

Effect of Age On the Rates of Postoperative Complications Following the Removal of Lower Third Molars – A Narrative Review

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Abstract

Introduction: Surgical removal of mandibular third molars (M3Ms) is a common oral surgery procedure with well-recognized associated short and long-term complications. The aim of this article was to review the effect of age on the rate of postoperative complications following the removal of lower third molars.

Method: A narrative review was performed via a comprehensive search of the past 20 years of articles on this topic. A PEO (Population, Exposure, Outcome) search strategy was used to generate potentially relevant articles. Secondary research and non-English articles were excluded. The generated articles were then screened for relevance before being included in a comprehensive review.

Results: The initial search, following the application of inclusion and exclusion criteria to the search, generated 170 articles. Following the careful screening of these articles against defined inclusion and exclusion criteria 24 articles were included in this narrative review.

Discussion: Eighteen of the 24 selected articles (75%) revealed a positive correlation between increasing complication rates and increasing age. None of the articles demonstrated that complication rates decrease as we age. Six of the articles were unable to demonstrate a significant difference between the age groups although the validity of some of these articles is questionable.

Conclusion: There is a clear correlation between an increase in experience of postoperative complications and increasing age with a suggestion that 25 years is a significant milestone for this.

Keywords: Mandibular third molars • Complications • Age

Introduction

Background

Mandibular third molars usually erupt anytime from the age of 16 to 25 years of age and are the most common tooth to become impacted. Surgical removal of lower third molars is one of the most commonly performed surgical procedures undertaken in secondary care within the NHS. And when the figures for both primary and secondary care are combined it is arguably the most common surgical procedure in the whole of the NHS averaging around 60,000 per year [1]. When the national guidelines from the National Institute for Health and Care Excellence (NICE) for wisdom teeth assessment sometimes negate the removal of potentially disruptive impacted wisdom teeth are we potentially increasing the risks to the patient for its future removal?

[2]. It would be prudent to question what the long-term impact may be for delaying the removal of the patient. Since the production of the NICE guidelines for wisdom teeth removal with the aim to reduce NHS expenditure on a procedure, that was costing it in excess of £ 12 million per annum, do these same patients who have had their surgery delayed until later in life eventually end up costing the NHS more money than had they been treated earlier in life? [1].

Post-operative complications that patients may experience following removal of lower third molars are as follows; pain, swelling, infection, alveolar osteitis, paraesthesia, trismus, bleeding, bruising, tooth dislodgement, mandible fracture, and bony necrosis (e.g. MRONJ/osteomyelitis/osteoradionecrosis) [3-10].

The aim of this narrative review was to try and ascertain if patient age had any positive or negative influence over complication rates following the removal of M3Ms.

Data and Methodology

This was a narrative review of current literature answering the research question which was designed by using a Population, Exposure, Outcome (PEO) search strategy. The search engines used to identify included studies were; PubMed/Medline, Google Scholar, and Science Direct with the master search being carried out within Medline. The inclusion criteria for articles for this study were as follows; Primary source studies; e.g. randomized-controlled trials, controlled trials, cohort studies, case reports, case-controlled studies, pragmatic prospective, and retrospective trials. Studies assessing rates of postoperative complications from lower third molars mention the age of the patients involved. Papers are written in English. Studies published in the last 20 years (1999 - 2019). The exclusion criteria for articles for this study were as follows; Secondary source studies; i.e. systematic reviews and meta-analyses. Papers not written in English. Papers not fulfilling the inclusion criteria.

For the "Population" component, patients requiring lower third molar removal, the MeSH terms searched were conducted in three phases; first ("extraction" or "removal") and "teeth", then "wisdom teeth" or "third molars". Finally, these two separate searches were combined via an and to produce the final selection of articles for "P" of PEO. Then for the "Exposure/Risk Factor" component, age, the MeSH terms used were; "age" or "elderly" or "young" or "old". For the "Outcome" component, rates of postoperative complications, the MeSH terms used were again conducted in three phases; first "complications" and "post-operative", secondly "pain" or "swelling" or "bruising" or "bleeding" or "trismus" or "paraesthesia" or "bone necrosis" or "mandible fracture" or "dry socket" or "alveolar osteitis" or "infection" or "MRONJ". Then finally these two searches were then combined to produce the final selection of articles for Outcome. Then finally the input was the final results of P, E, and O combined to produce the final selection of journal articles for the study. This search strategy is displayed visually in Table 1. Studies obtained were then screened against the inclusion and exclusion criteria. Those selected studies that fulfilled the criteria were critically appraised using the Critical Appraisal Skills Program (CASP), the JADAD scale, and the Cochrane risk of bias tool used to assess the risk of bias.

Result

The search generated 4,753 articles assessing third molar removal (Population), 3,813,283 articles discussing age (Exposure), and 103,775 discussing postoperative complications (Outcome). The final combined search generated 204 articles that satisfied the Population, Exposure, and Outcome criteria. The search was then completed by disregarding all articles not written in English and

only those articles published in the last 20 years (1998-2018). This then generated 2,956 articles assessing third molar removal (Population), 2,670,266 articles discussing age (Exposure), and 64,480 discussing postoperative complications (Outcome). The final combined search generated 170 articles which satisfied the Population, Exposure, and Outcome criteria.

These 170 articles were then subjected to the first phase of screening which involved reading each of the titles and deciding whether or not they seemed relevant to the research question. This screening phase reduced the number of articles from 170 to 89. The second phase of screening involved reading the abstracts for each of these articles and applying the proposed inclusion and exclusion criteria against them. This phase reduced the number of articles from 89 to 51. The full texts for each of these 51 articles were then obtained. This batch of 51 articles was then read carefully and the proposed inclusion and exclusion criteria's applied. The reference sections of each of these articles were also assessed to see if there were any additional relevant articles that had not been obtained in the main search. Any additional articles obtained were also screened against the inclusion and exclusion criteria. This final phase generated 22 articles from the initial search and 2 articles from the manual search of the bibliography sections of the included studies which meant there were 24 articles to assess for this narrative review [11-12].

The final selection of articles included 2 randomized controlled trials, 11 prospective cohort studies, 5 prospective clinical trials, 1 observational cohort study, 2 retrospective clinical studies, 1 cross-sectional study, 1 transverse study, and 1 questionnaire. The selected journal articles came from 15 different countries around the World. The total number of patients who underwent mandibular third molar removal within these 24 studies was 23,354 with the mention of over 47,844 third molars being removed. The age ranges discussed were from the youngest at 11 years up to 98 years of age. A summary of all of the included studies within this narrative review appears in alphabetical order by author in Table 1. The table summarises the age ranges discussed within each study along with the key age-related findings reported by each study.

Table 1. A summary of all articles included in the final selection following the screening

N o.	Ye ar	Count ry	Type Of Study	Numb er In Study	Complic ations Assesse d	Age Rang es Obse rved	Age-Related Conclu sions
1	2010	Nigeria	Retrospective comparative study	506 patients	Dry socket, infection, paraesthesia	93% <40yrs, 7% >40yrs	No significant difference between complication rates between the two age groups. Although numbers were not evenly spread between the two groups.
2	2008	Jordan	Prospective cohort study	148 patients, 245 M3Ms	Pain, trismus, dry socket, infection	Average age 21yrs +/- 3yrs	Older patients were statistically more likely to get dry sockets (p<0.05). >25yrs 46% more
3	2011	Brazil	Transverse study	210 patients, 605 M3Ms	Postop complications	11 – 64yrs (Average age 22yrs +/- 9yrs)	The overall complication rate was 9%. Age >25yrs had an increased overall risk of experiencing complications (p=0.02).
4	2011	Nigeria	Prospective cohort study	120 patients	Pain, swelling, trismus	19 – 42yrs (average age 26 yrs)	Significant influence of age on postop morbidity. Patients >35yrs old had significantly more trismus (p = 0.007), and pain (p = 0.01) but the swelling was not significantly different.
5	2011	USA	Prospective cohort study	4004 patients, 8748 M3Ms	Duration of postoperative disability.	>25yrs. (Average age 40yrs +/- 14yrs)	The overall complication rate was 19%. Increasing age was associated with increased recovery time (P <0.001).
6	2007	Canada	Prospective study	327 patients, 550 M3Ms	Dry socket, infection, paraesthesia	12 – 55yrs (Average age 24yrs)	The overall complication rate is 7%. 1.1% paraesthesia rate overall (all paraesthesia patients were >24yrs but this was not statistic

14	2007	Germany	Prospective case series	100 patients who were admitted with acute postop complications	Acute postop complications	14 – 86yrs (1/3 were >40yrs and 1/5 >50yrs)	The average time off work was 16 days. 80% were due to infection, 11% due to mandibular fracture, 3% to nerve injury, and 1% to hemorrhage.	19	2013	Nigeria	Prospective clinical trial	150 patients	Pain, trismus, swelling	16 - 25yrs compared to >25yrs (max age was 38yrs)	The average reported pain and swelling recorded was higher for >25yrs on all postoperative days but did not reach significant levels. No significant trismus difference (p > 0.05 but all average values were higher.
15	2002	France	Questionnaire	150 surgeons reported on approx. 750,000 M3Ms removed	Immediate and late mandibular fractures	19 – 75yrs (Average age 40yrs)	The average age is 37yrs for immediate fractures and 47yrs for late fractures. 85% occurred in >25yr olds.	20	2015	Norway	Prospective clinical trial	396 patients	Postop morbidity	194 patients >25yrs, 202 patients ≤25yrs	No significant difference between no. of days requiring analgesia and the days absent from work.
16	2010	Jordan	Prospective clinical trial	327 patients, 550 M3Ms	Pain, swelling, trismus, paraesthesia, bleeding, AO, infection, and mandible fracture	18 yrs- 40 yrs (average 23yrs +/- 4yrs)	Older patients reported significantly more frequent late complications (p = 0.000) including more dry sockets (p = 0.000) and trismus (p = 0.046)	21	2003	USA	A multi-center prospective cohort study	547 patients	Delayed recovery	14 – 40yrs	The odds of a patient >24yrs experiencing prolonged recovery are 3-4x more likely than ≤18yrs.
17	1999	Italy	Randomized controlled trial	141 patients	Dry socket, swelling, fever, infection, pain.	Average age 22yrs +/- 8yrs	<18yrs had no incidence of dry sockets compared to 6.4% of >18yrs which was a significant difference.	22	2001	UK	Prospective cohort study	354 patients	Surgical difficulty	16 – 63yrs (Average age 28yrs)	Patients >35yrs showed a significant increase in surgical difficulty and this increased again >50yrs (p < 0.05).
18	2009	Italy	Prospective clinical study	59 patients	Fever, swelling, pain, infection.	12 – 19yrs (average age was 15yrs)	32% had swelling, 15% had pain, and 8% had an infection.								

23	2009	Brazil	Prospective clinical trial	200 patients, 235 M3Ms	Pain, swelling, trismus, surgery time	16 – 40yrs (Average age 19yrs)	The older the patient the higher the correlation between surgical duration, bone density, and the risk of injury to local vessels.
24	2014	Switzerland	Retrospective clinical study	1001 patients, 1199 M3Ms	Dry socket, paraesthesia, abscess, dehiscence, bleeding	Average age 29yrs +/- 12yrs	Age had no effect on the development of paraesthesia.

Discussion

It is clear from this narrative review that age is definitely an influential factor in the experience of postoperative complications following the removal of lower third molars. 18 of the 24 studies reviewed stated in some capacity that increasing age had had a negative influence on the experience of postoperative complications [6,11-31]. Four of the studies concluded that age did not appear to negatively influence complication rates although neither did they include that increasing age reduced complication rates experienced [32-36]. Two of the studies were somewhat neutral in their conclusions as they reported rates of complications from either under 19 years of age only or over the age of 25 years only [37-38].

It would appear from the literature reviewed that 25 years of age was a significant age barrier after which complication rates noticeably increased in a large proportion of the studies. 08 of the 18 studies showing a significant influence of age on complication rates stated the age of 25 years as being the stepping point after which complication rates increase for outcomes such as alveolar osteitis, pain, swelling, trismus, or mandibular fracture [12, 17, 19, 20, 22, 23, 25, 27]. There were a few common reasons presented amongst the discussions within those articles that felt that increasing age had a negative influence on the experience of postoperative complications. These reasons given amongst the texts for older patients having greater complications were due to; increased bone density, delayed healing capacity, decrease in periodontal ligament width, and hypercementosis [6, 11, 13, 14, 16, 21, 28-30].

The M3Ms sit within the alveolar bone of the mandible and are attached to the surrounding bone via its periodontal ligament. The mandible begins development in the sixth week of prenatal development on each side of the embryo's mandibular arch. The following week the first bone tissue of the mandible forms and spreads rapidly from the angle to the midline and then formation passes posteriorly to eventually form the condylar head and coronoid process. Mature alveolar bone is 60% mineralized material, 25 percent organic material, and 15% water. The alveolar bone proper is that which lines the tooth socket and is comprised of compact bone although it is also known as bundle bone because Sharpey's fibers from the periodontal ligament insert into it from the root surface [39]. The density of the bone around a tooth obviously has the potential to increase the difficulty of removal of the tooth. A study that confirms this belief was performed in the Hard Tissue Research Unit of University College London in 1998 [40]. They assessed the mandibular bone of 42 individuals via various sources such as post-mortems, live surgical resections as part of unrelated osteotomy procedures, or cadaveric dissection. They

reported on the apparent density, mass per unit volume, of the bone with regard to age and dental status. The age range of their assessed patients ranged from 35 to 96 years. They concluded that the mandible, unlike other bones, does show an increase in density with increasing age which may help us to understand the increased perceived surgical difficulty and operation time removing lower third molars in patients of increasing age [11, 25, 29].

The development of a tooth within the jaw bone occurs via a number of stages of "odontogenesis". Bud, cap, and bell stage create the crown of the developing tooth followed by root development which continues long after the tooth has erupted into the oral cavity. The structure responsible for root development is the cervical loop which forms Hertwig's epithelial root sheath which lays down the root dentine and cementum. Eventually, the root sheath dissipates to leave the epithelial rests of Malassez involved in the formation of the periodontal ligament along with the ectomesenchyme from the dental sac surrounding the forming root. The lower third molar may erupt between the ages of 17 to 21 years of age with root completion occurring between the ages of 18 to 25 years of age. As root formation is completed so too does the periodontal ligament space reduce to its minimum width as the bone stabilizes around the developed root? It is interesting when considered alongside the findings of this review that the completion of root formation at approximately 25 years of age coincides with this apparent increase in complications following the removal of the tooth after that age as the root is fully developed. This restriction in movements of the root during removal could lead to more damage to the surrounding bone and perhaps an increase in pain and swelling following surgery [39].

As discussed previously, the body's ability to heal is known to be impacted by age. Reduction in levels of the vasoactive mediator nitric acid is produced by aged endothelial cells which then decreases capillary permeability at a wound site. Infiltration of macrophages and lymphocytes into the wound site is subsequently delayed. Re-epithelialization, collagen synthesis, and angiogenesis are all delayed in the aged population. Aged fibroblasts show a diminished response to growth factors which results in a delay in wound closure. As well as local influences on healing, the aging population are more likely to have other medical issues that impact healing such as diabetes, vascular disease, medications, etc. Given the above, it seems reasonable to suggest that this alteration in the wound healing process with age may affect the rate of complications experienced following lower third molar removal [41]. This result of increased susceptibility to complications amongst patients of increasing age was demonstrated in a number of studies within this narrative review [12, 14, 22, 27].

Potential limitations of this study would that the literature search did not include non-English written articles which may have excluded potentially relevant information for the topic.

Conclusion

It is evident from this narrative review that there is a clear correlation between an increase in experience of postoperative complications and increasing age with a suggestion that 25 years is a significant milestone with respect to this. It would appear that an increase in bone density, a decrease in periodontal ligament space, and a reduction in healing potential as we age are influential in increasing the surgical difficulty and experience of postoperative complications following the removal of lower third molars.

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