



# Common risk factors for postoperative pain following the extraction of wisdom teeth

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**Abstract** (J Korean Assoc Oral Maxillofac Surg 2015;41:59-65)

The extraction of third molars is a common task carried out at dental/surgery clinics. Postoperative pain is one of the two most common complications of this surgery, along with dry socket. Knowledge of the frequent risk factors of this complication is useful in determining high-risk patients, planning treatment, and preparing the patients mentally. Since the risk factors for postoperative pain have never been summarized before while the risk factors for dry socket have been highly debated, this report summarizes the literature regarding the common predictors of postextraction pain. Except for surgical difficulty and the surgeon's experience, the influences of other risk factors (age, gender and oral contraceptive use) were rather inconclusive. The case of a female gender or oral contraceptive effect might mainly be associated with estrogen levels (when it comes to dry socket), which can differ considerably from case to case. Improvement in and unification of statistical and diagnostic methods seem necessary. In addition, each risk factor was actually a combination of various independent variables, which should instead be targeted in more comprehensive studies.

**Key words:** Pain, Risk factors, Third molar, Extraction

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## I. Introduction

One of the most common procedures carried out in dental clinics and the most frequent task done at oral and maxillofacial surgery clinics is the extraction of wisdom teeth. This procedure is frequently followed by complications in the mandible<sup>1-3</sup>, including both iatrogenic (e.g., nerve injury, bone fractures, etc.) and inflammatory ones, such as dry socket, postoperative pain, delayed healing, postoperative infection, hematoma, swelling, trismus, etc.<sup>2,4-6</sup>. Although the overall complication rate might be generally low, and most complications are minor<sup>4,7-9</sup>, this surgery is so frequent that the population's morbidity of complications may be noticeable; thus, identifying methods to control or reduce them is

a major concern<sup>4,10,11</sup>. Besides, not all complications are rare. There are frequent and debilitating complications as well, including postoperative pain.

Pain is also one of the most common postoperative complications of extraction<sup>6,12-15</sup> and might be caused by the release of pain mediators from the injured tissues<sup>3,15</sup>. Pain is an important factor in clinical practice<sup>6,16</sup> and could even discourage patients from seeking dental treatment<sup>15,17,18</sup>. It begins after the anesthesia subsides and reaches its peak levels during the first postoperative day<sup>15,19,20</sup>. If dry socket or infection occur, the onset of inflammation will complicate alleviation of postoperative pain<sup>5,15,20-26</sup>.

In the setting of elective operations, such as third molar removal, patients demand to know the risks, benefits and postoperative quality of life of these procedures<sup>15,17,27</sup>. The knowledge of the risk factors of postsurgical complications has clinical implications in treatment planning, patient management and prognosis<sup>15,19,21,24,28-31</sup>. This essay briefly reviews the most common risk factors of pain following third molar removal.

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## II. Materials and Methods

The internet was searched to find relevant articles published before July 2014 regarding the risk factors of postextraction pain. The search engines used were Google Scholar, Pubmed/MEDLINE, ISI Web of Science, and Scopus. The keywords were as follows: “third molar”, “wisdom tooth”, “wisdom teeth”, “extraction”, “removal”, “postoperative pain”, “postsurgical pain”, “risk factor”, “prognostic factor”, and “predictor”.

More than 800 unique articles were initially found. All these article “titles” were reviewed to narrow down the scope of the search to more relevant articles, according to the eligibility criteria of the presentation of results of original research or short communications regarding pain perceived after the extraction of the third molars before July 2014; the time span was open to all articles published before this date. The articles of interest were collected and evaluated. The reference lists of the located articles were also consulted to identify additional relevant reports. Each article or abstract was read at least twice, and the proper information was aggregated. Other more general topics were also researched for the sake of discussing the matters.

## III. Results

### 1. Oral hygiene

The effects of hygiene maintenance on postoperative pain have not been widely assessed except in a few English and non-English articles. Sáez Cuesta et al.<sup>32</sup> extracted 100 wisdom teeth and found that patients with poor oral hygiene before surgery experienced higher pain levels during the first 6 postoperative hours. Peñarrocha et al.<sup>5</sup> explored 190 impacted third molars and found that pain increased with increasing lack of care to hygiene. Larrazábal et al.<sup>33</sup> asserted that pain increases were correlated with less brushing before surgery and also during the first postoperative week.

### 2. Difficulty of the extraction procedure and trauma

An association between different aspects of surgical difficulty (such as the impaction level and angle, extent of bone removal or length of surgery) and pain or paresthesia has been assessed in most previous studies<sup>6,14,15,28,29,34,37</sup> with a few exceptions<sup>12,38</sup>. Lago-Méndez et al.<sup>13</sup>, Pedersen<sup>14</sup>, Baqain et al.<sup>39</sup>, and de Santana-Santos et al.<sup>6</sup> stated that lengthier sur-

geries leave more painful sockets. However, Benediktsdóttir et al.<sup>29</sup> found that simply the root morphology and level of impaction were correlated to postoperative pain; they did not identify any impact of the actual surgery time<sup>29</sup>. Grossi et al.<sup>38</sup> also did not find a significant relationship between the elapsed time of surgery and the level of postoperative discomfort. Seymour et al.<sup>40</sup> stated that the postoperative pain level might not be dependent upon the operator or the extent of surgical trauma as estimated by operating time and radiographic score. On the other hand, Oikarinen<sup>35</sup>, Garcia Garcia et al.<sup>36</sup>, Haraji and Rakhshan<sup>15</sup>, and Yuasa and Sugiura<sup>37</sup> found that more difficult operations were more painful. The release of more inflammatory factors and proximity to the nerve might produce more intense pain in some difficult cases. This pain might shift to paresthesia or anesthesia in cases with direct injury to a nerve<sup>34</sup>. It should be noted that according to recent research, radiographic indicators alone (i.e., Winter, Pell and Gregory, Pederson)<sup>14,41-43</sup> cannot totally identify the extent of the difficulty of surgery<sup>6,13,29,34,44,45</sup>. Additionally, not all the difficulty determinants are necessarily prognostic factors for complications<sup>46</sup>. Therefore, better methods should be used to estimate surgical difficulty, or the latent variables should be assessed independently instead<sup>31</sup>.

### 3. The operator's expertise

An experienced surgeon might carry out a cleaner, less traumatic and yet faster operation than someone new to the procedure. Additionally, patients might trust experienced clinicians more. These factors (trauma, duration of surgery and anxiety) can play important roles in inducing complications<sup>8,12,22,28-30,47-53</sup>. Therefore, expert clinicians might obtain better results<sup>8,12,34,48-51,54-56</sup>. However, the evidence is controversial, as some authors did not denote a link between the surgeon's skill and the patient's postoperative pain<sup>29</sup>. Some of these “experience levels” were actually different terms of undergraduate study and thus indicated little about the surgeon's expertise<sup>57</sup>. A surgeon's experience might reduce the postoperative pain only within a short period after the surgery but may have no influence on the duration or intensity of longer pains<sup>12</sup>. This discrepancy might contribute to the controversial result depending on the time at which the pain is assessed.

### 4. Tobacco smoking

Smoking might increase pain by reducing blood supply in

the alveolar socket<sup>33,49</sup>. Meechan et al.<sup>49</sup> asserted that heavy smokers have a high chance of poor filling of their extraction sockets with blood. They also found a correlation between this phenomenon measured immediately after the extraction and painful sockets<sup>49</sup>. Nevertheless, to the author's knowledge, only certain authors have found a significant link between postoperative pain and smoking<sup>33</sup>. The only relationship that was found was between the pains perceived on the first post-surgical day and with postsurgical smoking<sup>33</sup>. The same study and many others did not correlate preoperative smoking with postsurgical pain in their total samples<sup>4,12,15,33,38,39</sup>. In the studies of Grossi et al.<sup>38</sup> and Heng et al.<sup>2</sup>, a greater amount of pain perceived by females was associated with smoking<sup>2,38</sup>. Grossi et al.<sup>38</sup> suggested that smoking only affects the perception of pain by females. However, Haraji and Rakhshan<sup>15</sup> adjusted for the role of gender while assessing the effect of smoking on pain. In their analysis, smoking had no significant effects on postoperative pain on the first or third postoperative days or in general. They also assessed the interaction of gender and smoking, and no significant results appeared<sup>15</sup>.

## 5. Gender

Gender is a crucial variable that should be considered when designing and analyzing the findings of studies in all areas and at all levels of biomedical and health-related research<sup>38</sup>. This issue has been ignored in the past and has gained popularity only in the last few decades<sup>58</sup>. The association between clinical pain and gender is not a simple one, but females have reported more frequent pains compared to men in terms of various anatomic regions, neuropathic conditions, chronic musculoskeletal pains, temporomandibular pains, facial pains, toothaches, etc.<sup>58-64</sup>. Postoperative pain studies lack standardization and are at some points conflicting; however, in general, it could be inferred that women might experience pain more often and to a greater extent than men<sup>58,65-68</sup>. Although the research in this regard is rather scarce in terms of postextraction pain by gender, the aforementioned results could imply that females might have a higher sensitivity to pain stimuli perhaps due to psychosocial factors (mood, sex role beliefs, pain coping strategies, and pain-related expectancies), catastrophizing and sex hormones<sup>38,69,70</sup>. Also the thinner mandible of women might render them more vulnerable to pain and some complications after dental procedures<sup>6,71</sup>. Some authors have reported more intense postsurgical pains<sup>28,29,40</sup>, longer symptom recovery times<sup>17,47</sup> or neurosensory deficit in females<sup>34</sup>. However, many others found

conflicting results<sup>4,12,15,37,38,46,57,72,73</sup>. Capuzzi et al.<sup>12</sup> reported a greater extent of pain in males. Yuasa and Sugiura<sup>37</sup> declared that postoperative swelling and morbidity but not pain might be greater in females. de Santana Santos et al.<sup>41</sup> observed significantly more pain in females only during the first 4 and 12 postoperative hours, but at the 24th and 48th postoperative hours, the greater pain intensity in women did not reach a level of significance<sup>41</sup>. This controversy might be rooted in various missing latent variables (e.g., hormonal, psychological or genetic differences, etc.).

## 6. Oral contraceptives

Contraceptive consumption might be less likely to affect or confound pain-related results<sup>4,12,38,74</sup>, although a few studies have reported on its positive role in this regard as well<sup>75</sup>. Regardless, modern contraceptive pills contain considerably lower doses of estrogen and therefore have a reduced role compared with those of the past<sup>34,76</sup>.

## 7. Age

The production and process of sensory stimuli might be influenced by aging<sup>77-79</sup>. The elderly could be at higher risk of complications, such as severe pain and sensory disturbances<sup>4,12,38,80,81</sup>, possibly because of this group's poorer healing potential, denser bones and completed dental roots<sup>4,28,34,82</sup>. Some investigators have observed significant deteriorating effects of aging on pain<sup>9,12,28,81</sup>. Blondeau and Daniel<sup>34</sup> reported increased neurosensory problems in patients older than 24 years. However, other studies have not identified such a role<sup>29,39,83</sup>. Adeyemo et al.<sup>84</sup> and Bui et al.<sup>4</sup> found no significant association between age and complications. Yuasa and Sugiura<sup>37</sup> reported a significant influence of age on swelling and collective postprocedural morbidity but not pain. Grossi et al.<sup>38</sup> observed a significant association between patients older than 23 years and merely severe trismus but not pain either reported subjectively by the patients or implied by the number of painkillers taken. Benediktsdóttir et al.<sup>29</sup> found no correlation between age and discomfort, despite their finding indicating that surgery could last significantly longer in older patients. In the study of Capuzzi et al.<sup>12</sup>, younger participants reported less pain in the first postextraction day, but the number of painkillers taken was not correlated with age. Haraji and Rakhshan<sup>15</sup> studied younger patients and showed that when the effects of the operation difficulty, smoking and gender were not controlled for, younger people might show

significantly greater pain. However, when these factors were adjusted for, younger patients showed a borderline significantly greater amount of pain only for the first postoperative day but not on the third postsurgical day<sup>15</sup>. The narrow range of patient ages could mask such an effect, since third molar extraction is usually indicated in young ages<sup>38</sup>, and debilitating effects of age might appear in older ages<sup>79</sup>. Some authors have advocated the removal of impacted molars in young adults to avoid severe or permanent sequelae<sup>9,34,81</sup>. Nonetheless, if the assumption is not confirmed, early prophylactic extraction of wisdom teeth, which is common in Europe and America, might not be justifiable<sup>38,84,85</sup>.

#### IV. Conclusion

Based on the number of studies agreeing that a certain po-

tential factor might likely be a real risk factor (Table 1), the trauma of surgery and experience of the surgeon were more likely to be causative or risk factors of pain. High levels of estrogen were not necessarily a risk factor for pain. Evidence suggesting a higher incidence of postextraction pain in females was outnumbered by reports that refuted such an association. The effect of age remained inconclusive. Although only a few studies regarding the effect of oral hygiene on postoperative pain exist, it was shown to be effective in that regard as well. There were at least three obstacles for detecting possible links between pain and risk factors: consumption of painkillers and antibiotics by the patients after surgery, which act as efficient confounders<sup>15,20,25</sup>, as well as poorer statistical approaches, and confusion of pain caused by a dry socket or infection with pain caused only by the surgery and also with discomfort. Except for a few essays<sup>15</sup>, almost

**Table 1.** A summary of studies supporting or not supporting the role of the searched risk factors (some studies fit both criteria)

Factor	Supporting study	Studies failing to support the risk factor
Oral hygiene	Sáez Cuesta et al. <sup>32</sup> Peñarrocha et al. <sup>5</sup> Larrazábal et al. <sup>33</sup>	-
Operation difficulty, duration or trauma as risk indicators of postoperative pain, sensory disruption or discomfort	Lago-Méndez et al. <sup>13</sup> Pedersen <sup>14</sup> Baqain et al. <sup>39</sup> de Santana-Santos et al. <sup>6</sup> Oikarinen <sup>35</sup> Garcia Garcia et al. <sup>36</sup> Haraji and Rakhshan <sup>15</sup> Yuasa and Sugiura <sup>37</sup>	Capuzzi et al. <sup>12</sup> Benediktsdóttir et al. <sup>29</sup> Grossi et al. <sup>38</sup> Seymour et al. <sup>40</sup>
The expertise of the surgeon	-	Benediktsdóttir et al. <sup>29</sup> Capuzzi et al. <sup>12</sup>
Smoking	Meechan et al. <sup>49</sup> Larrazábal et al. <sup>33</sup> Grossi et al. <sup>38</sup> Heng et al. <sup>2</sup>	Bui et al. <sup>4</sup> Haraji and Rakhshan <sup>15</sup> Larrazábal et al. <sup>33</sup> Capuzzi et al. <sup>12</sup> Grossi et al. <sup>38</sup> Baqain et al. <sup>39</sup>
Gender	In favor of female gender Phillips et al. <sup>28</sup> de Santana Santos et al. <sup>41</sup> Benediktsdóttir et al. <sup>29</sup> Seymour et al. <sup>40</sup> In favor of male gender Capuzzi et al. <sup>12</sup>	Eshghpour et al. <sup>57</sup> Abu Younis and Abu Hantash <sup>72</sup> Barbosa-Rebellato et al. <sup>73</sup> Carvalho and do Egito Vasconcelos <sup>46</sup> Haraji and Rakhshan <sup>15</sup> Yuasa and Sugiura <sup>37</sup> Bui et al. <sup>4</sup> Grossi et al. <sup>38</sup>
Age	Osborn et al. <sup>9</sup> Bruce et al. <sup>81</sup> Blondeau and Daniel <sup>34</sup> Capuzzi et al. <sup>12</sup> Phillips et al. <sup>28</sup>	Capuzzi et al. <sup>12</sup> Akadiri et al. <sup>83</sup> Adeyemo et al. <sup>84</sup> Bui et al. <sup>4</sup> Yuasa and Sugiura <sup>37</sup> Grossi et al. <sup>38</sup> Benediktsdóttir et al. <sup>29</sup> Capuzzi et al. <sup>12</sup> Haraji and Rakhshan <sup>15</sup> Baqain et al. <sup>39</sup>

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all previous studies have failed to distinguish dry socket or infection pain from pain caused by the surgery alone when evaluating the risk factors for postoperative pain. Future studies are warranted to account for each type of pain independently. Another issue ignored in almost all studies except a few<sup>15,28,31</sup> is that the variables that affect pain likely interact with each other. Therefore, analyses not accounting for the interactions are less accurate and less useful than those that consider a broader clinical picture<sup>31</sup>.

## Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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