

# KNOWLEDGE GAPS IN ORAL AND MAXILLOFACIAL SURGERY: A SYSTEMATIC MAPPING

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**Objectives:** The aim of this study was to evaluate available knowledge and identify knowledge gaps within the field of oral and maxillofacial surgery, by systematically collecting and evaluating systematic reviews. Twelve specific domains were selected: surgical removal of teeth, antibiotic and corticosteroid prophylaxis, orofacial infections, dental and facial trauma, orthognathic surgery, reconstructive surgery, benign tumors, cysts, premalignant lesions, oral complications of treatment of malignant tumors, hyperbaric oxygen therapy, temporomandibular joint surgery, cost effectiveness of different surgical treatments, and ethics.

**Methods:** The literature search, covering four databases, was conducted during September 2014: PubMed, The Cochrane library, Centre for Reviews and Dissemination and EBSCO dentistry and oral science source. Retrieved systematic reviews were quality assessed by AMSTAR.

**Results:** In all, 1,778 abstracts were identified, of which 200 met the inclusion criteria. Forty-five systematic reviews were assessed as of high to moderate quality. The results disclosed some existing evidence in a few domains, such as surgical removal of teeth and implant survival after sinus lifts. However, in all domains, the search revealed a large number of knowledge gaps. Also of concern was the lack of data regarding health economics and ethics.

**Conclusions:** In conclusion, there is a need for well-conducted clinical research in the fields of oral and maxillofacial surgery.

**Keywords:** Maxillofacial surgery, Oral surgery, Scientific uncertainties, Systematic mapping, Ethics

It is important to identify knowledge gaps in different areas of clinical medicine to stimulate the initiation of applied medical research. In 2010, The Swedish Agency for Health Technology Assessment and Assessment of Social Services (SBU) was assigned the task of identifying major knowledge gaps in health care. DUET (Database of Uncertainties about the Effects of Treatments) and SBU define a knowledge gap as present if systematic reviews reveal uncertainty about the medical effects of a health technology intervention, or if no systematic literature review is available (1;2).

Oral and maxillofacial surgery (OMS) comprises a wide range of treatments, from minor oral surgery undertaken in an outpatient setting to more complicated surgical interventions requiring hospital resources. Prevailing diagnoses include

infections, trauma, congenital and acquired malformations, benign tumors, and systemic diseases with orofacial manifestations. Common treatment modalities are surgical removal of wisdom teeth, implant surgery with or without bone augmentation procedures, repair of fractures, orthognathic surgery, reconstructive surgery, and temporomandibular joint surgery.

A systematic review is intended to summarize research within a limited field. However, a poorly performed systematic review can be as misleading as a flawed primary study. Therefore, it is of crucial importance that systematic reviews are based on high-quality studies, use proper methodology, and an independent quality assessment (3;4). The review can then identify the best available evidence and reliably report scientific uncertainty and knowledge gaps to practitioners and healthcare authorities, and encourage clinical research. The first step in this process is to investigate the scientific literature and summarize it through a systematic mapping. The aim of this study was to identify knowledge and knowledge

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gaps in twelve selected domains of oral and maxillofacial surgery.

## METHODS

To identify the most important domains in oral and maxillofacial surgery, eight major oral- and maxillofacial clinics in Sweden were requested to nominate five domains which they considered warranted priority in the systematic mapping. In addition, the four specialist members of the project group nominated the domains they considered to be the most important. There was good correlation between the proposals from the four specialists in the project group and from the OMS clinics

### Inclusion Criteria

Systematic reviews published in peer-reviewed journals addressing questions on any of the selected domains listed in Table 1 were included. Intervention, control, and outcome parameters were recorded in accordance with the particular question: *Population*: Human subjects; *Intervention*: Oral and maxillofacial surgical interventions, precautions to prevent, reduce, and treat perioperative complications and adverse events; *Control*: Reference test, control (comparator); *Outcome*: Efficacy of surgical interventions, validity, safety, cost-effectiveness, ethical aspects.

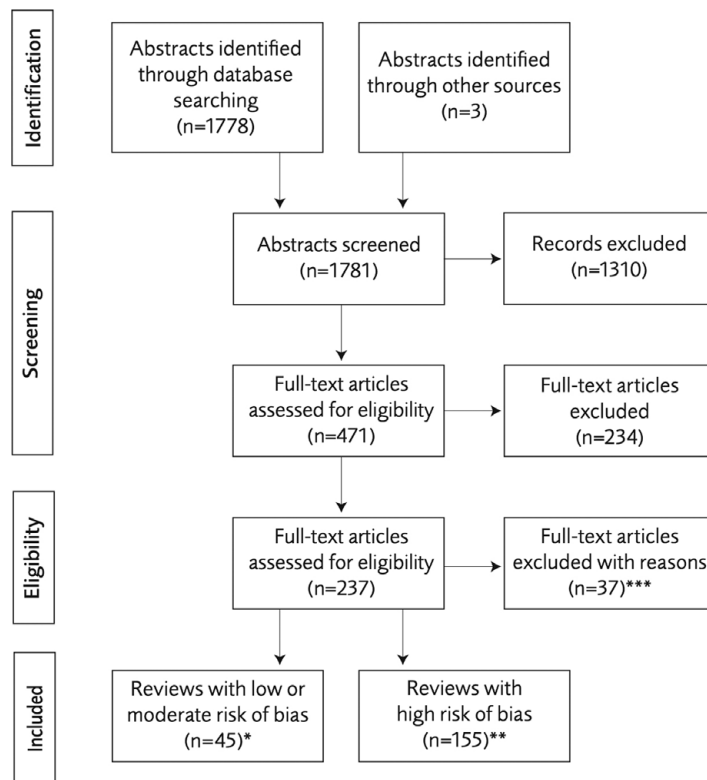
### Exclusion Criteria

All of the excluded domains listed in Table 1 are areas related to oral and maxillofacial surgical interventions bridging other areas within odontology, such as paediatric dentistry, periodontology, oral medicine, and endodontics. Because these domains involve several specialties, the project group would require a more diverse mix of experts for adequate mapping. Furthermore, including these domains was regarded to increase the project to an unfeasible amplitude.

### Literature Search Strategy

The latest literature search was undertaken during September 2014. Four databases were searched: PubMed, The Cochrane Library, Centre for Reviews and Dissemination (CRD), and EBSCO dentistry and oral science source. There were no language restrictions. The search algorithm was: (“Surgery, Oral” [Mesh] OR “maxillofacial surgery” [tiab] OR “craniofacial surgery” [tiab] OR “oral surgery” [tiab] OR “orthognathic surgery” [tiab] OR “Oral Surgical Procedures” [Mesh] OR (“Dental Implants” [Mesh] OR “dental implants” [tiab] OR “oral implants” [tiab] OR temporomandibular [tiab] AND surgery [tiab]) AND systematic [sb]).

Figure 1 is a flow chart presenting the number of retrieved abstracts, included and excluded articles and stage of exclusion in each stage of the process. Abstracts identified according to the inclusion criteria were screened independently by two re-



**Figure 1.** Flow chart presenting the number of retrieved abstracts, included and excluded articles, and stage of exclusion in each stage of the process. \*The main objectives and results of the systematic reviews with low/medium risk of bias are summarized in Supplementary Table 3. \*\*Systematic reviews excluded due to high risk of bias is presented in Supplementary Table 4. \*\*\*Systematic reviews that are excluded with reason in the eligibility step is presented in Supplementary Table 5.

view authors. If at least one reviewer considered an abstract to be relevant, it was included and read in full text.

### Data Extraction and Quality Assessment

Data extraction, assessment of relevance, and quality of included reviews were undertaken independently by two review authors. Any differences were resolved by consensus discussion. When necessary, a third review author was consulted. In the case of a reviewer being the author, the quality was assessed by two other independent reviewers.

The quality (in terms of risk of bias) of all full text reviews was assessed using AMSTAR (5). Items 1–3 and 5–8 were selected as being most important. The prespecified criteria for low, moderate, and high risk of bias are presented in Supplementary Table 1. A conservative approach was used; if a feature was not reported, it was assumed to be absent. If the answer to a particular item was unclear, it was discussed by the group and a decision was reached as to whether the review should be classified as having a low, moderate, or high risk of bias. As a general rule, the quality of the primary studies included in the reviews was not checked. An exception was when there was inconsistency or uncertainty about the results or the conclusions of a review. In these cases, random checks of individual articles were made.

**Table 1.** List of Domains Included and Excluded in the Systematic Mapping

Domains included in the map	Domains not included in the map
Surgical removal of teeth	Implant surgery without bone augmentation
Antibiotic or corticosteroid prophylaxis	Surgical treatment of cleft-lip-palate defects
Orofacial infections of dental origin	Surgical treatment of periodontal conditions including peri-implantitis
Maxillofacial, mandibular and dental trauma	Surgical treatment of malignancies
Orthognathic surgery	Endodontic surgery
Reconstructive oral and maxillofacial surgery	Dentoalveolar surgery in the pediatric patient
Benign tumors of the jaws and surrounding soft tissue	Nonsurgical treatment of benign oral mucosal lesions
Cysts of the jaws and surrounding soft tissue	
Premalignant lesions of the oral mucosa	
Oral complications of treatment of malignant tumors	
Hyperbaric oxygen therapy in conjugation with maxillofacial surgery	
Temporomandibular joint surgery	
Ethics	

**Table 2.** Identified Knowledge and Level of Evidence According to Authors of the Systematic Review

Domain	Statement	Level of evidence (according to authors of the included systematic reviews)
Surgical removal of teeth	Ibuprofen is more effective than paracetamol for pain relief after lower third molar surgery	Strong
Surgical removal of teeth	Vertical and horizontal alveolar bone loss is most rapid during the first 3–6 months after tooth extraction	Strong
Surgical removal of teeth	Clinical loss of alveolar bone width is greater than loss in height after tooth extraction	Strong
Surgical removal of teeth	Combinations of paracetamol and NSAID (ibuprofen) are more effective for pain relief than either drug alone	Moderate
Surgical removal of teeth	Patients with INR > 3.5 should be referred to their physician for consideration of warfarin dose adjustment prior to tooth extractions	Moderate
Surgical removal of teeth	Socket preservation techniques and flap surgery result in less contraction of alveolar bone after tooth extraction	Moderate
Maxillofacial, mandibular and dental trauma	Maxillo-mandibular fixation with bone screws is not associated with root damage to adjacent teeth	Moderate
Reconstructive oral and maxillofacial surgery	Sinus lifts after implant placement are associated with a higher complication rate than no sinus lifts	Moderate
Temporomandibular joint surgery	Lavage reduces pain slightly better than non-surgical treatment of TMJ conditions	Moderate
Ethics	Information to patients before invasive procedures improves their knowledge and understanding	Moderate
Antibiotic and corticosteroid prophylaxis	Antibiotic prophylaxis reduces the rate of postoperative infections in implant surgery, trauma surgery and orthognathic surgery.	Low

### Handling of Data

Existing knowledge for each domain was based only on data in reviews judged as having low or moderate risk of bias. However, with respect to knowledge gaps, reviews with low, moderate, and high risk of bias were included. In accordance with the working process described by Whitlock et al. (6), no synthesis was made of the effect size of different interventions.

### RESULTS

In total, 200 systematic reviews were included. Supplementary Table 2 presents the proportion of reviews with low/moderate or high risk of bias and the distribution of reviews in the different domains. In Supplementary Table 3, the main objectives and results of the systematic reviews with low/medium risk of bias are summarized. A table with the excluded systematic

**Table 3.** Knowledge Gaps Identified from the Systematic Reviews

Domain	Knowledge gaps
Surgical removal of teeth	<ul style="list-style-type: none"> <li>– Prophylactic removal of third molars</li> <li>– Important variables to predict surgical difficulty</li> <li>– The best procedure for wound closure after surgical removal of third molars</li> <li>– The use of autologous platelet concentrate for beneficial healing after tooth extractions</li> <li>– The effect of adjuvant laser therapy for reducing pain, swelling and trismus after third molar surgery</li> <li>– The prevention of alveolar osteitis, including chlorhexidine treatment</li> <li>– Prophylactic removal of teeth before radio therapy to avoid complications</li> <li>– Adverse effects of analgesics</li> <li>– Effectiveness of acupuncture for treatment of acute dental pain</li> <li>– Risk factors of osteonecrosis of the jaws in patients on bisphosphonate medication for non-malignant disorders</li> <li>– Risk of bleeding in patients medicating with Warfarin and other anticoagulant therapy during dental surgical procedures.</li> <li>– Thromboembolic events after topical application of tranexamic acid</li> <li>– The effect of coronectomy or complete removal of mandibular third molars on nerve injuries</li> <li>– Long-term effects (&gt; 12 months) after tooth extraction</li> <li>– Soft tissue changes after tooth extraction</li> <li>– Type of surgical procedure most suitable for ridge preservation after tooth extraction</li> </ul>
Antibiotic or corticosteroid prophylaxis	<ul style="list-style-type: none"> <li>– Effect of antibiotic prophylaxis in surgical removal of teeth. The role of antibiotic prophylaxis in preventing bacterial endocarditis</li> <li>– The role of antibiotic prophylaxis in oral and maxillofacial surgery other than implant, fracture and orthognathic surgery</li> <li>– Type of preferred antibiotic compound, dose and duration of treatment</li> <li>– The effect of corticosteroids on edema, trismus and pain after third molar removal</li> <li>– The effect of corticosteroid prophylaxis in oral and maxillofacial surgery</li> </ul>
Orofacial infections	<ul style="list-style-type: none"> <li>– Effect of interventions for preventing and treating orofacial infections in oral surgery.</li> </ul>
Maxillofacial, mandibular and dental trauma	<ul style="list-style-type: none"> <li>– Effect of early or delayed treatment of mandibular fractures.</li> <li>– Effect of closed versus open surgical management of mandibular fractures (condylar fractures included)</li> <li>– Effect of different osteosynthesis materials in surgical treatment of mandibular fractures</li> <li>– Removal or retention of teeth in the fracture line.</li> <li>– The effects of different interventions for management of avulsed teeth</li> <li>– Diagnostic value of ultrasonography</li> <li>– Screening tools and interventions for domestic violence</li> </ul>
Orthognathic surgery	<ul style="list-style-type: none"> <li>– The long-term effects of anterior segmental osteotomies on soft tissue response</li> <li>– The effect of different alar base sutures in maintaining preoperative alar base width</li> <li>– Soft tissue changes after bilateral sagittal split osteotomy</li> <li>– The aesthetic and functional implications following clockwise or counter-clockwise rotation of the occlusal plane in orthognathic surgery</li> <li>– Hypotensive anesthesia during bimaxillary osteotomy to reduce blood loss</li> <li>– The therapeutic effect of tranexamic acid on blood loss in orthognathic patients.</li> <li>– Neurogenic complications after orthognathic surgery</li> <li>– Effects of low-level laser for treatment of iatrogenic nerve injuries</li> <li>– The effect of orthognathic surgery on TMD</li> <li>– The benefits of orthognathic surgery on quality of life</li> <li>– Relationship between malocclusion and masticatory function</li> <li>– Long term stability of Le Fort 1 advancement or distraction osteogenesis in cleft lip palate patients</li> <li>– Evaluation of vertical stability of the open bite after combined orthodontic and orthognathic surgical treatments</li> <li>– Skeletal stability and complications of bilateral sagittal split osteotomies (BSSO) and mandibular distraction osteogenesis (MDO) in the treatment of mandibular hypoplasia</li> <li>– Evaluate horizontal relapse after bilateral sagittal split advancement with different types of rigid internal fixation</li> <li>– Evaluate evidence for long-term stability after surgical and non-surgical treatments of anterior open bite.</li> </ul>

Table 3. Continued

Domain	Knowledge gaps
Reconstructive surgery	<ul style="list-style-type: none"> <li>—Identify factors influencing stability after bimaxillary surgery for skeletal Class III malocclusion</li> <li>—Investigate the accuracy of computer programs in predicting skeletal and soft tissue changes after orthognathic surgery.</li> <li>—Precision and accuracy of virtual planning of orthognathic procedures</li> <li>—Effect and complications of rapid maxillary expansion.</li> <li>—Effect of orthognathic surgery and osteodistraction on speech and velopharyngeal status.</li> <li>—Complications of mandibular distraction osteogenesis in congenital deformities</li> <li>—Evaluate evidence that corticotomy and dental distraction reduce orthodontic treatment time</li> <li>—Upper airway alterations after maxillo-mandibular advancement (MMA).</li> <li>—The efficacy and safety of maxillo-mandibular advancement in treating obstructive sleep apnea</li> <li>—Preferred surgical techniques for treating Angle Class III malocclusions</li> <li>—Effect of different bone augmentation materials and tissue engineering in patients with severely resorbed jaw bone; autogenous, allogenic, xenograft, barrier membranes, biological substances (bone morphogenic protein, platelets etc.)</li> <li>—Effect of different surgical augmentation procedures; sinus lift, vertical and horizontal augmentation, zygomatic implants and osteodistraction</li> <li>—Effect of immediate and delayed implant placement in reconstructed bone</li> <li>—Effects of bisphosphonate therapy on dental implant osseointegration</li> <li>—Effects of radiotherapy on dental implant outcome</li> <li>—Implant survival in augmented vs pristine bone</li> <li>—Effect of robotic surgery in reconstructive surgery</li> <li>—Bone quality assessment before and after reconstruction of bone</li> </ul>
Tumors	<ul style="list-style-type: none"> <li>—Effect of interventions for treating tumors in oral surgery.</li> <li>—Preferred treatment of unicystic ameloblastoma</li> </ul>
Cyst	<ul style="list-style-type: none"> <li>—Effect of interventions for treating cysts in oral surgery.</li> </ul>
Premalignant lesions	<ul style="list-style-type: none"> <li>—Effect of interventions for treating premalignant lesions in oral surgery.</li> </ul>
Oral manifestations of treatment of malignant tumors	<ul style="list-style-type: none"> <li>—Effect of interventions for treating oral manifestations of treatment of malignant tumors by oral surgery.</li> </ul>
Hyperbaric oxygen therapy in conjunction with oral and maxillofacial surgery	<ul style="list-style-type: none"> <li>—Effect of hyperbaric oxygen treatment in oral surgery.</li> </ul>
Temporomandibular joint surgery	<ul style="list-style-type: none"> <li>—Effects of palliative inflammatory medication in patients with TMJ disorders</li> <li>—Effect of different methods of surgical treatment of TMJ disc derangement (arthrocentesis, arthroscopy, disc repositioning, discectomy and modified condylotomy)</li> <li>—Effect of different methods of surgical treatment of TMJ ankyloses (autogenous and alloplastic)</li> <li>—Effect of coronoidectomy and coronoidotomy in patients with enlargement of the coronoid process</li> <li>—Effect of different methods of surgical treatment of recurrent TMJ dislocation</li> <li>—Effect of different methods of surgical treatment of TMJ benign tumors</li> <li>—Effect of hyaluronic acid injections in patients with temporomandibular disorders</li> <li>—Effect of botulinum injections in patients with masseter hypertrophy</li> <li>—Management of TMJ involvement</li> <li>—In juvenile arthritis patients</li> <li>—Diagnostic value of bone scans in patients with condylar hyperplasia</li> </ul>
Ethics	<ul style="list-style-type: none"> <li>—Preferred methods for preventing wrong side surgery</li> <li>—Preferred type of intervention to improve patients' knowledge</li> </ul>

reviews with high risk of bias, and the reason for exclusion regarding to AMSTAR, is found in the Supplementary Table 4. Systematic reviews considered to be beyond the scope of the review are listed in Supplementary Table 5. No systematic reviews with low/moderate risk of bias were identified in the following domains: orofacial infections of dental origin, cysts, premalignant lesions, oral complications of treatment of malignant tumors, and hyperbaric oxygen treatment in oral and maxillofacial surgery. Existing knowledge and knowledge gaps are summarized in [Tables 2](#) and [3](#), respectively.

### Surgical Removal of Teeth

Sixteen systematic reviews with low or moderate risk of bias were filed under this domain but they were highly diverse. Five addressed surgical techniques to minimize postsurgical complications ([7;8](#)) and techniques to preserve the height and width of the alveolar process after tooth extraction ([9–11](#)). The reviews disclosed only low evidence in favor of triangular incisions for third molar removal. There was strong evidence that rapid vertical and (in particular) horizontal bone loss occurred during the first 1–3 months after extraction. There was supporting evidence that socket preservation therapies resulted in less contraction of the alveolar bone after extraction.

However, it was not possible to determine the best biomaterial supplement or surgical procedure to preserve the alveolar ridge. In one study comparing the effect of alveolar ridge preservation and unassisted socket healing, it was concluded that postextraction ridge preservation might limit but not eliminate alveolar ridge resorption. Neither cost-effectiveness nor case selection criteria were presented, and it was not possible to determine which material or method was most effective ([12](#)).

Two systematic reviews dealt with prophylactic removal of asymptomatic third molars ([13;14](#)) and one compared damage to the inferior alveolar nerve after partial or total removal of third molars ([15](#)). The first question could not be answered, while there was weak evidence to suggest that coronectomy was associated with fewer cases of nerve damage. Furthermore, because of the lack of high quality research, it was not possible to answer the question of whether the natural dentition should be extracted or retained before radiotherapy ([16](#)).

The search identified five systematic reviews covering various pharmacological approaches to reduce bleeding, pain, and swelling after tooth extraction. One review provided some evidence that topical applications of tranexamic acid could reduce postoperative bleeding ([17](#)) while the effects of autologous platelet concentrate ([18](#)) or chlorhexidine ([19](#)) were inconclusive. In two systematic reviews of postoperative pain relief ([20;21](#)), there was consensus that a combination of drugs (paracetamol, ibuprofen/NSAID) was more effective than each drug alone. The level of evidence was moderate and further research on the adverse effects seems to be warranted. One review presented strong evidence in support of referring patients

on warfarin, who have an elevated international normalized ratio ( $>3.5$ ), to a physician for consideration of dose adjustment before tooth extraction ([22](#)).

### Antibiotic and Corticosteroid Prophylaxis

In this domain, two systematic reviews of antibiotic prophylaxis were included: one for third molar surgery ([23](#)) and the other for prevention of bacterial endocarditis ([24](#)). Both provided evidence of low or very low quality; thus, the use of prophylactic antibiotics during invasive dental procedures remains a knowledge gap. No systematic reviews of corticosteroids were identified. One systematic review examined the evidence supporting the administration of prophylactic antibiotics in implant installation, orthognathic, and trauma-related surgery. Although a reduction in prevalence of postoperative infections was reported ([25](#)), there was no evidence to support prolonged administration of antibiotics, beyond the day of the surgical procedure, and insufficient evidence to determine which antibiotic drug or dose was most effective.

### Orofacial Infections of Dental Origin

No systematic reviews with low or medium risk of bias were identified.

### Maxillofacial, Mandibular, and Dental Trauma

Four systematic reviews with low or moderate risk of bias were identified. Two concerned mandibular fractures: whether open or closed management was preferable ([26](#)) and whether teeth involved in the fracture line should be retained or extracted ([27](#)). Both reviews found insufficient evidence to support the various clinical procedures and found no differences in postoperative infections. One systematic review presented evidence of moderate quality that the use of intermaxillary screws was very rarely associated with root damage ([28](#)). The fourth review was unable to find intervention studies on prevention of domestic violence, leading to a decrease in the prevalence of dental trauma ([29](#)).

### Orthognathic Surgery

In this domain, nine systematic reviews were assessed ([30–38](#)). Two identified a knowledge gap concerning the effect of orthognathic surgery on soft tissue changes ([30;36](#)). Three reviews examined interventions to reduce blood loss during orthognathic surgery. Two disclosed lack of evidence for the effect of hypotension anesthesia ([31;38](#)) whereas one showed lack of evidence on the effect of tranexamic acid ([32](#)). There was also a lack of knowledge about the effect of orthognathic surgery on temporomandibular joint function ([34](#)). The question of the effect of different types of alar base sutures on postoperative alar base width could not be answered ([33](#)). The evidence in support of the use of low effect lasers in the healing of iatrogenic nerve injuries was graded as very low

(35). Finally, a knowledge gap was identified as to the preferred surgical intervention to normalize an Angle Class III malocclusion (37).

#### Reconstructive Oral and Maxillofacial Surgery

Four studies were included in the domain of reconstructive oral and maxillofacial surgery (39–42). One study investigated whether zygomatic implants offered an advantage over other bone augmentation techniques in rehabilitation of the deficient edentulous maxilla. However, no evidence for a preferred method could be found (39). The question of whether implant survival differed between placement in augmented and pristine bone could not be answered because of the limited scientific value of the included primary studies (40). Neither could the most beneficial bone augmentation method before implant installation be identified (41). One systematic review compared different protocols for sinus lift but found that there was inadequate scientific evidence to indicate the preferred method. The systematic review also assess the beneficial or harmful effects of maxillary sinus lifts with or without bone augmentation. This showed that sinus lifts after implant placement was associated with a higher complication compared with treatment not involving sinus lift (42).

#### Benign Tumors of the Jaws and Surrounding Soft Tissue

One systematic review was included from this domain, evaluating which treatment of unicystic ameloblastoma gave the lowest recurrence rate. The formulated question could not be answered because the evidence of the included studies was estimated as low (43).

#### Cysts of the Jaws and Surrounding Soft Tissue

No systematic reviews with low or medium risk of bias were identified.

#### Premalignant Lesions of the Oral Mucosa

No systematic reviews with low or medium risk of bias were identified.

#### Oral Complications Associated with Treatment of Malignant Tumors

No systematic reviews with low or medium risk of bias were identified.

#### Hyperbaric Oxygen Therapy in Conjunction with Oral and Maxillofacial Surgery

No systematic reviews with low or medium risk of bias were identified.

#### Temporomandibular Joint Surgery

Six systematic reviews were included in the temporomandibular joint domain (44–49). There was no evidence to support the efficacy of combined palliative and anti-inflammatory medica-

tion for treatment of disc displacement without reduction (44). Because of insufficient scientific evidence, the focus question, as to which surgical intervention has the best effect on various temporomandibular joint disorders, could not be answered (45;46;48). Comparing conservative treatment with temporomandibular lavage, a slightly better effect on pain relief was noted for the latter (47). The efficacy of botulinum toxin injections on masseter hypertrophy was identified as a knowledge gap (49).

#### Ethics

One systematic review found strong evidence to support the effectiveness of various interventions to improve the knowledge and understanding of patients undergoing invasive dental procedures (50). Likewise, there was evidence of low quality to suggest that interventions to reduce wrong side surgery can be effective (51).

## DISCUSSION

In the era of evidence-based medicine, systematic reviews are important contributions to the scientific literature, providing clinicians and researchers with a quality-assessed, condensed update on relevant clinical issues. In recent years, the number of published systematic reviews has grown significantly and this trend is likely to continue (52;53). There is, however, a risk that a systematic review with suboptimal methodology may give rise to biased conclusions or promote less cost-effective methods. Therefore, it is crucial that the quality of systematic reviews is also assessed by independent referees, using validated tools (3;4), for example AMSTAR (3;5).

The most common shortcomings of the systematic reviews evaluated in this project were that the primary studies were not quality assessed and that primary studies with a high risk of bias were allowed to form the basis for conclusions. Another common bias was that the primary studies were not reviewed independently by two examiners.

This complex systematic review revealed considerable knowledge gaps in several domains within oral and maxillofacial surgery. Even many routine dentoalveolar surgical procedures seemed to be based on insufficient quality of evidence. Of particular note was the total lack of systematic reviews with low or moderate bias concerning cysts, premalignant lesions, and orofacial infections of dental origin. However, lack of evidence does not necessarily mean that an intervention or treatment has no effect rather that the effect is uncertain and that further high-quality clinical trials are warranted. The clinician must apply the evidence-based practice triad according to Sackett et al. (54), requiring judicious integration of systematic assessments of clinically relevant scientific evidence, consideration of the patient's oral and medical status and history, the oral and maxillofacial surgeon's clinical expertise, and the patient's treatment needs and preferences.

This underpins the need and responsibility of the profession to understand and remain updated on the best available evidence for oral and maxillofacial surgical care. In this context, complex systematic reviews constitute an important aid. Considering the large number of areas with lack of solid evidence-based practice, a rational sequential approach to this problem would be to prioritize future research into the identified knowledge gaps, according to priority. Although it was beyond the scope of this study to rank the identified knowledge gaps, this is strongly recommended, preferably according to the methodology of the James Lind Alliance to allocate initial efforts and financial means to the most urgent areas (55).

Sub-domains where no primary studies could be found, or where the identified studies did not meet the AMSTAR requirements, were listed as knowledge gaps. It has previously been suggested that systematic reviews with high risk of bias should be excluded from the synthesis of knowledge (6). However, in the current study, these were regarded as knowledge gaps to circumvent a false impression of high evidence domains. Despite the large number of identified knowledge gaps within the field of oral and maxillofacial surgery, there were some domains in which evidence of high or moderate quality was noted, as summarized in Table 2.

However, in some such cases, despite evidence of high or moderate quality, a definite conclusion could not be reached. For example, there was evidence that thorough preoperative patient information consistently improved patients' awareness and knowledge of the planned treatment. However, the type of knowledge most likely to promote informed consent for the intervention could not be identified (50). Another example is that, although socket preservation therapies and flap surgery are associated with less contraction of alveolar bone, neither the most effective surgical method nor the best socket preservation technique could be identified (11;12).

Although dental implants without prior/simultaneous reconstruction comprise a large proportion of oral and maxillofacial surgery procedures, it was decided to exclude these systematic reviews from the analyses: because this sub-domain is vast and complex, it should preferably be the subject of a separate evaluation. Furthermore, as uncomplicated implant surgery involves other areas of expertise such as periodontology, dental prosthodontics, and pediatric dentistry, such a separate evaluation should be undertaken in collaboration with representatives from these specialties.

#### Ethical Consideration

The fact that there is a pronounced gap in the scientific evidence on diagnosis and treatment in almost all of the selected sub-domains of OMS does not mean that in clinical practice there is no basis for selecting a particular method in preference to another. For example, methods that can expose patients to a high risk should be avoided. Methods involving particularly high costs should also be avoided, until their cost-effectiveness

has been tested properly. Moreover, diagnosis and treatment based on established theoretical assumptions are preferred to methods which lack a theoretical basis. In the absence of scientific evidence in support of alternative methods, established treatments should be adhered to SBU (56). It was noteworthy that important, patient-oriented aspects, such as the acceptability of an intervention, were only occasionally mentioned in the systematic reviews.

In some serious conditions such as osteoradionecrosis or osteonecrosis associated with malignant disease, ethical considerations may complicate the application of an optimal study design. In these cases, treatment has to be based on experience of clinical practice. Furthermore, there is a risk of bias, as in many sub-domains of OMS, the research is funded by industry. This funding clearly enables research to be undertaken, but it may negatively affect study design by over-estimation of results.

## CONCLUSIONS

This complex systematic review has disclosed a pressing need for high quality research in the selected subdomains of oral and maxillofacial surgery. Several aspects of surgical removal of teeth are, however, well documented, and there is also evidence that bone fixation screws are not associated with root damage, that sinus lifts are associated with a higher complication rate than implant placement without sinus lifts, that in treatment of temporomandibular joint conditions, lavage reduces pain compared with nonsurgical treatment, and that information provided before invasive procedures improves patients' knowledge and understanding.

However, it is evident that substantial knowledge gaps remain in all domains, including many routine interventions. There is also a pronounced lack of studies which focus on health economics or ethical issues. The lack of data on health economic aspects is of concern because many of these procedures are expensive. Within all the selected sub-domains, there was a lack of systematic reviews of good quality. Until such evaluations are available, expensive treatments should be undertaken sparingly.

## SUPPLEMENTARY MATERIAL

Supplementary Table 1:

<https://doi.org/10.1017/S026646231700023X>

Supplementary Table 2:

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Supplementary Table 3:

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Supplementary Table 4:

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Supplementary Table 5:

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## CONFLICTS OF INTEREST

The authors do not have any perceived or actual conflicts of interest to declare.

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