

# Complications post simple exodontia: A systematic review

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## Abstract

Exodontia procedures are not without complications, which are the dentist's responsibility to avoid by taking into account clinical, imaging, systemic, and operative factors, among others. The purpose of this systematic review is to determine and analyze the prevalence of complications post simple exodontia (CPES). The method used in this systematic review was adapted from the Cochrane Handbook and PRISMA statement. A systematic search was conducted in PubMed, Scopus and ScienceDirect using the search terms "Exodontia" AND "Complications". The search was conducted from the starting coverage date to January 31, 2020. The inclusion criteria were studies on simple exodontia, studies on CPES prevalence and human studies. Studies on complications after third molar exodontia, generalities in exodontia, narratives and systematics literature reviews, book chapters, and animal studies were excluded. A total of 1,446 articles were found in the first search using the search strategy (725 in PubMed, 96 in Scopus and 631 in ScienceDirect). After duplicates were removed, 948 articles were obtained. After reading the title and abstract, 9 articles were read in full. Finally, 3 articles were included in the review, with the most common complications being trismus, alveolitis, pain, dehiscence, infections, and retained roots. Trismus of the chewing muscles, alveolitis and retained roots were the most prevalent CPES, which were most likely related to the surgeon's experience, surgery duration and tissue trauma during surgery.

**Keywords:** exodontia, complication, systematic review, dentoalveolar surgery

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## Introduction

Exodontia is a common procedure in dental practice; however, it is not without complications. Complications are defined in the literature as “unforeseen events that tend to elevate morbidity above expected” in a surgical procedure, and are usually related to age,<sup>1,2</sup> medical status<sup>3</sup> and harmful patient habits.<sup>4</sup> Complications can be classified as intraoperative and postoperative (post-exodontia),<sup>5</sup> when they occur during and after surgery, respectively. Regarding post-exodontia complications, a wide array is described and they can be classified into infectious, such as surgical wound infection, abscess and necrotizing fasciitis, and non-infectious, such as pain, hemorrhage, edema, alveolitis, paresthesia, communication with the maxillary sinus, temporomandibular disorder, trismus, tissue emphysema, and others.<sup>5–8</sup> These complications can range from mild to fatal<sup>8</sup>; therefore, great care to prevent the complications is essential. In this regard, the dentist can influence factors that affect a successful exodontia and decrease the risk of post-exodontia complications, such as accessibility, vision, patient positioning, correct surgical technique,<sup>9</sup> and complementary imaging examinations such as periapical radiography, orthopantomography,<sup>10</sup> and recently, radiation-free imaging techniques such as magnetic resonance and ultrasound imaging. The latter allows adequate three-dimensional visualization comparable to cone-beam computed tomography (CBCT) and an acceptable determination of the size of periapical lesions.<sup>11,12</sup> Exodontia of the third molar, as well as its complications, have been extensively studied in terms of diagnosis,<sup>13</sup> treatment<sup>14,15</sup> and prevention<sup>16</sup> because it is a highly complex procedure in which the tooth is often included or semi-included,<sup>17</sup> and the procedure requires more instruments and a longer operating time. Because of the above, the scientific literature refers to this type of exodontia as complex or surgical, as opposed to the exodontia of fully erupted teeth, which is referred to as simple or non-surgical exodontia.<sup>9</sup> Regarding the latter, there have been few studies focusing on the prevalence and analysis of complications post simple exodontia (CPES).

The goal of this systematic review was to investigate the reported prevalence of CPES.

## Material and methods

### Development of the protocol

The method used in this systematic review was adapted from the Cochrane Handbook for Systematic Reviews of Interventions<sup>18</sup> and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.<sup>19</sup> The following PICO question was used: What is

the prevalence of complications post simple exodontia (CPES)? (Table 1).

Table 1. PICO criteria

PICO	Description
Population	patients with indication for exodontia
Intervention	simple exodontia
Control	patients without post-exodontia complications in relation to patients with post-exodontia complications
Outcomes	prevalence of post-exodontia complications

### Search strategy

The following search terms were used in the PubMed, ScienceDirect and Scopus databases: “Exodontia” AND “Complication”. The search was conducted from the starting coverage date to January 31, 2020.

### Inclusion and exclusion criteria

The inclusion criteria for the articles analyzed in this study were studies on simple exodontia, studies on CPES prevalence and human studies. Studies on complications after third molar exodontia, generalities in exodontia, narratives and systematic literature reviews, book chapters, and animal studies were excluded.

### Screening process

Two independent reviewers searched the databases, removed duplicated articles, read the titles and abstracts to exclude articles that were not relevant to the research topic, and finally read the full texts of the selected articles to ensure compliance with the inclusion criteria. Discrepancies between the 2 reviewers were resolved with the assistance of a 3<sup>rd</sup> team member.

### Data extraction

Two reviewers independently extracted the following data from the included studies: author, year of publication, population studied, sociodemographic characteristics, academic level of the operator, number of simple exodontias performed during the study period, number of CPES, and prevalence of different types of CPES.

### Evaluation of the methodological quality and the risk of bias

For this study, the criteria used by Burgos et al.<sup>20</sup> were modified. A score of 0–7 indicated poor evaluation, 8–14 average evaluation and 15–21 good evaluation, as summarized in Table 2. The criteria proposed by Higgins et al.<sup>21</sup> were used to assess the risk of bias and are summarized in Table 3.

**Table 2.** Evaluation of the methodological quality of the analyzed studies

Description of the methodology	Baniwal et al., 2007 <sup>28</sup>	Ventakshwar et al., 2011 <sup>29</sup>	Tong et al., 2014 <sup>30</sup>
	qualification		
Objective	3	3	3
Design	3	3	3
Sample selection criteria	2	3	2
Characteristics of the study population	3	3	3
Characteristics of the applied reference standard	3	3	3
Characteristics of the diagnostic test under study	3	3	2
Sample size	3	3	3
Total	20	21	19

**Table 3.** Risk of bias

Study	Randomization (selection)	Allocation concealment (selection)	Blinding of participants (performance)	Blinding of assessors (detection)	Incomplete results data (wear)	Selective notification about results (notification)	Other sources of bias (other)
Baniwal et al., 2007 <sup>28</sup>	low	low	low	low	low	unclear	high
Ventakshwar et al., 2011 <sup>29</sup>	low	low	low	low	high	low	low
Tong et al., 2014 <sup>30</sup>	low	low	low	low	low	low	low

**Table 4.** Excluded articles

Study	Reason for exclusion
Simon and Matee, 2001 <sup>26</sup>	does not specify complexity of the exodontia
Malden and Maidment, 2002 <sup>27</sup>	describes a particular complication from third molar exodontia
Christiaens and Reychler, 2002 <sup>22</sup>	describes exodontia of third molars
Blondeau and Daniel, 2007 <sup>23</sup>	describes exodontia of third molars
Øyri et al., 2015 <sup>24</sup>	describes exodontia of third molars
Momin et al., 2018 <sup>25</sup>	describes exodontia of third molars

## Results

Using the above search strategy, 1,446 articles were retrieved from 3 databases (725 from PubMed, 96 from Scopus and 631 from ScienceDirect). After duplicated articles were removed, 948 papers remained. After reading their titles and abstracts to determine their suitability for the study, 9 articles were read in their entirety to ensure compliance with the inclusion criteria. As a result, 6 articles were eliminated: 4 described exodontia of third molars,<sup>22–25</sup> 1 did not specify the complexity of exodontia<sup>26</sup> and 1 described a specific complication caused by third molar exodontia<sup>27</sup> (Table 4 show the details of excluded articles). Finally, 3 articles were included in this systematic review (Fig. 1).<sup>28–30</sup> The study groups in these 3 papers consisted of 22,084 patients in whom, who were treated with a total of 31,401 simple exodontia procedures in these 3 articles. Table 5 presents the details of these complications.

## Methodological quality and the risk of bias

The 3 articles were of good methodological quality (Table 2 shows their quality from a quantitative view).

The risk of bias is summarized in Table 3, which shows the characteristics of each study. In general, all 3 papers had a low level of bias, with all articles providing appropriate definitions of the inclusion and exclusion criteria used in the study.

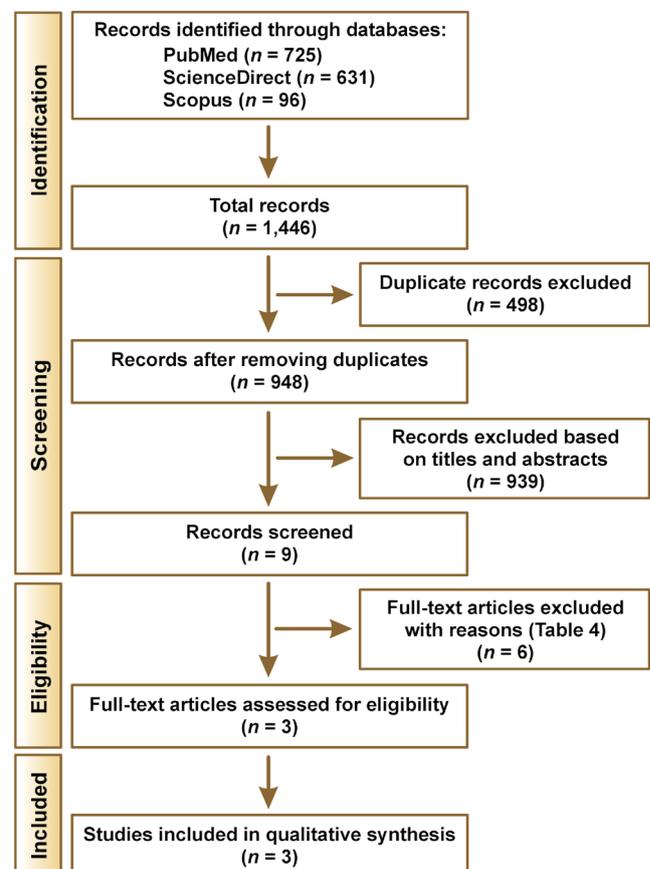
**Fig. 1.** Flow diagram of the study

Table 5. Characteristics of studies

Study	Study population	Sociodemographic characteristics	Academic level of the operator	Number of SESP	CPES n (%)	Prevalence of types of post-exodontia complications						
						A n (%)	H n (%)	T n (%)	P n (%)	I n (%)	RR n (%)	D n (%)
Baniwal et al., 2007 <sup>28</sup>	patients treated by simple exodontia from March 2004 to March 2005 at B.P. Koirala Institute of Health Sciences, Mechi and Koshi zonal hospitals, Dharan, Nepal	6,639 patients, 37.12% men and 62.88% women, age range: 5–65 years, mean age NR	dental undergraduate students (4 <sup>th</sup> and 5 <sup>th</sup> year), interns and dentists	8,455	60 (0.70)	11 (0.13)	19 (0.22)	NR	NR	3 (0.03)	21 (0.25)	NR
Venkateshwar et al., 2011 <sup>29</sup>	patients without systemic compromise, not pregnant or lactating, treated by simple exodontia between October 2007 and September 2010 in the Department of Oral and Maxillofacial Surgery at Padmashree Dr. D.Y. Patil Dental College and Hospital, Mumbai, India	14,975 patients, 56.5% men and 43.5% women, age range: 14–82 years, mean age: 41 years	dental undergraduate students and interns	22,330	8659 (38.77)	2618 (11.70)	289 (1.30)	4,023 (18.00)	864 (3.90)	86 (0.38)	NR	779 (3.48)
Tong et al., 2014 <sup>30</sup>	patients treated by exodontia (simple and/or complex) from February 1 to June 30, 2012, at the Faculty of Dentistry of the University of Otago, Dunedin, New Zealand	454 patients, 48% men and 52% women, age range: 11–91 years, mean age: 45 ± 19.3 years	dental undergraduate students (4 <sup>th</sup> and 5 <sup>th</sup> year) and dentists	412	57 (13.80)	32 (7.70)	0 (0.00)	23 (5.50)		2 (0.40)	NR	NR

NR – not reported; CPES – post-exodontia complications; A – alveolitis; H – hemorrhage; T – trismus; P – pain; I – infection; RR – retained roots; D – dehiscence; SESP – simple exodontia in the study period.

## Synthesis of the results

Three of the included articles shared similar characteristics. Baniwal et al. aimed to analyze the prevalence of exodontia complications at tertiary and peripheral care centers at the Institute of Health Sciences in Kathmandu, Nepal, in 2007.<sup>28</sup> Exodontias were performed in peripheral centers by dentists and internal surgeons, and in tertiary centers by dentists, interns and 4<sup>th</sup>- and 5<sup>th</sup>-year students of dental school. Exodontias of impacted teeth were excluded. A total of 8,455 simple exodontias were performed in 6,639 patients, 37.12% of whom were male and 62.88% of whom were female, ranging in age from 5 to 65 years, under local anesthesia. Sixty complications and 37 CPES were reported to occur during and after the 7,152 exodontias performed in tertiary centers. In peripheral centers, there were 1,303 exodontias performed with 30 complications and 23 CPES. The CPES in the tertiary care center included 11 retained roots, 10 postoperative hemorrhages, 7 cases of alveolitis, 3 cases of osteomyelitis, 3 infections, and 1 hematoma, while the CPES in the peripheral centers included 10 retained roots, 9 postoperative hemorrhages and 4 cases of alveolitis. The rate of postoperative hemorrhage was statistically higher in peripheral centers than in tertiary care centers ( $p$ -value < 0.05).

The study by Venkateshwar et al. was performed in 2012 in Mumbai, India.<sup>29</sup> A total of 22,330 simple ex-

odontias were performed on 14,975 patients, (8,464 being men and 6,511 women, age range: 14–82 years. Exodontias performed using a simple elevator and forceps were included in the study, but complex exodontias were not. All patients were injected with a maximum of 5 mL of 2% lidocaine hydrochloride anesthetic solution, given antibiotics (amoxicillin (250/500 mg) or amoxicillin (250 mg) and cloxacillin (250 mg)), as well as painkillers, and instructed how to care for their wounds during the post-operative period. The most common indications for exodontia were: periodontal disease (37.9%), caries (30.3%), orthodontic causes (14.8%), trauma (7.9%), defective endodontics (6.8%), a non-functional tooth (5.9%), iatrogenic causes (3.2%), and other causes (3.2%). Of the exodontias performed, 23% were of anterior maxillary teeth, 28% of posterior maxillary teeth, 16% of anterior mandibular teeth, and 33% of posterior mandibular teeth. The most common CPES were trismus in 4,023 patients (18%), alveolitis in 2,618 patients (11.7%) and pain in 86 patients (0.39%). There was a statistically significant difference ( $p$ -value < 0.05) between undergraduate and intern students in terms of exodontia complications, with undergraduate students having a higher incidence of complications. On the other hand, with regard to the time required to perform exodontia, the authors found significant differences ( $p$ -value < 0.05) in favor of a higher frequency of complications in exodontias performed in 30–60 min compared to exodontias performed in less than 30 min.

Finally, Tong et al. conducted a study at the Faculty of Dentistry of University of Otago in Dunedin, New Zealand, to determine the frequency and correlations of CPES.<sup>30</sup> In this study, approx. 1 out of every 11 teeth extracted were incisors or canines, nearly 1/3 were first or second premolars (29.6% of all teeth removed), and the first, second and third molars each accounted for approx. 20% of all teeth extracted (23.8%, 20.7% and 17.3%, respectively). More maxillary teeth than mandibular teeth were extracted (56.7% and 43.3%, respectively). A total of 412 simple exodontias were analyzed, with CPES occurring in 13.8% of cases, including 32 incidences of alveolitis (7.7%), 23 cases of pain and trismus (5.5%), and 2 infections (0.4%). Alveolitis was the most common complication, accounting for 56% of all complications. On the other hand, a statistically significant difference ( $p$ -value < 0.05) was found between the academic level of operators and the incidence of CPES, with 4<sup>th</sup>-year students (18.5%) having a higher incidence of complications compared to 5<sup>th</sup>-year students (11.0%) and graduated dentist (9.6%). The most common cause of alveolitis was exodontia of the first and second mandibular molars.

## Discussion

The objective of this systematic review was to determine and analyze the prevalence of CPES described in the literature. The most common CPES in the study by Baniwal et al. were the retained roots.<sup>28</sup> Venkateshwar et al.<sup>29</sup> reported trismus to be the most common, and Tong et al.<sup>30</sup> reported alveolitis. However, the general literature describes alveolitis as the most studied complication post exodontia.<sup>31</sup>

Alveolitis was described by Blum as “postoperative pain at and around the exodontia site, which increases in severity at any time between the 1<sup>st</sup> and 3<sup>rd</sup> days after exodontia, accompanied by partial or total disintegration of the blood clot within the socket, with or without halitosis”.<sup>32</sup> The average percentage reported is 3% in simple exodontia and increases to 30% in exodontias when third mandibular molars are included.<sup>31,33</sup> These values are similar to those found in this review (0.13–11.7%). Several factors have been linked to the occurrence of alveolitis, including flap design used in surgery,<sup>34</sup> menstrual cycle and/or use of oral contraceptives,<sup>35,36</sup> immediate irrigation of the alveoli with physiological serum post-exodontia,<sup>37</sup> use of painkillers,<sup>38</sup> smoking habits,<sup>39</sup> traumatic exodontia,<sup>4</sup> curettage of the socket,<sup>40</sup> use of antibiotics,<sup>16,41,42</sup> surgical time,<sup>43</sup> and operator experience.<sup>39</sup> Presurgical antibiotic prophylaxis<sup>16,42</sup> and postsurgical prescriptions of pharmacologic therapies<sup>41</sup> are described as possible preventive measures in alveolitis incidence. In this regard, Ramos et al. and Ren et al. determined in their respective systematic reviews<sup>16,42</sup> that prophylactic antibiotic use significantly reduces the incidence of alveolitis. However, due to the

risk of bacterial resistance,<sup>44</sup> it is preferred to use post-exodontia chlorhexidine administration in any formulation, concentration or regimen, as it has been shown to reduce the incidence of alveolitis,<sup>45</sup> and reserve prophylactic antibiotic administration for patients with a medical history and local conditions that increase the risk of alveolitis. These factors may explain why trismus (and not alveolitis or other infectious complications) was more common in the study by Venkateshwar et al.,<sup>29</sup> in which antibiotics were given to all patients postoperatively.<sup>16</sup>

Trismus is defined differently by each author, but they all agree that it is a prolonged spasm of the mandibular elevator muscles that results in a limitation in buccal opening.<sup>46</sup> On the other hand, its etiology can be congenital, traumatic, neoplastic, neuromuscular, reactive, psychogenic, and drug-induced.<sup>47</sup> In relation to its traumatic etiology, scientific evidence has proposed muscle or joint pain to be responsible for the muscle spasms that limit buccal opening.<sup>48</sup> Ernberg et al. suggested that a synergist co-contraction produced by the masseter and anterior belly of digastric muscles may cause a reduction in buccal opening.<sup>49</sup> Bodéré et al. showed an increase in the electromyographic activity of the masseter and temporal muscles in patients with myofascial pain, in which electromyographic activity increased bilaterally, even though the pain was unilateral.<sup>50</sup> Furthermore, the electromyographic activity of the temporal and masseter muscles, as well as the resting masseter reflex, were significantly higher in the groups of patients with pain compared to the group without pain. The authors concluded that an increase in electromyographic activity would likely stem from central nociceptive mechanisms. This supports the pain theory proposed by Fougere et al., who suggested that electromyographic activity is reduced in the agonist muscles (in this case, mandibular elevators) during muscle function in situations that generate pain.<sup>51</sup> Lund et al. observed that muscle pain can result from the general protection of sore muscles during static and dynamic contractions, resulting in a characteristic “dysfunction” as a means of normal protective adaptation that is responsible for limiting buccal opening.<sup>52</sup> Regarding postoperative pain after exodontia, Lago-Mendez et al. demonstrated that patients undergoing more complex and time-consuming exodontias suffered a statistically significant higher degree of postoperative pain than those undergoing exodontia of less complexity and time.<sup>53</sup> Along the same research line, De Santana-Santos et al. showed that for patients undergoing mandibular third molar included exodontia, time was a statistically predictive factor of pain, swelling and trismus.<sup>54</sup> This correlates with the findings of a study by Venkateshwar et al., who found a higher prevalence of complications in simple exodontias lasting more than 30 min as compared to shorter procedures.<sup>29</sup>

In the present study, the prevalence of pain ranged from 3.9% to 5.5%. Al-Khateeb et al. discovered the prevalence of pain to be 81.8% on the first night following intervention, as well as a statistically significant higher prevalence

of pain in females between days 3 and 5 after exodontia.<sup>55</sup> On the other hand, these investigators discovered that teeth with chronic inflammation were associated with increased postoperative pain. There was also a significant correlation between the average pain intensity scores and previous dental injection pain. In contrast, Lago-Mendez et al. showed a statistically significant relationship between surgical difficulty and postoperative pain in a study of lower third molar exodontia, with the most extensive and difficult surgeries producing the most pain.<sup>53</sup> Finally, in a study that included third molar exodontia, Capuzzi et al. discovered that pain was statistically more intense in men than in women on the first and 3<sup>rd</sup> days.<sup>56</sup> Furthermore, patients treated by experienced surgeons reported less pain on the 1<sup>st</sup> and 3<sup>rd</sup> day following surgery than patients treated by inexperienced surgeons. There was also a direct correlation between age and pain, with younger patients reporting less pain than older ones. Given that 2 of the previous articles discuss exodontia of third molars, these findings partially match the data collected in this systematic review. Tong et al. reported a female sex predominance regarding the prevalence of pain, but it did not reach statistical significance. Meanwhile, no significant difference was found between pain prevalence and increased age; however, the authors commented on the importance of the surgeon's experience as patients treated by 4<sup>th</sup>- and 5<sup>th</sup>-year students had a higher prevalence of pain than those treated by dentists. These findings appear to indicate that experience allows for a better approach to surgical difficulty, resulting in a reduction in tissue trauma that causes pain.<sup>30</sup> However, Rakhshan et al. failed to find a relationship between clinical experience of the person performing exodontia and postoperative pain, so this issue should be viewed with caution.<sup>57</sup>

The literature describes dehiscence as the opening or rupture of a previously closed surgical incision site.<sup>58</sup> Its prevalence in lower third molar exodontia ranged from 0.5% to 33%,<sup>59,60</sup> while the prevalence found in this systematic review was 3.48%, which was only reported by Venkateshwar et al.<sup>29</sup> Factors such as technique, dentist dexterity, suture type, and type and design of the mucoperiosteal flap,<sup>60-62</sup> supported by the dentist's experience allows the surgeon to better address all intraoperative difficulties and avoid or reduce the likelihood of generating a dehiscence. This is consistent with the findings of the studies included in this systematic review, which showed a higher level of CPES in less experienced surgeons and students.<sup>28-30</sup>

The prevalence of postoperative infections varies between 0.8% and 42.6%,<sup>63,64</sup> and in this systematic review it was between 0.03% and 0.4%. This difference may be due to the fact that these studies were conducted on surgical exodontias, which involve increased tissue trauma and surgical time. Furthermore, in the study by Venkateshwar et al., the patients in which the analyzed exodontias were performed received a prescription for postoperative antibiotics, which could have decreased the prevalence

of postoperative infections.<sup>29</sup> According to Jerjes et al., there is a statistically significant relationship between the dentist's experience and the incidence of postoperative infections, with oral and maxillofacial surgery residents being twice as likely as specialists to cause an infection.<sup>65</sup>

Retained roots are an intraoperative complication that occurs when a root fragment fractures and falls inside the socket during tooth avulsion. The dentist must decide whether to leave the root fragment inside the socket or attempt to excise it. If the fragment is left inside the socket, this could lead to a postoperative complication if the patient has painful symptoms or an infection. The most similar clinical situation is the intentional coronectomy of third molars with an anatomical position near the mandibular canal. Exodontias of these are considered to pose high risk of causing damage to the lower alveolar neurovascular structures. However, studies show that the likelihood of a complication from intentionally leaving a root in the socket is extremely low. Cosola et al. found that in 130 patients who underwent coronectomy with 4 years of follow-up, only 13 had root displacement but all were asymptomatic.<sup>66</sup> Nayyar et al. reported that the incidence of retained roots varied between 11% and 37%,<sup>67</sup> which is higher than the rate found in this systematic review. This difference is mainly because the prevalence described in the literature included studies in which the prevalence percentage was calculated based on orthopantomography<sup>67,68</sup> instead of exodontia. Retained roots tend to migrate from their position,<sup>66-68</sup> but they do not pose a long-term risk.<sup>68,69</sup> Factors such as pulp vitality, root stability in exodontia and complete wound closure promote root encapsulation.<sup>67</sup> This encapsulation facilitates the success of the maneuver and prevents dysesthesia.<sup>70</sup> This information should be carefully analyzed because in coronectomy the teeth are mostly without cavities or periodontal disease, unlike teeth in which unplanned root fracture occurs. The presence of these pathologies could affect the results other than those described in coronectomy studies.<sup>71,72</sup>

Hemorrhage had a prevalence ranging from 0.22% to 1.3% in this systematic review. The prevalence described in the literature is 0.1% in healthy patients and approx. 21.8% in anticoagulant-treated patients.<sup>73</sup> Factors such as multiple exodontias, increased prothrombin time, imbalance in hemostasis during surgery, high serum creatinine levels, and antibiotic prophylaxis are associated with postoperative hemorrhage in patients receiving oral antithrombotics.<sup>74</sup> Baniwal et al. proposed that hemorrhages were more prevalent in peripheral centers and that, according to the literature, are more frequent in patients with alveolitis and retained roots.<sup>28</sup> Identifying risk factors associated with hemorrhage and proactively controlling PT-INR in patients receiving antithrombotic therapy is essential.<sup>74</sup>

In terms of relationship between the experience of the dentist and CPES, Larsen et al. examined the surgical exodontias of 138 impacted third molars performed by experienced and inexperienced dentists. Alveolitis was

significantly more common in patients treated by an inexperienced surgeon. The experienced surgeons had 16 cases of alveolitis in 102 surgical sites compared to the 12 cases of alveolitis in 32 sites in the inexperienced surgeons group, indicating a statistically significant increase of more than 130% in the number of alveolitis cases in patients operated on by inexperienced surgeons.<sup>39</sup> Sisk et al. studied CPES in patients treated by academic oral surgeons and students.<sup>75</sup> They identified a difference between the prevalence of alveolitis among academic surgeons and students that was statistically significant for mandibular exodontia and total exodontia. The authors associated the lack of experience with greater surgical trauma in the student group, which would explain the difference between the 2 groups. Capuzzi et al. discovered similar results in their study.<sup>56</sup>

While the majority of the articles focused on third molar exodontia, findings reported in them are consistent with those found in this systematic review. For example, Baniwal et al. showed a low overall CPES prevalence of 0.47% (40) out of a total of 8,445.<sup>28</sup> Venkateshwar et al., on the other hand, discovered that complications occur more often in patients treated by undergraduate students than in treated by interns.<sup>29</sup> Furthermore, they discovered a significant difference in favor of a higher frequency of complications in exodontia performed in 30–60 min compared to exodontia performed in less than 30 min. Finally, Tong et al. suggested a relationship between CPES and the academic level of surgeons and found a statistically significant difference of more CPES in the least experienced group of 18.5%, 11% and 9.6% in 4<sup>th</sup>- and 5<sup>th</sup>-year students and dentists, respectively.<sup>30</sup>

However, in relation to the prevention of non-infectious post-exodontia complications, it has been shown that the use of kinesiotaping (KT) after impacted mandibular third molar exodontia significantly reduced swelling, pain and trismus.<sup>6</sup> In addition, it is associated with an improvement in the quality of life of the patients who received this therapy.<sup>76,77</sup> On the other hand, the use of platelet-rich plasma has also been associated with a significant decrease in pain and trismus.<sup>78</sup> In addition, the placement of an intraoral latex drainage system after exodontia of impacted mandibular third molars has been associated with a faster and less traumatic recovery.<sup>79</sup> Although, the mentioned studies were carried out in relation to exodontia of impacted third molars, it is prudent to consider these therapies in the case of extractions that are complicated and associated with prolonged surgical times.

## Limitations

Few studies solely focused on simple exodontia as opposed to papers concerning third molar exodontia, which are far more prevalent than publications about simple exodontia. However, because there were few articles on simple exodontia, the findings had to be discussed in conjunction with studies on the surgical exodontia of third molars.

## Conclusions

The most prevalent CPES in simple exodontia were retained roots described by Baniwal et al.,<sup>28</sup> trismus in the study by Venkateshwar et al.<sup>29</sup> and alveolitis in the paper by Tong et al.<sup>30</sup> These complications appear to be associated with the surgeon's experience, surgical time and tissue trauma during surgery. As a result, careful examination of each clinical case is required to compensate for the potential lack of experience of students and newly graduated dentists in the prevention of CPES.

## Ethics approval and consent to participate

Not applicable.

## Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Consent for publication

Not applicable.

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