)	93 (1.5)	NRC (NRC)	NRC (NRC)	NRC (NRC)	NRC (NRC)
Tsuneishi <i>et al.</i> (23) (Japan, 2005)	CS/P	672 (16,232)	20-89 (51)	M/F	469 (69.8)	1,522 (9.4)	1,329 (40.0)	193 (1.2)	581 (86.5)	3,320 (20.5)	1,857 (11.4)	1,857 (55.9)	1,463 (9.0)	1,463 (44.1)	3,320 (20.5)	773 (4.7)	773 (41.6)	556 (3.4)	556 (16.8)

* Data calculated by the present authors from information published in the articles. NRC = Not reported or calculable from information presented in the article; n = number of teeth or subjects; M = male; F = female; CS= Cross-sectional study; P=Periapical radiographic survey; OPG = Orthopantomogram survey.

CONSIDERAÇÕES

Apesar de existirem vários artigos que estudam a relação entre as condições periapicais e a qualidade das obturações do sistema de canais radiculares, quando restringimos a amostra apenas a pacientes idosos, nos deparamos com inexistência de pesquisas sobre esse tema. Desse modo, nesta revisão foram incluídos 14 artigos cujas amostras não eram restritas a indivíduos idosos, fato que poderia ser considerada uma limitação deste trabalho.

Além disso, são muitas as variáveis que influenciam a qualidade das obturações do sistema de canais radiculares. O mesmo vale para a avaliação da saúde periapical. Isso se reflete na dificuldade em comparar estudos com critérios tão diferentes.

Assim, somente a partir de trabalhos com critérios rígidos e claros é que poderemos traçar um perfil real da epidemiologia da PA em pacientes idosos e a partir daí, identificar onde os tratamentos endodônticos estão falhando. Minimizando essas falhas, estaremos contribuindo para a diminuição dos focos infecciosos e consequentemente de possíveis futuras disseminações sistêmicas.

CONCLUSÃO

Levando-se em consideração a análise dos 14 artigos incluídos nessa revisão sistemática, pode-se concluir que a saúde periapical, representada pela frequência de PA, tem relação direta com a qualidade das obturações do sistema de canais radiculares em pacientes idosos. Desse modo, canais com obturações consideradas como inadequadas apresentam maior frequência de PA.

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APÊNDICES

APÊNDICE 1: Declaração de autoria.

DECLARAÇÃO

As cópias de artigos de minha autoria ou de minha coautoria, já publicados ou submetidos para publicação em revistas científicas ou anais de congressos sujeitos a arbitragem, que constam da minha Dissertação de Mestrado, intitulada **“CONDIÇÃO PERIAPICAL E QUALIDADE DAS OBTURAÇÕES DE CANAIS EM IDOSOS: UMA REVISÃO SISTEMÁTICA”**, não infringem os dispositivos da Lei nº 9.610/98, nem o direito autoral de qualquer editora.

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