Coronectomia como alternativa a terceiros molares inferior: revisão sistemática e meta-análise

Coronectomy as an alternative for lower third molars: systematic review and meta-analysis

Coronectomia como alternativa a terceros molares inferiores: revisión sistemática y metaanálisis

RESUMO

Objetivo: Avaliar se a coronectomia é superior à extração convencional de terceiros molares inferiores. **Materiais e Métodos:** Os artigos foram selecionados de acordo com os critérios PICO nas bases de dados eletrônicas. Os principais desfechos avaliados em curto prazo foram: lesão do nervo alveolar inferior, dor, alveolite e infecção. O principal resultado a longo prazo foi a migração radicular. **Resultados:** 5 estudos comparando coronectomia com extração convencional e com período de controle superior a 1 ano foram incluídos no estudo. O maior tempo de seguimento foi de 3 anos e o menor foi de 13,5 meses. Nos estudos incluídos nesta revisão, houveram 44 casos de lesão do nervo alveolar inferior no grupo controle e 25 casos no grupo coronectomia. A dor foi relativamente maior no grupo de extração convencional. A migração radicular foi maior nos primeiros 6 meses e estabilizou após o primeiro ano. **Conclusão:** A coronectomia é um procedimento seguro com menor incidência de complicações pós-operatórias e menor taxa de lesão do nervo alveolar inferior, embora seja claro que não é uma técnica isenta de risco. **Palavras-chave:** Coronectomia; Terceiro molar inferior; Nervo alveolar inferior.

ABSTRACT

Objective: To evaluate whether coronectomy is superior to conventional extraction of lower third molars. **Materials and Methods:** The articles were selected according to the PICO criteria in electronic databases. The main outcomes evaluated in the short term were: inferior alveolar nerve injury, pain, dry socket and infection. The main long-term outcome was root migration. **Results:** 5 studies comparing coronectomy with conventional extraction and with a control period longer than 1 year were included in the study. The longest follow-up time was 3 years and the shortest was 13.5 months. In the studies included in this review, there were 44 cases of inferior alveolar nerve injury in the control group and 25 cases in the coronectomy group. Pain was relatively greater in the conventional extraction group. Root migration was greatest in the first 6 months and stabilized after the first year. **Conclusion:** Coronectomy is a safe procedure with a lower incidence of postoperative complications and a lower rate of injury to the inferior alveolar nerve, although it is clear that it is not a risk-free technique. **Keywords:** Coronectomy; Lower third molar; Inferior alveolar Nerve.

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RESUMEN

Objetivo: Evaluar si la coronectomía es superior a la extracción convencional de terceros molares inferiores. **Materiales y Métodos:** Los artículos fueron seleccionados según los criterios PICO en bases de datos electrónicas. Los principales resultados a corto plazo fueron: lesión del nervio alveolar inferior, dolor, alveolitis seca e infección. El principal resultado a largo plazo fue la migración de raíces. **Resultados:** Se incluyeron en el estudio 5 estudios que compararon coronectomía con extracción convencional y con un período de control mayor a 1 año. El tiempo de seguimiento más largo fue de 3 años y el más corto de 13,5 meses. En los estudios incluidos en esta revisión, hubo 44 casos de lesión del nervio alveolar inferior en el grupo de control y 25 casos en el grupo de coronectomía. El dolor fue relativamente mayor en el grupo de extracción convencional. La migración de raíces fue mayor en los primeros 6 meses y se estabilizó después del primer año. **Conclusión:** La coronectomía es un procedimiento seguro con menor incidencia de complicaciones postoperatorias y menor tasa de lesión del nervio alveolar inferior, aunque está claro que no es una técnica exenta de riesgos. **Palabras clave:** Coronectomía; Tercer molar inferior; Nervio alveolar inferior.

INTRODUCTION

By unerupted teeth are meant all those which after the time of formation, have not been able to erupt into the oral cavity. The most commonly observed teeth in this situation are the lower third molars, followed by the upper third molars, and the upper and supernumerary canines[1]. Surgical treatment of unerupted teeth is indicated for: prevention of periodontal disease, root resorption, and/or caries of adjacent teeth , prevention of pericoronaritis and development of cysts and odontogenic tumors , and orthodontic indications[2,3].

It is noteworthy that extraction of lower third molars is frequently associated with postoperative complications . The most commonly described complications are: Infections and paresthesia of the inferior alveolar nerve (NAI) or lingual nerve[2,4-6].

The lower third molars are often located near the NAI, so paresthesia of this nerve is a possible postoperative complication. To minimize the damage to the inferior alveolar nerve (NAI), Ecuyer and Debien proposed in 1984 a surgical procedure, consisting in the removal of the crown from the third molar, whose roots are fully developed and which is in close contact with the mandibular canal[7], and this procedure is called coronectomy. The literature has shown that this technique significantly reduces the risk of iatrogenic injury to the NAI (LNAI), with some studies also indicating a lower complication rate[8]. This is achieved by intentionally removing the dental crown and preserving the root in vitro in close relation to the mandibular canal[9].

Concerns have been expressed in the literature regarding the description of this technique, as its performance may be related to root migration[7,10-13]. Therefore, it is necessary to review the literature on the evidence in favour or against coronectomy as a safe surgical technique for the treatment of the lower third molars, as well as the possible complications of this technique.

The aim of the present study was to provide systematically review of coronectomy to understand the benefits and complications of this technique based on clinical studies with a postoperative control greater than 01 year, because previous studies show a different duration migration dental after the surgical technique.

MATERIALS AND METHODS

The present study was a systematic review carried out according to the PRISMA-2009 (www.prisma-statement.org) criteria.

REGISTRATION AND PROTOCOL

The work was registered on the PROSPERO platform under the number CRD-4202208815, and is available in full at: www.crd.york.ac.uk/PROSPERO/.

ELIGIBILITY CRITERIA

Articles were selected according to the PICO criteria: Population (P): patients with the inferior third molar near the lower alveolar nerve canal; Intervention (I): exodontia by coronectomy technique; Comparison (C): Extraction by conventional techniques; Outcome (O) postoperative complications. The key question was "What are the indications and complications of using the coronectomy technique?". Full studies, published in English or Portuguese, were selected. The selected articles had the following characteristics: a) a description of the relationship between the mandibular third molars and the inferior alveolar nerve canal; b) preoperative imaging; c) postoperative follow-up of more than 1 year and d) patients older than 18 years.

Excluded: Case reports, case series, studies in a language other than English, studies with a follow-up period of less than or equal to 1 year, patients with syndrome , or with concomitant comorbidities.

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INFORMATION SOURCES AND SEARCH STRATEGY

The systematic review of all articles was performed without narrowing down the year of publication. The last search was performed in December 2022. Articles were searched in the electronic databases: PubMed, Embase, Web of Science and Scopus. The search strategy was structured with Boolean operators (AND / OR) and aimed to identify all relevant studies on potential complications related to the performance of coronectomy and to adapt to each database. The following descriptors were used: "Molar, Third", "Coronectomy" and "Oral Surgery", and the MeSH terms and entry terms (Table 1) were used.

A manual search of the bibliography of the selected articles was then performed. References of articles selected for inclusion were reviewed to identify possible unselected articles.

Table 1 - List of MeSH terms and Entry terms

Patients with third molar in contact with the IAN	"Molar, Third"[Mesh] OR "Molars, Third" OR "Third Molar" OR "Third Molars" OR "Tooth, Wisdom" OR "Wisdom Tooth" OR "Teeth, Wisdom" OR "Wisdom Teeth" OR "Tooth, Impacted"[Mesh] OR "Impacted Tooth" OR "Teeth, Impacted" OR "Impacted Teeth"
Coronectomy	Coronectomy OR "partial odontectomy" or root retention
oral surgery	"Surgery, Oral"[Mesh] OR "Maxillofacial Surgery" OR "Surgery, Maxillofacial" OR "Oral Surgery" OR "Exodontics" OR "Tooth Extraction"[Mesh] OR "Extraction, Tooth" OR "Extractions, Tooth" OR " Tooth Extractions"

IAN: Inferior Alveolar Nerve

SELECTION PROCEDURE

First, the articles were evaluated by reading the title and abstract by two independent reviewers, BD and IT Articles that met the selection criteria were selected. In cases where the title and abstract were not informative, articles were read in full by two reviewers. After selection, duplicate studies were excluded. Disagreements between reviewers were resolved after a discussion. Agreement was assessed using the Kappa test.

DATA COLLECTION PROCESS AND DATA ITEMS

The following data were collected from each article : Author(s), date of publication, type of study, number of patients, type of surgical procedure, preoperative imaging, postoperative control, dental migration (time), and mediate and late complications.

STUDY RISK OF BIAS ASSESSMENT

The selected articles were evaluated by the author BD to assess the risk of bias, and if positive , they were reviewed by both authors BD E IT and any discrepancies were resolved after a discussion between the authors.

The Hawker scale was used to assess quality of the studies and the risk of methodological bias . Each selected article was assessed using questions based on the Hawker scale: 1) whether the title and abstract covered information relevant to pico; 2) whether the study described an objective at the end of the introduction; 3) whether the methodology was highly detailed and consistent; 4) whether the sample e(ie, the action, process or technique chosen) was appropriate for the analysis of the study; 5) whether the analysis of the results included statistical tests relevant to the proposed objective; 6) whether secondary data sources were used (e.g. ,imaging) 7) whether the results meet the proposed objectives; 8) whether the study is replicableor generalizable, and 9) the importance of the study in clinical practice.

Responses could result in scores ranging from1 to 4. Thus the questions were scored as follows: 4 ("good"), 3 ("fair"), 2 ("bad") and 1 ("very bad"). In the end, the scores for each question were summed for each study . 4 for each question). The studies with scores above more than 30 points were classified as "high quality"; between 18 and 30 points as "moderate quality"; and below18 points as “low quality" .The kappa test was used to measure the degree of agreement between the two reviewers on the quality analyzes of the articles. The consensus scores were used for the final the Hawker scale data.

EFFECT MEASURES

All included studies assessed LNAI as the primary outcome and pain, infection, alveolitis, root migration and the need for a new surgical procedure as secondary outcomes (Table 2). Data such as frequency and percentage of cases were collected.

SYNTHESIS METHODS

A synthesis narrative of the data from the included studies was performed. Quantitative analysis was performed by a meta-analysis using OpenMeta software [Analyst], considering the random effect model with a confidence interval of 95%, a significance level of 5%, and a correction factor of 0.5.

Table 2 - Outcomes of the included studies. LNAI: Lower alveolar nerve injury; NR: Not reported.

Authors (year)	Extraction complications n (%)	coronectomy complications n (%)	Lost coronectomy complicationsn (%)	root migration n (%)	New intervention n (%)
Cilasun et al, (2010)	-LIAN: 2 -Pain: NR -Infection: NR - Dry socket: 1	-LNAI: 0 - Pain: 1 -Infection: NR -Alveolitis: NR	NR	NR	1 (patient option)
Hatano et al. (2009)	-LNAI: 6 (5%) -Pain: 8 (6.8%) -Infection: 4 (3.4%) -Alveolitis: 10 (8.5%)	-LNAI: 1 (1%) - Pain: 19 (18.6%) -Infection: 1 (0.9%) -Alveolitis: 2 (2%)		87 (85.29%)	4 (PO infection)
Kang et al, (2019)	-LNAI: 6 (10.9%) - Pain: NR - Infection: NR - Alveolitis: 2 (5.4%)	- LNAI: 0 - Pain: NR - Infection: NR - Alveolitis: 1 (1.8%)	NR	90.9% (first 6 months)	10
Leung and Cheng (2009)	-LNAI: 9 (5.1%) -Pain: 102 (57.3%) -Infection: 12 (6.7%) - Alveolitis: 5 (2.8%)	-LNAI: 1 (0.6%) -Pain: 65 (41.9%) -Infection: 9 (5.8%) - Alveolitis: 0	-LNAI: 1 (6.2%) -Pain: NR -Infection: NR - Alveolitis: NR	1st week: 16.2% 3 months: 62.2% 6 months: 23.6% 12 months: 11.5% 24 months: 2%	two
Renton et al, (2005)	- LNAI: 19 (19%) -Pain: 22 (21.6%) - Infection: 1 (1%) - Alveolitis: 10 (10%)	-LNAI: 0 -Pain: 8 (13.8%) -Infection: 3 (5.2%) - Alveolitis: 7 (12%)	-LNAI: 5 (8%) - Pain: 4 (11.1%) - Infection: 0 - Alveolitis: 4 (11%)	5 (< 2mm)	NR

NR: Not reported.

RESULTS

STUDY SELECTION

The searches were conducted in 4 databases. The first search included a total of 119 articles in PUB MED; 29 articles in ON THE WEB OF SCIENCE; 104 articles in SCOPUS; and 150 articles in EMBASE, for a total of 402 articles. After removing duplicate articles, a total of 148 items remained. Fifty-eight articles were excluded from the title and 90 remained for a full reading. After a full reading, 85 studies were closed for the following reasons: Lack of a control group; clinical case studies and case series; studies without follow-up of more than 1 year. Thus, 5 studies were included for the synthesis of results (Figure 1).

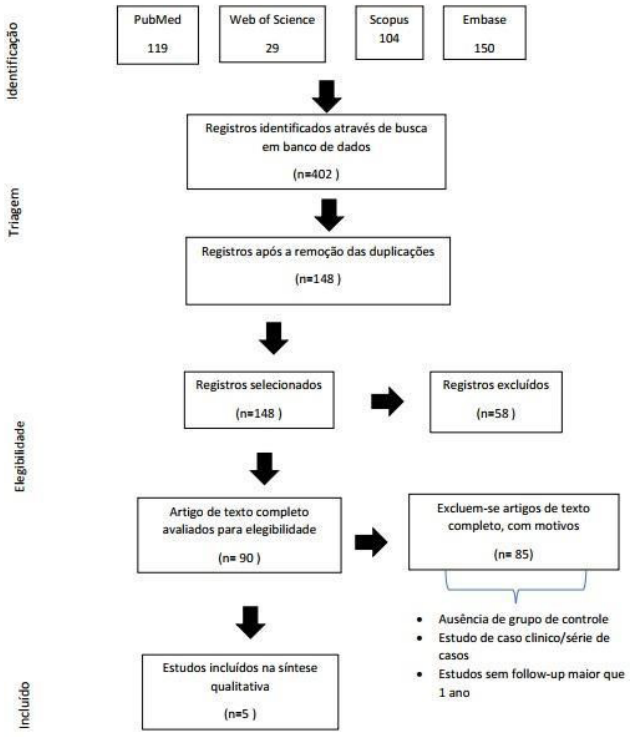

Figure 1 - Prisma Flowchart

STUDY CHARACTERISTICS

We included in the study 5 studies that compared coronectomy with conventional extraction and had a control period of more than 1 year. The longest follow-up time was 3 years and the lowest was 13.5 months. Of the 5 studies, 2 were prospective cohort studies, 1 was a case-control study and 2 were randomized clinical trials. The articles evaluated in this study included a total of 791 patients, divided into 540 cases of conventional extraction and 510 cases of corenectomy.

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RISK OF BIAS IN THE STUDIES

The Hawker et al. scale was applied to assess the quality of the included studies, with three studies being of moderate quality and two studies high quality

The kappa test was used to measure interobserver agreement . The result was a value of 0.58 with a moderate agreement based on the Landis and Koch 's criteria. The reviewers agreed with the rating of the selected articles and the results were tabulated.

RESULTS OF INDIVIDUAL STUDIES

Of the total number of cases in which coronectomy was proposed, 68 (13.33%) were classified as "unsuccessful coronectomy " because root movement occurred after crown separation, and these roots were removed (Table 3).

The causes of coronectomy failure were conical (80.4%), distal impaction[13], or vertical[13,14], 61% of the cases, and the narrowing of the roots within the canal[14].

Table 3 - Description of selected studies. CBCT: Cone Beam Computed Tomography; ECP: Prospective cohort study; ECC: Case-control study; ECRC: Randomized controlled clinical trial.

Authors (year)	Type of study	Patients (n)	complete extraction	Coronectomy	unsuccessful coronectomy	follow up (months)	Imaging Examination
Cilasun et al. (2010)	ECP	120	87	88	2 (2.27%)	17.9	- CBCT
Hatano et al. (2009)	ECC	220	118	102	5 (5.06%)	13.5	- Panoramic (pre-op) - CBCT (control)
Kang et al. (2019)	ECP	92	55	55	9 (16.36%)	36	- Panoramic (pre) - CBCT (control)
Leung and Cheng (2009)	ECRC	231	178	171	16 (9.4%)	24	- Panoramic
Renton et al. (2005)	ECRC	128	102	94	36 (38.29%)	25	- Panoramic

CBCT: Cone Beam Computed Tomography; ECP: Prospective cohort study;
ECC: Case-control study; ECRC: Randomized controlled clinical trial.

4.2.1 INJURY TO THE NAI (LNAI)

LNAI was observed in all studies in which tooth extraction was performed using the conventional technique (8.14%)[14-17], although reports of LNAI were also observed for patients undergoing coronectomy (0.39%)[15,16].

4.2.2 PAIN

Pain was relatively greater in the conventional extraction group, with 28.33% (153 cases) being reported in the extraction group and 19.60% (100 cases) in the coronectomy group.

4.2.3 POSTOPERATIVE INFECTION

Regarding cases of infection, there were 2.74% (14 cases) in the coronectomy group and 3.14% (17 cases) in the control group.

In the coronectomy group four (4%) patients developed postoperative infection, and these were submitted to root removal, without signs of inferior alveolar nerve injury[15].

4.2.4 ALVEOLITIS

The cases of alveolitis were almost equal, being 4.07% (22 cases) in the conventional extraction group and 4.11% (21 cases) in the coronectomy group.

4.2.5 ROOT MIGRATION AND NEED FOR A SECOND INTERVENTION

Root migration has been reported in 4 studies[13-16]. Root migration can be observed from the first postoperative week to 24 months postoperatively[16]. According to some studies, root morphology was the most relevant factor for migration, which occurred more frequently in conical roots[13,14]. Migration of these roots resulted in soft tissue exposure in 02 patients[15], and it collapsed into the oral cavity in 10 patients[13]. In addition, postoperative infection occurred in 4 cases, and the roots were extracted[15]. In the 17 cases of reoperations for root removal. None of them reported LNAI[13,15,17-19].

Dental migration seems to occur more frequently in the first 6 months. According to Leung

et al.[16] dental migration can be observed from the first week (16.2%) and within 24 months postoperatively (2%). the highest frequency observed in the first 3 months postoperatively (62.2%).

RESULTS OF SYNTHESES

The meta-analysis on the inferior alveolar nerve injury comparing the group that underwent surgery with the group that underwent coronectomy was performed with five studies, considering the random effect[14-17]. The group in which tooth extraction was performed was 9.3 times more likely to have inferior alveolar nerve injury than to the group in which coronectomy was performed. There was a statistically significant difference between groups (p<0.001) (Confidence interval 95%, 3.037 – 28.310; Heterogeneity: Q value 1.052; I 2 0%; Tau ^{2} 0.000 ; p-value 0.902. N extraction=540, N coronectomy=472) (Figure 2).

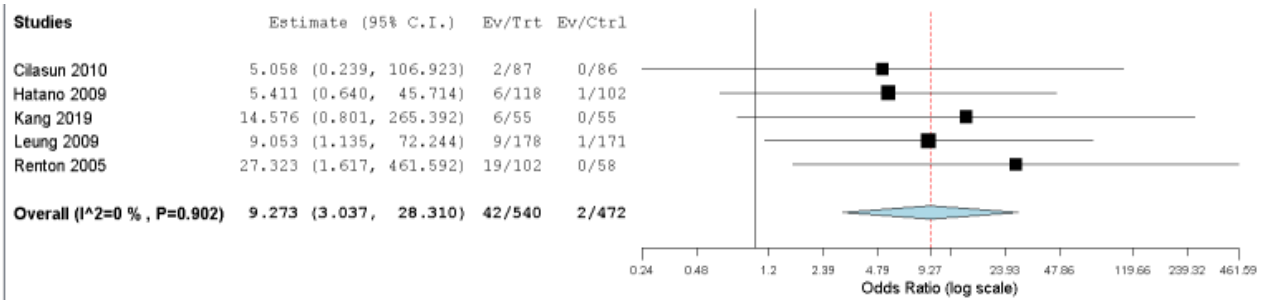

Figure 2 - Comparison of inferior alveolar nerve injury between the groups undergoing tooth extraction and coronectomy.

The meta-analysis on pain presented in the group that underwent tooth extraction compared to the group that underwent coronectomy was performed with 04 studies, considering the random effect[14-17]. The group that underwent tooth extraction was 1.1 times more likely to present pain compared to the group that underwent coronectomy, however, there was no statistically significant difference between the groups (p=0.865) (Confidence interval 95%, 0.390 – 3.063; Heterogeneity: Q value 15.274; I ^{2} 80.359%; Tau ^{2} 0.775; p-value 0.002. N extraction = 485, N coronectomy = 417) (Figure 3).

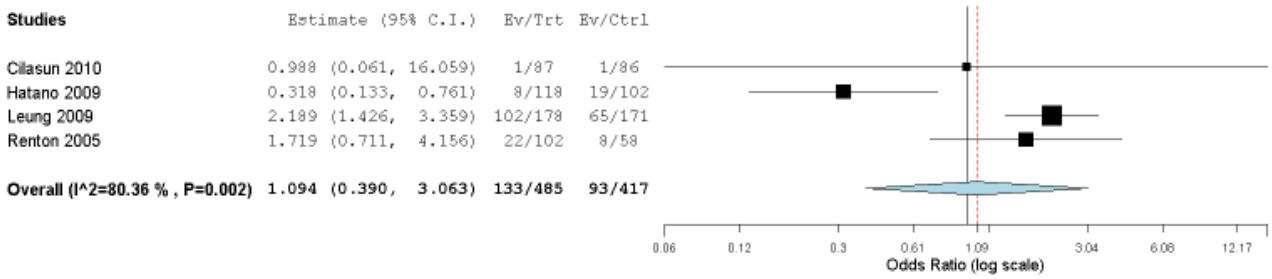

Figure 3 - Comparison of pain occurrence between the groups undergoing tooth extraction and coronectomy.

The meta-analysis on the infection presented in the group that underwent tooth extraction compared to the group that underwent coronectomy was performed with 04 studies, considering the random effect[14-17]. The group that underwent tooth extraction was 1.1 times more likely to have infection compared to the group that had coronectomy, however, there was no statistically significant difference between the groups (p=833) (Confidence interval 95%, 0.433 – 2.825; Heterogeneity: Q value 3.587; I ^{2} 16.357%; Tau ^{2} 0.181; p-value 0.310. N extraction = 485, N coronectomy = 417) (Figure 4).

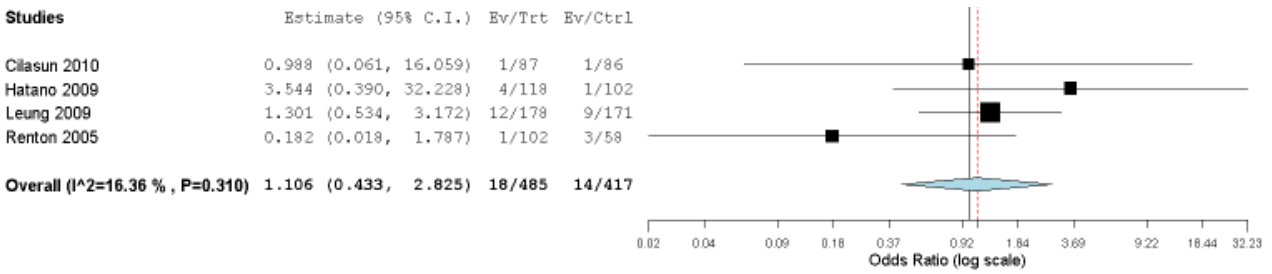

Figure 4 - Comparison of infection rates between the groups undergoing tooth extraction and coronectomy.

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The meta-analysis on alveolitis presented in the group that underwent exodontia compared to the group that underwent coronectomy was performed with 05 studies, considering the random effect[14-17]. The group that underwent tooth extraction was 2.1 times more likely to have alveolitis compared to the group that had coronectomy, however, there was no statistically significant difference between the groups (p=0.143) (Confidence interval 95%, 0.778 – 5.641; Heterogeneity: Q value 5.467; I^2 26.834%; Tau ^{2} 0.344; p-value 0.243. N extraction = 540, N coronectomy = 472) (Figure 5).

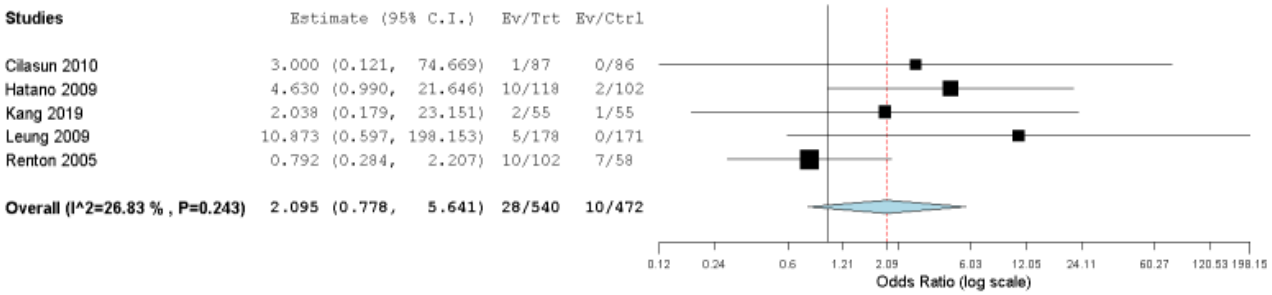

Figure 5 - Comparison of dry socket incidence between the groups undergoing tooth extraction and coronectomy.

DISCUSSION

This literature review shows that coronectomy may be a viable alternative to the extraction of lower third molars in proximity to the inferior alveolar nerve[13,15,16], but this technique is not without risks. Coronectomy aims to avoid injury to the inferior alveolar nerve when there is proximity to the roots of the unerupted third molars. This proximity can be observed by panoramic radiography or computed tomography. The results of the review indicate that computed tomography is the most effective tool for locating the lower alveolar nerve and for surgical planning, as the scan provides a three-dimensional evaluation and confirms the results of other studies indicating that computed tomography is the best option to show the true proximity of the inferior alveolar nerve with the roots which according to the study opt for coronectomy in 12% of cases[18].

If treatment by coronectomy is chosen, it is expected that there will be no nerve injury, however, the results of the study suggest that coronectomy reduces the injury index of the inferior alveolar nerve, which is lower compared to conventional extraction which is consistent with the result of the authors[18,19].

However, even if the LNAI index is lower, it is still present, and should be one of the points to consider when performing coronectomy, because the vast majority of patients recover within a few months if nerve damage occurs.

Also, when coronectomy is planned, all studies indicate failure of the procedure at the time it is performed, i.e., mobilization of the roots occurred and they were removed[13-15,17].

In addition to nerve damage there are other short-term complications, such as pain, infection, and alveolitis mentioned in several studies. In the study of[19] pain was the major short-term complication, occurring in 19.8% of patients, similarly other work presented 18.6% of pain was reported as a complication of coronectomy[14], higher rates were reported in the systematic review of in which 23% of patients experienced pain after coronectomy, the pain index at complete extraction was also high with a percentage of 26%[20].

In terms of alveolitis many studies report similar rates in the coronectomy and conventional extraction groups

Another important factor to consider is root migration, as migration occurs in 100% of coronectomy cases, which some authors report is higher in the first three months[16], while others claim it is higher in the first six months[13], with a consensus in the literature that migration is lower after the first year[15,16,18]. If root migration progresses, there are cases where it erupts in the mouth and a second surgical procedure is required for removal[11].

It has been reported that root removal is also required in cases of infection[16]. In contrast to the study conducted by Renton and coworkers no second surgery was required for root removal after coronectomy[14]. Another factor is failure of coronectomy, which was noted in all studies included in this study. Failure rates vary and are higher in some studies such as Renton et al[15] and Leung et al[16] with 36 and 15 cases, respectively, while they were much lower in the work of[13,15,17].

Therefore, it is important to weigh the existing risks when indicating coronectomy at the expense of conventional exodontia. When choosing coronectomy the risk of iinferior alveolar

nerve injury decreases by about 5%, on the other hand, root migration occurs in almost 100% of cases and in a portion of these cases, root extraction is necessary. Thus, opting for coronectomy reduces the risk of the inferior alveolar nerve injury by 5% and doubles the risk of all complications if the extraction of the remaining root is required.

Most studies indicate that further randomized controlled studies with a longer follow-up period are needed to evaluate whether coronectomy is indeed a viable alternative to the extraction of lower third molars near the inferior alveolar nerve.

CONCLUSION

The studies included in the systematic review suggest that coronectomy may be a viable alternative to extraction of lower third molars near the inferior alveolar nerve because it has a lower rate of injury to the lower alveolar nerve, although it is clearly not a risk- free technique. It can not be considered superior ou inferior when in comparison to conventional extraction, due to its surgical and clinical goal. More randomized clinical trials with long-term follow-up are needed.

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