A report for
Universitätsklinikum Schleswig-Holstein/Campus Kiel
on shared decision making for toothless jaw
(full prosthesis vs. full implant-supported denture)

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LIST OF ABBREVIATIONS

CADTH	Canadian Agency for Drugs and Technologies in Health
CCD	Complete conventional denture
CCT	Controlled clinical trial
CI	Confidence interval
CDSR	Cochrane Database of Systematic Reviews
CPG	Clinical practice guideline
CRD	Centre for Reviews and Dissemination
CSR	Cumulative survival rates
DA	Decision aid
DARE	Database of Abstracts of Reviews of Effects
FAQ	Frequently asked question
GIN	Guidelines International Network
GRADE	Grading of Recommendations, Assessment, Development and Evaluations
HTA	Health Technology Assessment
IOD	Implant-supported overdenture/prosthesis
KSR	Kleijnen Systematic Reviews
NA	Not applicable
N	Sample size
NHS	National Health Service (UK)
NICE	National Institute for Health and Care Excellence
NR	Not reported
OHIP-14	Oral Health Impact Profile-14
OHIP-49	Oral Health Impact Profile-49
PICOS	Participants, intervention, comparators, outcomes and study design
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
QoL	Quality of life
RCT	Randomised controlled trial
RR	Risk ratio
SD	standard devation
SDM	Shared decision making
SR	Systematic review
TRIP	Turning Research Into Practice
UK	United Kingdom
VAS	Visual Analogue Scale

1. PROJECT OBJECTIVE

A key aim of the research project “Making SDM a reality” is to inform patients as part of shared decision making (SDM).

To support this, Kleijnen Systematic Reviews (KSR) Ltd has prepared an evidence report with a synthesis of the evidence of the relevant treatment options.

The topic of this evidence report is to present a summary of outcomes resulting from the use of full prosthesis vs full implant-supported denture in completely edentulous patients.

2. METHODS

2.1 INCLUSION CRITERIA

The research question underpinning the literature searches for this topic was developed in conjunction with clinical departments at Universitätsklinikum Schleswig-Holstein/Campus Kiel. The question was framed in terms of participants, intervention, comparators, outcomes, and study design (PICOS), see Table 1.

Table 1: Inclusion and exclusion criteria

	Included	Excluded
Population	Edentulous patients (or patients with unserviceable residual teeth; any reason for teeth loss; adults only)	Patients with contraindication to implantation; partial edentulism; children/adolescents
Intervention	Full prosthesis (complete conventional denture [CCD])	None
Comparator	Full implant-supported overdenture (IOD): • Lower jaw implants (mandible; 1 to 5 removable, from 6 fixed) • Upper jaw implants (maxilla; <4 experimental, 4 to 5 removable, 6-8 fixed)	None
Outcomes	• Treatment duration and length of hospital stay • Pain and/or discomfort during the procedure • Use and choice of anaesthesia • Survival/failure of prosthesis • Impact on function (chewing ability, prosthesis stability) • Health-related quality of life (QoL) • Satisfaction with treatment • Short and long-term complications or side effects • Costs (procedure costs and maintenance)	None
Study design	Systematic reviews (SRs), health technology assessments and guidelines; primary research including RCTs, CCTs, cohort studies*	Literature reviews; expert opinions; letters
Effect modification / Subgroups**	• fixed vs removable denture • the number of implants • Impact of immediate, early and/or delayed loading	Not applicable
*to be considered if evidence from SRs/CPGs is scarce ** to be considered if SRs or primary studies explicitly report on effect modifiers/subgroup analyses (no meta-regression etc. necessary)		

2.2 FREQUENTLY ASKED QUESTIONS

The following research questions were identified as frequently asked questions (FAQs):

FAQ1: What does treatment for edentulous patients involve?

- Description of procedure (e.g. length of procedure, length of hospital stay, number of sessions required)
- Pain and/or discomfort during treatment; need for and choices of anaesthesia

FAQ2: What is the denture/implant survival/failure?

FAQ3: What is the functional benefit for a patient?

- Prosthesis stability and grip (especially when chewing or speaking)
- Chewing ability (chewing effectiveness)
- Hygiene ability

FAQ4: What is the impact on quality of life (QoL) and/or satisfaction?

FAQ5: What are the short and long-term complications?

- Soft tissue problems
- Pain caused by the prosthesis
- Prosthetic fractures
- Need for relining or repairs
- Peri-implantitis (inflammation of gum tissue surrounding an implant)
- Impact on bone level

FAQ6: What are the financial costs and/or resource implications to the patient?

- The costs of each treatment option
- Expenditure following treatment (e.g., hygiene, dental appointments)

2.3 LITERATURE SEARCHES

Literature searches were conducted to identify systematic reviews, health technology assessments (HTAs) and guidelines on edentulous patients.

The search strategies were developed specifically for each database and the keywords adapted according to the configuration of each database. Searches were limited by date range to 2015-2020. Searches were not limited by language or publication status.

2.4 SEARCH SOURCES

The following systematic review specific databases were searched from 2015 to present:

- Cochrane Database of Systematic Reviews (CDSR) (Wiley): issue 12, December 2020
- Health Technology Assessment (HTA) database (CRD): 2015 to 31 Mar 2018
- KSR Evidence (Internet) (https://ksrevidence.com/): 2015 to 10 December 2020
- Epistemonikos (Internet) (https://www.epistemonikos.org/): 2015 to 10 December 2020
- International HTA Database (INAHTA) (https://database.inahta.org/): 2015 to 10 December 2020

The following guidelines resources were searched from 2015 to present:

- Guidelines International Network (GIN) (Internet) (https://www.g-i-n.net/home): 2015 to 9 December 2020
- NHS Evidence (Internet) (www.evidence.nhs.uk/): 2015 to 10 December 2020
- NICE Guidance (Internet) (https://www.nice.org.uk/guidance): 2015 to 10 December 2020
- ECRI Guidelines Trust (Internet) (https://guidelines.ecri.org/): 2015 to 10 December 2020
- Turning Research Into Practice (TRIP) (www.tripdatabase.com): 2015 to 9 December 2020
- Canadian Agency for Drugs and Technologies in Health (CADTH) (www.cadth.ca): 2015 to 11 December 2020

The following relevant organisation website was scanned for guidelines from 2015 to present:

- International Team for Implantology (www.iti.org)

Targeted searches

To identify questions related to shared decision making and edentulous patients, targeted searches were undertaken in the following databases from 2015 to present:

- Embase (Ovid): 1974 to 10 December 2020
- MEDLINE and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily (Ovid): 1946 to 10 December 2020

Full details of all search strategies are presented in Appendix 1.

Handling of citations

Identified references from the bibliographic database searches were downloaded into EndNote bibliographic management software for further assessment and handling.

Online resources

An additional online search was performed on National Health Service (NHS) website (https://www.nhs.uk/), The British Society of Prosthodontics (https://www.bsspd.org/) and British Association of Oral and Maxillofacial Surgeons (https://www.baoms.org.uk/) websites to identify any relevant resources. PROSPERO, an international prospective register of systematic reviews, was searched for any protocols fulfilling the eligibility criteria and published between 2018 to April 2021. For any eligible protocols, the full text was retrieved (if published and available).

2.5 Methods of study selection, quality assessment and data extraction

Study selection

A stepwise approach was used to identify the most recent and relevant evidence. Two reviewers independently screened the title and abstract of each record identified by the search and determined the potential relevance of each record. For potentially relevant records, the full paper was obtained, independently checked by two reviewers, and inclusion criteria applied. Any disagreements were resolved through discussion.

An evidence hierarchy was used to select the most appropriate studies to populate the evidence tables. Where more than one study could provide evidence, the most relevant studies were selected using the following criteria: recency (most recent preferred), quality (highest quality preferred), representativeness (populations representative of the general target population preferred).

Data extraction

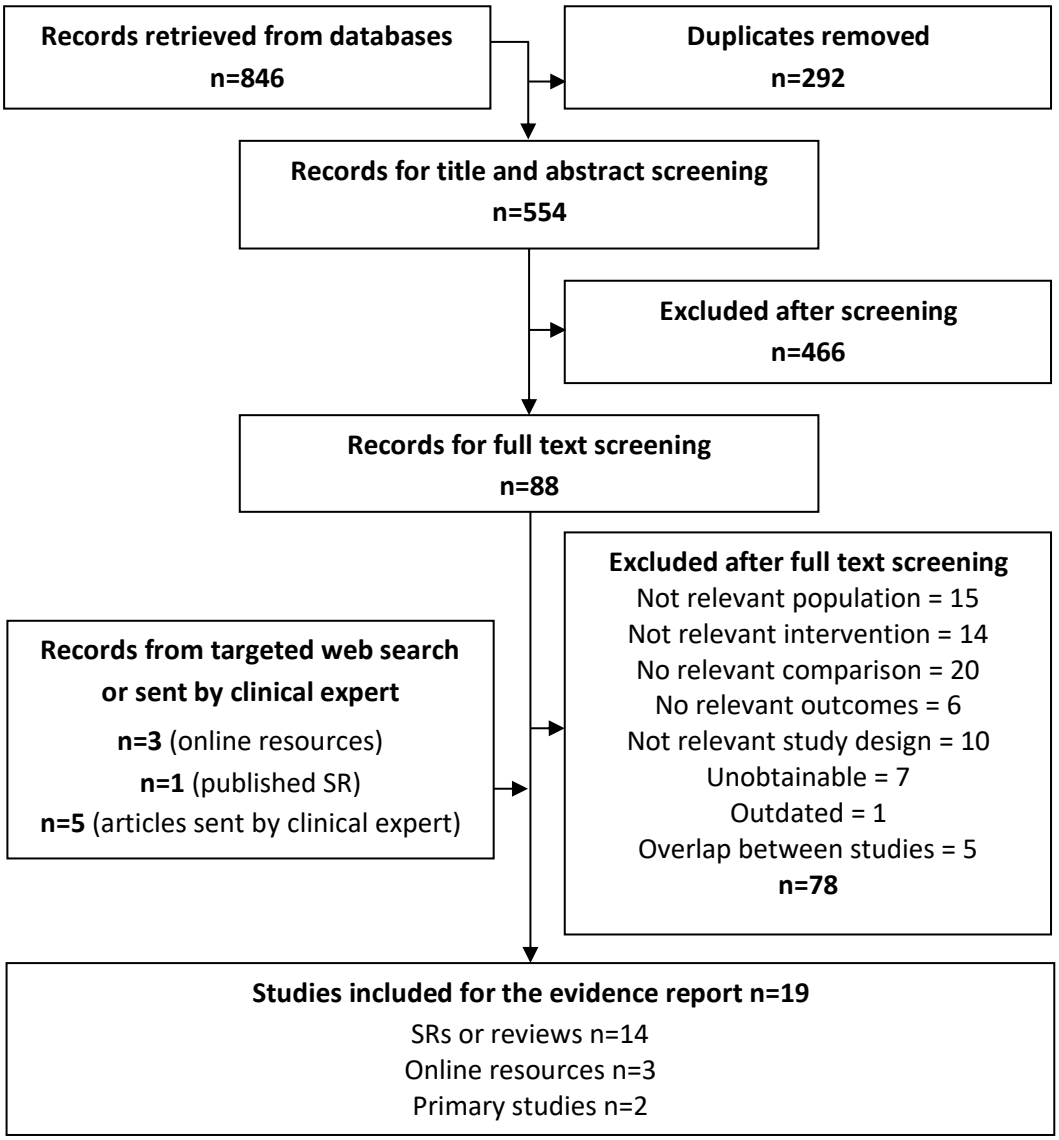
For studies which required data extraction, data were extracted by one reviewer and checked by another. Any disagreements were resolved by consensus.

3. RESULTS

3.1 LITERATURE SEARCH RESULTS AND INCLUSION ASSESSMENT

Searches were conducted in December 2020 to identify systematic reviews, HTAs or evidence-based guidelines. A total of 846 records were retrieved from the literature searches. After removal of duplicate records, 554 titles and abstracts were screened by two reviewers. After screening, 88 records were selected for further assessment, from which 10 were selected as meeting the inclusion criteria. In addition, three online resources were used to provide background information. A summary of the study selection process according to modified PRISMA reporting guidelines[1] is reported in Figure 1.

Figure 1: Study selection process



3.2 OVERVIEW OF THE EVIDENCE

Table 2 summarises the sources of evidence used to answer the six FAQs in this report. No guidelines or recommendations for comparison between CCDs and IODs in mandible (lower jaw), maxilla (upper jaw) or both jaws were found through the literature search. One outdated German guideline[2] for patients with edentulous maxilla was identified and is currently being updated. The evidence for the comparison of interest (CCDs vs IODs) was covered in four systematic reviews[3-6] with another systematic review evaluating the impact of replacing CCDs with IODs[7]. Five articles identified (n=5)[8-12] provided supplementary evidence for IODs (supported by one up to 10 implants) and one SR for CCDs (the article found through additional searches).[13]

Most of the systematic reviews focused on mandible only (the lower jaw; n=7[3-6, 9, 11, 12]) followed by both jaws (n=3[7, 8, 13]) and maxilla only (the upper jaw; n=1[10]). Even though the research question in Boven 2015[7] was focused on both jaws, only two primary studies evaluated outcomes for prosthesis in maxilla and the study results were only applicable to mandible. Only two studies specified, and extracted the data from the primary studies, whether IOD used was removable or fixed.[7, 8] The subgroups of interest, as described in Table 1, were covered in seven systematic reviews.[5, 6, 8-12] One systematic review[8] included evidence for fixed and removable IODs separately and allowed comparison of outcomes between mandible vs. maxilla. The impact of loading time of implants used in IODs on patients' outcomes was evaluated in four systematic reviews.[8, 9, 11, 12] The impact of the number of implants in IODs on patients' outcomes was described in five systematic reviews.[5, 6, 8-10]

Background information on the condition and treatments of interest were not extensively covered in systematic reviews, thus, online resources from the NHS website,[14] the British Society for the Study of Prosthetic Dentistry[15] and the British Association of Oral and Maxillofacial Surgeons[16] were included. There was no comparative evidence for prosthesis survival (FAQ2) for comparison of CCDs and IODs, however, implant and overdenture survival in both jaws was evaluated in IOD-only systematic reviews[8-12] whereas the longevity and failure rates of CCDs were assessed in one other systematic review.[13] The clinical expert consulted on this topic provided further evidence (2 reviews[17, 18] and 2 primary papers[19, 20]).

The evidence for FAQs 3, 4 and 5 for comparison between CCDs and IODs is covered in five systematic reviews[3-7] which include randomised controlled trials (RCTs) as well as observational studies. The clinical expert provided further evidence (one SR) for the prevalence and incidence of peri-implantitis, a common side effect related to implant placement.[21] The evidence for FAQ5 focused on bone loss. Costs (FAQ 6) were only briefly mentioned in one systematic review.[3] Published denture costs were reported in Canadian dollars with the evidence being derived for a case control study and cost effectiveness analysis.[3, 22] Additional information for FAQs 3-5 on IODs, with exception of FAQ6, was based on evidence from RCTs and observational studies in four systematic reviews.[9-12]

The duration of follow-up in primary studies varied substantially from two to 168 months. All included articles featured fully edentulous patients. Ten systematic reviews evaluated

patients of all ages whereas one review (Kroll 2018[4]) restricted the inclusion criteria to patients ≥65 years.

All included systematic reviews were likely to be of high risk of bias due to the low quality of the search strategies and inclusion of primary studies published in the English language only (all except two studies). Three systematic reviews did not assess or did not provide sufficient details of the tools used for the assessment of risk of bias of included studies.[3, 5, 7] Overall, the risk of bias of included studies, as reported by the authors, was fair/moderate.[4, 6, 8-13]

Table 2: Evidence sources

Study ID	Type of evidence	Treatment comparison	Jaw	**FAQ1:** background information	**FAQ2:** implant survival/ failure	**FAQ2:** Prosthesis survival/ failure	**FAQ3:** function	**FAQ4:** QoL/ satisfaction	**FAQ5:** short and long-term complications	**FAQ6:** costs
Boven 2015[7]	SR	**removable IOD (replacing CCD)**	both jaws	-	-	-	✓	✓	-	-
Fu 2020[6]	SR	**CCD vs IOD** (1-IOD); **1-IOD vs 2-IOD**	mandible	-	-	-	✓	✓	-	-
Kroll 2018[4]	SR	**CCD** (in both arches) vs **IOD** (IOD in mandible, CCD in maxilla)	mandible	✓	-	-	✓	✓	-	-
Kutkut 2018[3]	SR	**CCD vs IOD** (unsplinted 2-IODs)	mandible	✓	-	-	✓	✓	✓	✓
Oh 2020[5]	SR	**CCD vs IOD** (2-IODs); **2-IOD vs 4-IOD**	mandible	✓	-	-	-	-	✓	-
Taylor 2021*[13]	SR	**CCDs** (single or pair)	both jaws	-	-	✓	-	-	-	-
Kern 2016[8]	SR	**fixed or removable IOD** (1 to 6 implants in maxilla; 2 to 10 in mandible)	both jaws	-	✓	-	-	-	-	-
Borges 2020[12]	SR	**IOD** (1 - 4 IODs)	mandible	-	✓	-	✓	-	✓	-
Di Francesco 2019[10]	SR	**IOD** (2 - 8 IODs)	maxilla	-	✓	✓	-	✓	-	-
Dreyer 2018**[21]	SR	**IOD**	NA	-	-	-	-	-	✓	-
Elawady 2017[9]	SR	**IOD** (1-IOD vs 2-IODs)	mandible	-	✓	-	-	-	✓	-
Padmanabhan 2020[11]	SR	**IOD** (1-IOD)	mandible	-	✓	-	-	✓	✓	-
Attard 2004a**[17]	review	**IOD**	both jaws	-	✓	-	-	-	-	-
Attard 2004b**[18]	review	**IOD**	both jaws	-	✓	-	-	-	-	-
Jemt 2018a**[19]	primary study	**IOD**	both jaws	-	✓	-	-	-	-	-
Jemt 2018b**[20]	primary study	**IOD**	both jaws	-	✓	-	-	-	-	-
British Association of Oral and Maxillofacial Surgeons[16]	online resource	**IOD**	both jaws	✓	-	-	-	-	-	-
British Society for the Study of Prosthetic Dentistry[15]	online resource	**CCD and IOD**	both jaws	✓	-	-	-	-	-	-

Study ID	Type of evidence	Treatment comparison	Jaw	**FAQ1:** background information	**FAQ2:** implant survival/ failure	**FAQ2:** Prosthesis survival/ failure	**FAQ3:** function	**FAQ4:** QoL/ satisfaction	**FAQ5:** short and long-term complications	**FAQ6:** costs
NHS[14]	online resource	**CCD**	both jaws	✓	-	-	-	-	-	-

CCD – complete conventional denture; NA – not applicable; NHS – National Health Service; SR – systematic review; 1-, 2-, 3-, 4-IOD – 1-, 2-, 3-, 4-implant supported-overdenture

*The article identified through additional web search

**The evidence provided by the clinical expert

3.3 FAQ1: What does treatment for edentulous patients involve?

This section describes two treatment options for edentulous patients i.e., CCDs and IODs. A brief description of the condition and two treatment options (including background, stages of treatment and maintenance) is provided below (Table 3).

Table 3: Description of options

Edentulism
What is edentulism? Edentulism is a condition described as tooth loss in either one (mandible or maxilla) or both jaws simultaneously due to conditions such as periodontal disease, abscess formation, trauma, vertical tooth fracture or others.[3] Patients can be fully edentulous, meaning they have lost all teeth in one or both jaws, or partially edentulous where only partial loss of the functional dentition takes place.[15] The condition can have a detrimental effect on patients' health. Patients report lower QoL, they have difficulties with daily functioning (e.g. speaking, reduced masticatory functions) and concerns with aesthetics limiting social engagement.[4, 5] Edentulism can lead to nutrient deficiencies which increase the risk of other health problems.[7] Tooth loss can also lead to irreversible reduction of the alveolar bone height that changes the shape and size of the treated area.[5] Treatment options include use of CCDs or IODs.
Full prosthesis/denture (CCD)
What is CCD? A CCD is a removable denture with false teeth that replace all upper and/or lower teeth in edentulous patients and is supported only by tissue present on the jaw. Dentures can be made with various materials, such as acrylic (plastic), nylon or metal, using different methods. CCD sit on top of the gums and the jawbone.[14] *Treatment* Due to changes in the shape of the affected area and gums following removal of all teeth, the jaw may be left to heal first before fitting in CCD.[5] Considering that patients might not yet be fully edentulous at the beginning of the treatment, the number of appointments required can vary substantially. Patients are not required to stay in hospital.[15] During initial appointments of denture preparation, health professionals will take the primary, and later working, impressions of patient's mouth (an imprint of the treated area) along with information relating to residual ridge height and other clinically relevant features of edentulous mouth. Following denture preparation by a dental technician, the fit is assessed during the trial insertion appointments and adjustments made if needed.[15] The shape and colour of the denture can be modified based on patients' preference.[14] Further review appointments analyse patient's experience and check for any changes in the CCD that may require the dentist/technician's input.[15] After the treatment is completed, the patient receive necessary instructions on the use and care of CCDs.[15]

Post-treatment maintenance

Patients might be required to wear CCDs all the time straight after fitting it, including during the night, for a period of time stipulated by a health professional. When removed, CCDs should be kept clean and moist, i.e. submerged in denture-cleaning solution, to avoid drying out or the denture changing shape.[14]

Patients using CCDs need to care for their gums and have regular general check-ups. CCDs require regular maintenance e.g., base relining, base and occlusal adjustments, repairs, denture or denture tooth replacement when required. The frequency of maintenance depends on personal needs.[3]

Implant-supported overdenture/prosthesis (IOD)

What is IOD?

An IOD is a dental prosthesis that is supported by dental implants (false metal roots screwed into the jawbone) and placed in the mandible or maxilla.[4, 16] Implants are retained due to the process of osseointegration (bone growth on the implant surface). Fixed IODs refers to a prosthesis fixed to the jaw and which the patient is not able to remove daily. Removal of the fixed prosthesis can only be carried out by a dentist. Removable IODs can be taken out by a patient anytime during the day in order to carry out regular maintenance and cleaning.[15] Dental implants can improve the function of the dental base by supporting and stabilising the overdenture/prosthesis.[5]

Patients can be fitted with different numbers of implants (from one up to 10 implants depending on the jaw). The variety of lengths, materials used, angles of placement in the jaw, use of lining or splinting and attachment styles between an implant and overdenture impacts the overall costs of IODs.[8]

Treatment

Similar to the treatment with CCDs, the number of appointments required for fitting in IODs can vary substantially between patients and hospital stay is not required. However, patients will need to have the implants implanted before fitting in the overdenture/prosthesis. The length of time for implant placement following the removal of teeth can vary and may impact the success of the procedure.[15]

Putting together an IOD treatment plan requires careful consideration of a number of factors related to patient's general health, the condition of structures inside the mouth (e.g. bone volume and height) and patient's extra-oral features (e.g. facial asymmetry).[10, 15] Regardless of type and number of implants, their distribution or length must be decided in advance.[15]

Implant placement is considered a surgical procedure that requires local anaesthesia in order to gain access to the bone under gums without causing pain to the patient. Optional intravenous sedation or a general anaesthetic can be given to patients who become very anxious during the procedure. After the bone is exposed, a small hole is drilled in the structure and an implant screwed in place. Single implant placement takes approximately half

an hour with the number of implants in IOD affecting the length of time of procedure. The affected area is very likely to be sore after the procedure and time off work might be required based on personal circumstances.[15, 16] Potential side effects include bleeding, infection or nerve bruising.[16]

Overdenture/prosthesis can be loaded on top of implants either immediately or following the healing phase of the surgical area.[8, 11, 15] The process of prosthesis preparation is similar to CCDs, however, patients are required to use provisional prosthesis (with impressions made before implant placement) before the definitive prosthesis placement.[15] After the treatment, patients receive necessary instructions on the use and care of IODs and implants used to support the prosthesis.[15]

Post-treatment maintenance

Patients using IODs need to care for their gums, area around implants and have regular general check-ups. IODs require regular maintenance e.g., base relining, base and occlusal adjustments, repairs, denture or denture tooth replacement when required. In addition, adjustments or replacement of attachments and/or implants might be required. The frequency depends on personal needs, health status and type of prosthesis.[3]

3.4 FAQ2: What is the denture/implant survival/failure?

This section describes the information relating to denture and implant survival and/or failure for the main comparison (CCDs vs IODs) and for CCDs and IODs individually. Longevity and CCDs failure rates were reported in one[13] and survival of prosthesis supported by implants was reported in another systematic review.[10] Implant survival and/or loss in IODs was described in four articles.[8, 9, 11, 12] The clinical expert forwarded the evidence on the long-term implant survival from two reviews[17, 18] and a registry study (reported in two papers) where patients were followed up to 30 years.[19, 20]

The evidence is insufficient to infer the size of any difference between mandibular or maxillary CCDs and IODs in terms of prosthesis survival. Patients wearing mandibular, maxillary or pair of CCDs reported high mean longevity of their prosthesis and increase in failure rates as expected with longer follow-up time. Maxillary IODs have high survival rates with evidence lacking for mandibular IODs. Estimated three and five-year survival rates of implants used in IODs were very high. The number of implants used in IODs and loading time have a substantial impact on loss rate with some differences between maxilla and mandible. Based on the results of the primary study, implants have high overall cumulative survival rates (CSRs) with better outcomes of implants placed in mandible when compared to maxilla. Long-term implant success is high in both fixed and removable IODs.

Background information and definitions

Prosthesis survival rate was not defined in Di Francesco 2019.[10] Longevity of complete prosthesis was defined as the length of time between insertion and its replacement with a new denture or alternative treatment such as implant-supported overdentures or a fixed

prosthesis.[13] Complete denture failure proportions were derived from included studies and explicit definition not provided.

Implant failure was not defined in Elawady 2017.[9] Implant survival was defined as "an implant being still in situ with a bony anchorage after the observation period" in Kern 2016[8] and "whether the implant is or is not in the alveolar bone" in Borges 2020.[12] Two systematic reviews, Padmanabhan 2020[11] and Di Francesco 2019[10], did not provide a definition for "implant survival".

The time of loading was described as immediate (within one week from implant placement), early (between one week and two months) or delayed (>2 months).[8, 11]

CCDs vs IODs: prosthesis survival

None of the systematic reviews evaluated denture survival of CCDs in comparison with IODs in mandible or maxilla.

CCDs only: prosthesis survival/failure

Mean longevity and proportions of failed CCDs were reported in one study.[13] For maxillary CCDs, the weighted mean denture longevity was 10.26 years (standard deviation [SD] 3.8; n=589 dentures) and for mandibular 8.63 years (SD 2.63; n=864 dentures). For patients wearing both, maxillary and mandibular CCDs, the mean weighted mean denture longevity was 10.76 years (SD 4.68; n=1570 dentures). After 1 to 2 years of follow-up, the proportion of failed CCDs was reported as 0.05 (95%CI 0 to 0.1; n=3 studies) i.e., failure rate of 5%. For 5 to 6 years and >10 years of follow-up, the failure proportions were reported at 0.12 (95%CI 0.08 to 0.16; n=7 cohort from 5 studies) and 0.41 (95%CI 0.28 to 0.53; n=7 cohorts from 5 studies), respectively.

IODs only: prosthesis survival/failure

After a follow-up of at least two years, Di Francesco 2019[10] reported a survival rate of maxillary overdentures (mixed number of implants) that ranged from 87.5% to 100% (n=19 studies [one RCT and 18 observational]; 94.7% to 100% for ≥6 implants with a splinted anchorage; 87.5% to 100% for four implants with or without a splinted anchorage; 95% to 100% for <4 implants with or without splinted anchorage). Pooled IODs survival rates with <4 and ≥4 implants after at least two years of follow-up were 100% (SD 0.155) and 97.9% (SD 0.812), respectively (P=NR; no other information was reported). No evidence was found for mandibular prosthesis.

IODs only: implant survival/failure

The estimate loss rate of implants used in IODs was described in two studies.[8, 11] In Kern 2016[8], studies with removable IODs most often included one to four implants and fixed IODs ≥5 implants. Some primary studies included four or five implants with either removable or fixed prosthesis. The systematic review included 54 studies (4 RCTs and 50 prospective observational studies), but the authors did not report the number of studies per each comparison (n=81 study populations).

Based on Table 4, the loss rates for all patients were very low (<1 implant per 100 implant years) with exception of implant used in maxillary removable 4-IODs and mandibular 1-IODs. Implants used in maxillary removable 4-IODs had more than eight times higher loss rate when compared to implants used in maxillary fixed IODs. Evaluation of the impact of loading time on implant loss revealed that in mandible, patients with immediately loaded overdentures (either fixed or removable) had much higher implant loss rate when compared to delayed loading. The opposite was seen for maxilla where implant loss was much higher in fixed and removable overdentures loaded later (delayed; >2 months) when compared to immediate loading. Evaluation of the number of implants used in prosthesis showed that in both, mandible and maxilla, lower number of implants used in denture is associated with greater impact on loss rate.

Estimated three and five-year implant survival rates for overdentures with various numbers of implants were reported in two studies (Table 5).[8, 11] Subgroup analysis based on number of implants used and loading time was also described. However, both studies used estimated implant loss rate in the calculations of survival rates with an underlying assumption of constant event rate over time. The extrapolation of the data might not be consistent in the clinical situation. The results for 10-year survival from Padmanabhan 2020[11] were not reported as the SR did not include any primary studies with follow-up >5 years and the results were judged by clinical experts as unreliable.

Overall, estimated three and five-year implant survival rates were very high with exception of <4 implant removable IODs in maxilla which are associated with a higher risk of loss (Table 4).[8] Similar results were reported in Di Francesco 2019[10] with pooled survival rate of <4 maxillary implants being significantly lower than in ≥4 implants after at least two years of follow-up (92.85% [SD 3.7] and 96.24% [SD 1.1], respectively; P<0.016).

Impact of immediate/early vs delayed loading on implant survival rate of 1-4 IODs was also evaluated in Borges 2020[12] with results at three, 12, 24, 36 and 120 months showing similar survival rates between the two subgroups at each follow-up point with pooled risk difference of survival -0.011 (95%CI -0.037 to 0.014, P=0.376; immediate/early: 315 out of 533 implants, delayed: 310 out of 469 implants).

Evaluation of the number of failure events of 1-IODs and 2-IODs was in one systematic review (Elawady 2017[9]; follow-up ranged from 12 to 60 months) showing that implants used in 2-IODs have a significantly higher risk of failing than implants used in 1-IODs (risk ratio 3.26 [95%CI 1.18 to 8.97], P=0.02).

Table 4: Estimated loss rate of implants used in fixed and removable IODs in mandible or maxilla

Reference	Sub-group	Jaw	Subgroup description	Follow-up time	No. of studies	No. of patients	Proportion of implant losses*	Total exposure time (implant years)	Estimated loss rate per 100 implant years [95%CI] and P value for comparison^		Certainty - quality of evidence / Assessment for use in DA
Kern 2016[8]	All patients	both jaws	Fixed IOD	at least 3 years (range 3 to 21.5 years)	unclear	955	72/5306	30984.12	0.23 (0.18 to 0.29)	<0.0001; 0.0148§	Very low (high risk of bias and inconsistency) / Not applicable - not the main comparison
			Removable IOD (all)			1383	118/3901	21281.16	0.55 (0.46 to 0.66)		
			Removable IOD (excl <4 maxilla implants)**			1354	72/3768	20644.26	0.35 (0.28 to 0.44)		
		mandible	Fixed IOD			592	30/2923	15924.04	0.19 (0.13 to 0.27)	0.298	
			Removable IOD			1280	47/3494	19562.16	0.24 (0.18 to 0.32)		
		maxilla	Fixed IOD			363	42/2383	15060.08	0.28 (0.21 to 0.38)	<0.0001	
			Removable IOD (excl 4 maxilla implants)**			84	25/334	1082.1	2.31 (1.56 to 3.42)		
	Impact of loading time	both jaws	Fixed IOD: Delayed			598	41/3512	24693.9	0.17 (0.12 to 0.23)	0.1652	
			Fixed IOD: Immediate			209	10/1143	3691.64	0.27 (0.15 to 0.5)		
			Removable IOD: Delayed (excl <4 maxilla implants)**			1175	58/3323	17883.03	0.32 (0.25 to 0.42)	0.0282	
			Removable IOD: Immediate (excl <4 maxilla implants)**			152	14/389	2245.23	0.62 (0.37 to 1.05)		
		ma	Fixed IOD: Delayed			386	5/1999	13210	0.04	<0.0001	

Reference	Sub-group	Jaw	Subgroup description	Follow-up time	No. of studies	No. of patients	Proportion of implant losses*	Total exposure time (implant years)	Estimated loss rate per 100 implant years [95%CI] and P value for comparison^		Certainty - quality of evidence / Assessment for use in DA
									(0.02 to 0.09)		
			Fixed IOD: Immediate			82	4/412	1210.46	0.66 (0.33 to 1.32)		
			Removable IOD: Delayed			1091	33/2989	16800.93	0.2 (0.14 to 0.28)	0.0003	
			Removable IOD: Immediate			152	14/389	2245.23	0.62 (0.37 to 1.05)		
		maxilla	Fixed and removable IOD: Delayed (excl <4 maxilla implants)**			296	61/1847	12566	0.49 (0.38 to 0.62)	0.0125	
			Fixed and removable IOD: Immediate (excl <4 maxilla implants)**			127	2/731	2688.18	0.08 (0.02 to 0.32)		
	No. of implants	mandible	Fixed IOD: ≥5 implants			278	11/1452	10807.77	0.1 (0.06 to 0.18)	<0.0001	
			Fixed IOD: 4 implants			189	16/762	2004.85	0.8 (0.49 to 1.3)		
			Removable IOD: 1 implant			66	3/66	182.81	1.64 (0.53 to 5.09)	0.0088; 0.0097†	
			Removable IOD: 2 implants			557	24/1134	7274.9	0.33 (0.22 to 0.49)		
			Removable IOD: 4 implants			365	8/1366	6971.25	0.11 (0.06 to 0.23)		
		maxilla	Fixed IOD: ≥6 implants			303	37/2057	13099.78	0.28 (0.2 to 0.39)	NA	

Reference	Sub-group	Jaw	Subgroup description	Follow-up time	No. of studies	No. of patients	Proportion of implant losses*	Total exposure time (implant years)	Estimated loss rate per 100 implant years [95%CI] and P value for comparison^		Certainty - quality of evidence / Assessment for use in DA
			Removable IOD: <4 implants			49	46/133	636.9	7.22 (5.41 to 9.64)	<0.0001	
			Removable IOD: 4 implants			84	25/334	1082.1	2.31 (1.56 to 3.42)		
Padmanabhan 2020[11]	**All patients**	**mandible**	1-IOD	Range 1 to 5 years	12 (3 RCTs and 12 prospective observational)	305	NR/305	NR	6.03 (4.91 to 7.16)	NA	

CI – confidence interval; DA – decision aid; IOD – implant-supported overdenture; NA – not applicable; NR – not reported
*No. of post-loading implant losses/total no. implants;
**<4 implants were excluded due to very high risk of implant loss; the results for all patients with removable IOD in maxilla were not reported
^Effect estimates were not reported
§ fixed vs removable (all): <0.0001, fixed vs removable (without <4 maxillary implants): 0.0148
†1 implant vs 2 implants: 0.0088; 2 implants vs 4 implants: 0.0097

Table 5: Estimated three and 5-year survival of implants used in fixed and removable IODs in mandible and maxilla

Reference	Sub-group	Jaw	Subgroup description	Follow-up time	No. of studies	No. of patients	Estimated 3-year implant survival (95%CI)	Estimated 5-year implant survival (95%CI)	Certainty - quality of evidence / Assessment for use in DA
Kern 2016[8]	All patients	both jaws	Fixed IOD	at least 3 years (range 3 to 21.5 years)	NR	955	99.31% (99.13 to 99.45)	98.84% (98.55 to 99.08)	Very low (high risk of bias and inconsistency) / Not applicable - not the main comparison
			Removable IOD (all)			1383	98.35% (98.03 to 98.62)	97.27% (96.73 to 97.71)	
			Removable IOD (excl <4 maxilla implants)*			1354	98.96% (98.69 to 99.17)	98.27% (97.82 to 98.63)	
		mandible	Fixed IOD			592	99.44% (99.2 to 99.61)	99.06% (98.66 to 99.34)	
			Removable IOD			1280	99.28% (99.05 to 99.46)	98.81% (98.41 to 99.1)	
		maxilla	Fixed IOD			363	99.17% (98.87 to 99.38)	98.62% (98.13 to 98.97)	
			Removable IOD (excl <4 maxilla implants)*			84	93.3% (98.91 to 99.41)	89.09% (84.28 to 92.5)	
	Impact of loading time	both jaws	Fixed IOD: Delayed			598	99.5% (99.33 to 99.63)	98.86% (98.51 to 99.1)	
			Fixed IOD: Immediate			209	99.19% (98.5 to 99.56)	98.65% (97.51 to 99.27)	
			Removable IOD: Delayed			1175	99.03% (98.75 to 99.25)	98.41% (97.92 to 98.76)	
			Removable IOD: Immediate			152	98.15% (96.89 to 98.9)	96.95% (94.89 to 98.17)	

Reference	Sub-group	Jaw	Subgroup description	Follow-up time	No. of studies	No. of patients	Estimated 3-year implant survival (95%CI)	Estimated 5-year implant survival (95%CI)	Certainty - quality of evidence / Assessment for use in DA
		mandible	Fixed IOD: Delayed			386	99.89% (99.73 to 99.95)	99.8% (99.55 to 99.9)	
			Fixed IOD: Immediate			82	98.04% (96.11 to 99.01)	96.75% (93.61 to 98.36)	
			Removable IOD: Delayed			1091	99.41% (99.17 to 99.58)	99.01% (98.61 to 99.3)	
			Removable IOD: Immediate			152	98.14% (96.89 to 98.9)	96.93% (94.87 to 98.17)	
		maxilla	Fixed and removable IOD: Delayed (excl <4 maxilla implants)**			296	98.55% (98.15 to 98.87)	97.60% (96.93 to 98.13)	
			Fixed and removable IOD: Immediate (excl <4 maxilla implants)**			127	99.75% (99.04 to 99.94)	99.60% (98.40 to 99.90)	
	No. of implants	mandible	Fixed IOD: ≥5 implants			278	99.7% (99.45 to 99.83)	99.49% (99.1 to 99.72)	
			Fixed IOD: 4 implants			189	97.63% (96.17 to 98.54)	96.1% (93.69 to 97.59)	
			Removable IOD: 1 implant			66	95.2% (85.84 to 98.42)	92.13% (77.53 to 97.38)	
			Removable IOD: 2 implants			557	99.02% (98.53 to 99.34)	98.36% (97.58 to 98.91)	
			Removable IOD: 4 implants			365	99.66%	99.45%	

Reference	Sub-group	Jaw	Subgroup description	Follow-up time	No. of studies	No. of patients	Estimated 3-year implant survival (95%CI)	Estimated 5-year implant survival (95%CI)	Certainty - quality of evidence / Assessment for use in DA
							(99.31 to 99.82)	(98.86 to 99.7)	
		maxilla	Fixed IOD: ≥6 implants			303	99.16% (98.84 to 99.39)	98.6% (98.07 to 98.98)	
			Removable IOD: <4 implants			49	80.52% (74.88 to 85.02)	69.7% (61.75 to 76.3)	
			Removable IOD: 4 implants			84	93.3% (90.25 to 95.42)	89.09% (84.29 to 92.5)	
Padmanabhan 2020[11]	All patients	mandible	1-IOD	Range 1 to 5 years	12 (3 RCTs and 12 prospective observational)	305	NR	91.93% (82.8 to 100)	
	Impact of loading time		1-IOD: Delayed		unclear	207		95.43% (87.47 to 100)	
			1-IOD: Early			76		84.98% (60.96 to 100)	
			1-IOD: Immediate			229		96.67% (77.42 to 100)	

CI – confidence interval; DA – decision aid; IOD – implant-supported overdenture; NR – not reported
* <4 implants were excluded due to very high risk of implant loss; the results for all patients with removable IOD in maxilla were not reported

The clinical expert provided the primary evidence (a registry study) on the long-term implant survival (up to 30 years) of fully edentulous patients (n=4049 patients with 24,781 implants placed in 4585 edentulous arches) who received IODs (mostly fixed IODs). The implants had either a turned surface (placed between 1986 and 2002) or a moderately rough surface (2003 to 2015) and the number ranged from 2 to 8. Most of the implant failures (344 events out of 803 reported; 43%) occurred during the first year after implant placement. Approximately 16% of failures occurred during the second year and 18% for the 3 following years up to 5 years in function. Overall CSRs for the first event were 93%, 89.3%, 87.4%, 86.2%, 84.9%, 83.8% and 83.3% after 0 to 1, >1 to 5, >5 to 10, >10 to 15, >15 to 20, >20 to 25 and >25 to 30 years of follow-up, respectively.[19] The overall CSRs of implants placed in mandible was much higher than for implants in maxilla. The implants with a turned surface had lower CSRs than implants with a moderately rough surface. [20]

Based on the evidence included in two reviews sent by the clinical expert, the long-term implant success of implants placed in fixed or removable IODs is high. For fixed maxillary and/or mandibular prosthesis, three studies provided the data after 10 years of follow-up and the implant success rate ranged from 93% to 97.6%. Based on the data from one study, implant success rate of implants placed as part of fixed mandibular IOD after follow-up of 20 years was 98.9%.[17] Similarly, the implant success rate after 10 years of follow-up of implants placed as part of removable maxillary and/or mandibular IOD was high (range 86.9% to 96.4%; n=3 studies).[18] Important to note is that the studies reported in the review considered only two widely used implant systems i.e., ITI and Brånemark.[17, 18]

3.5 FAQ3: What is the functional benefit for a patient?

This section provides information on the functional benefits of CCDs and IODs for edentulous patients. Evidence was reported in five systematic reviews[3, 4, 6, 7, 12] with outcomes in most studies reported in narrative summaries.

Low quality evidence showed some increases in patients' masticatory performance following treatment of adult edentulous patients with mandibular IODs when compared to CCDs. The impact of maxillary CCDs or IODs on patients' masticatory performance was unclear. Very limited evidence was found for the impact of the number of implants and loading time on masticatory performance or implant stability in IODs. Lack of standardised tests to assess function restricted the comparability of results.

Background information and definitions

Currently, no guidelines for assessment and reporting of masticatory function (i.e. chewing, mixing ability, bite force etc.) exist with the outcome being measured in different ways between studies (i.e. by chewing gum, using occlusal bite force meter or electromyography) which substantially affects comparability of results.[6]

CCDs vs IODs: functional benefits

In one systematic review[7] evaluating mandibular IODs (mixed number of implants) replacing CCDs in edentulous patients, treatment with IODs resulted in an increase in masticatory performance (n=7 [2 RCTs and 5 prospective studies]). Patients were able to chew better (n=2 studies), needed fewer chewing cycles to reach the same result (n=1) and were able to eat tougher foods (n=1) after IOD treatment. One study showed no difference in chewing efficiency between CCDs and IODs. The authors reported an improvement of the average maximum bite force after IOD treatment (n=2 studies) which remained after 10 years (n=1). In another systematic review[4] of patients using mandibular IODs (with CCDs in maxilla), mean difference in scores as related to chewing ability was significantly higher than patients with mandibular and maxillary CCDs (n=2 studies; VAS scale 0-100; mean difference 18.18 [95%CI 11.97 to 24.39], P<0.001).

In Kutkut 2018[3], treatment with mandibular 2-IODs was reported to offer a significantly greater ability to function when compared to CCDs (n=11 studies; four RCTs and seven observational studies; no effect estimates were reported – unclear if results are clinically relevant) with one RCT showing no difference. Patients with 2-IODs performed better functions in comfort with their dentures, could eat a wide range of food items with less difficulty, and experienced less impact on various daily life aspects than patients with CCDs. Two implant IODs, when compared to CCDs, achieved better stability (n=15; six RCTs and nine observational studies) which was reflected in increased chewing force, improved chewing experience, significant improvement of patients' masticatory performance and discomfort during function. One RCT showed no difference in mixing ability between CCDs and 2-IODs[3].

Moreover, a significantly higher masticatory efficiency/performance was reported for patients replacing mandibular CCDs with 1-IODs (n=2 before-after studies) and in patients

using 1-IODs when compared to CCD users (n=1 RCT) after two months of follow-up in one systematic review (no effect estimates were reported – unclear if results are clinically relevant).[6] However, one RCT did not show a difference in mixing ability at 12 months.[6]

IODs only: functional benefits

Masticatory performance for 1-IODs vs 2-IODs was evaluated in one systematic review.[6] Two implant IODs, when compared to 1-IODs, showed significant improvement in masticatory performance (n=1 RCT) as well as a significant reduction in the masseter muscle activity (n=1 RCT; no effect estimates were reported – unclear if results are clinically relevant).

The impact of immediate vs delayed loading (defined in FAQ2) in 2-4 IODs on implant stability quotient at three, 6, 12, 24 and 36 months was evaluated in Borges 2020.[12] While delayed loading was favoured at three months (standardised mean difference 0.602 [95%CI 0.309 to 0.895]; P<0.001), the difference between loading times diminished after further follow-up of six, 12, 24 and 36 months (six months: standardised mean difference -0.109 [95%CI -0.781 to 0.564, P=0.751; 12: -0.201 [95%CI -0.498 to 0.095, P=0.183; 24: -0.157 [95%CI -0.824 to 0.51, P=0.644 and 36: -0.161 [95%CI -0.609 to 0.287, P=0.481, respectively). It is unclear if differences are clinically meaningful.

3.6 FAQ4: What is the impact on QoL and/or satisfaction?

This section provides information on the impact of using CCDs or IODs on patients' QoL and satisfaction as measured by various tools and self-administered questionnaires. Outcomes in most of systematic reviews included in this section[3, 4, 6, 7, 10, 11] were reported in narrative summary.

The evidence showed a substantial increase in QoL and patients' satisfaction following treatment with mandibular IODs in adult edentulous patients (low quality of evidence). The impact of maxillary CCD or IODs on patients' QoL or satisfaction was unclear. Very limited evidence was found for the impact of the number of implants and loading time of IODs on QoL or patients' satisfaction.

Background information on tools

Oral HRQoL in dentistry is measured by the validated Oral Health Impact Profile-49 (OHIP-49) questionnaire composed of 49 items relating to physical and psychological parameters. However, shorter versions of the same questionnaire, such as OHIP-14 (contains only 14 questions) or OHIP-EDENT (questionnaire specified for group of edentulous patients with cross-culture versions in different nations) also exist.[6] The scores derived from these questionnaires cannot be directly compared to each other which restricts the data analysis. Furthermore, patients' satisfaction, evaluated in various functional and comfort parameters such as chewing ability or stability, is assessed by self-administered questionnaires that use visual analogue scales (VAS). Parameters included in each questionnaire can differ and they are often defined in various ways with VAS scales varying in length.[6, 7] Similar to QoL, data analysis of patients' satisfaction might be restricted by the heterogeneity of questionnaires and definitions used in the studies.

CCDs vs IODs: QoL and satisfaction

Kutkut 2018[3] reported a substantial improvement in the OHIP and oral health-related QoL (measured with various methods) in adult patients who received mandibular IODs when compared to CCDs (n=7 studies; three RCTs and four observational). In the same study, overall satisfaction was significantly higher in patients using IODs when compared to CCDs (n=12 studies; seven RCTs and five observational) with only one study (RCT) reporting similar satisfaction between CCDs and IODs users (no effect estimates were reported).[3]

Results of Boven 2015,[7] focused on mixed IODs in patients previously wearing mandibular CCDs, showed improvements of patients' satisfaction with their oral status as seen from custom-made questionnaires (n=22 studies), the general satisfaction scores (n=7), the Vervoorn questionnaires (n=4), the OHIP-20 (n=4), the OHIP-EDENT (n=3) and the McGills denture satisfaction questionnaire (n=2), the self-reported denture satisfaction scale (n=3) and the patient denture complaint questionnaire (n=1). After five years, as seen based on the custom-made questionnaires (n=7), general satisfaction scores (n=1), verbal questions (n=2), the self-reported denture satisfaction score (n=1), OHIP-20 (n=1) and OHIP-14 (n=1), treatment of CCD wearers with IODs led to improvements in patients' satisfaction with their oral status. Authors described improvements reached after one year were stable for the first five years (n=13) and the next 10 years (n=3). One study (n=1) highlighted that the amount of satisfaction of edentulous patients differs depending on prosthetic type i.e. patients rehabilitated with fixed prostheses obtained a generally higher level of satisfaction than patients wearing overdentures, except for the parameter for oral hygiene (bad breath and ease of cleaning; no effect estimates were reported).

Fu 2020[6] compared CCDs with 1-IODs in the mandible. Three studies measured QoL (n=1 RCT using OHIP-EDENT; n=2 before-after study of patients exchanging CCD for 1-IOD measured by OHIP-49 or OHIP-EDENT). Results of both prospective studies revealed a significant improvement of oral health-related QoL after treatment with 1-IODs for edentulous patients previously using CCDs at one and three months ($P<0.05$ for comparisons; no effect estimates were reported – unclear if results are clinically relevant). Patients using CCDs evaluated in one RCT showed worsening of their QoL while patients with 1-IOD showed significant improvement after follow-up of 12 months ($P<0.05$ for 1-IOD; no effect estimates were reported).

Patients satisfaction between mandibular CCDs and 1-IODs was evaluated in one RCT and six observational before-after studies in the same systematic review.[6] Results indicated that after being treated with 1-IODs, edentulous patients had a significant improvement of patient satisfaction in all comfort and functional parameters (i.e., general satisfaction; comfort; ability to speak or chew and others) after follow-up that ranged from two months and five years. Only one study reported a lower satisfaction with aesthetics (no effect estimates were reported – unclear if results are clinically relevant).

Results of Kroll 2018[4] evaluating elderly patients (≥65 years old) wearing mandibular CCDs or IODs (number of implants not reported), with CCDs in maxilla, showed significant impact on

patients QoL and general satisfaction. The results were similar for specific aspects of satisfaction i.e., comfort, stability/retention, aesthetics and chewing (Table 6).

Only one review (Boven 2015[7]) reported results of one primary study focused on improvement of patients' satisfaction in adults previously wearing maxillary CCDs and treated with IODs. Based on the general satisfaction score, patients showed an improvement in satisfaction with their oral status (no effect estimate was reported – unclear if results are clinically relevant).

Table 6: QoL and satisfaction with the use of mandibular CCDs or IODs (with CCDs in maxilla) in edentulous patients aged ≥65 years

Reference	Outcome description	Follow-up period	No. of studies (type of study)	Nr of patients	Effect estimate (95%CI) and P value for comparison		Notes	Certainty - quality of evidence	Assessment for use in DA
Kroll 2018[4]	OHIP-EDENT total score	2 - 12 months	4 (RCTs)	unclear	Mean difference: -12.524 (-17.005 to -8.043)	<0.001	favours IODs	Very low (high risk of bias and inconsistency)	Difference in favour of IODs but data of low quality ⇗
	general satisfaction*	2 - 6 months	3 (RCTs)		Standardised mean difference: 0.77 (0.258 to 1.282)	0.003	favours IODs		
	satisfaction with denture comfort**	2 - 3 months	2 (RCTs)		Risk ratio: 1.103 (0.943 to 1.29)	0.222	similar satisfaction with comfort between CCD vs IOD		No difference shown ⇔
	satisfaction with aesthetics**				Risk ratio: 1.088 (0.953 to 1.242)	0.212	similar satisfaction with aesthetics between CCD vs IOD		
	satisfaction with stability/retention**				Risk ratio: 1.153 (0.959 to 1.358)	0.13	similar satisfaction with stability/retention between CCD vs IOD		
	satisfaction with chewing**				Risk ratio: 1.214 (0.995 to 1.482)	0.056	at borderline of significance (towards IODs)		

CCD – complete conventional denture; CI – confidence interval; DA – decision aid; IODs – implant-retained overdenture; NR – not reported; RCT – randomised controlled trial
*based on means (SD) from VAS scales (range 0-100 and 0-1000); **based on ordinal data ("satisfied", "tolerate", "unsatisfied/dissatisfied")

IODs only: QoL and satisfaction

For patients treated with mandibular 1-IODs (Padmanabhan 2020[11]), most of the studies that measured patient satisfaction before and after treatment reported a marked improvement of comfort, speech and chewing ability (n=6; one RCT and five observational studies).

QoL for comparison of mandibular 1-IODs vs 2-IODs was reported in two RCTs (using OHIP-EDENT only with various maximum values) in Fu 2020.[6] Results for both studies showed a significant difference between 1-IOD and 2-IOD at 12 months (P<0.05 no effect estimates – unclear if results are clinically relevant) with one study reporting that scores were similar at 60 months. Conflicting results were reported for patients' satisfaction (n=3 RCTs) for comparison of 1-IODs and 2-IODs.

Di Francesco 2019[10] focused on a mixed number of implants used to support maxillary IODs. Patient satisfaction was consistently high, irrespective of both the number of implants employed and the type of anchorage systems used to support an overdenture (number of studies unclear).

3.7 FAQ5: What are the short and long-term complications?

This section provides information on potential short- and long-term complications of using CCDs and/or IODs. The information was described in five systematic reviews.[3, 5, 9, 11, 12] The clinical expert provided the additional resource to highlight the complication often seen in the clinical practice.[21]

The evidence was insufficient to infer the size of any difference between mandibular CCDs and 2-IODs in terms of bone loss and pain (no other complications were reported; low quality of evidence). No evidence was identified to conclude the risk of complications for the different number of implants used in IODs vs CCDs or for a comparison of maxillary CCDs vs IODs. The number of implants used in IODs was likely to impact bone loss in the mandible (low quality of evidence). Limited evidence was found for other complications following treatment with IODs only. Based on the clinical opinion, peri-implantitis is frequently seen in patients with implant-supported prostheses.

Background information and definitions

Bone loss can be measured radiographically, however, this method might not be sensitive to very small changes in the bone height and can be impacted by factors such as patient mouth opening or head positioning. Cone beam computed tomography or cast models can be used as an alternative. Substantial heterogeneity exists in the units of bone height measurement.[5] Bone loss was not well described in the studies. One study reported "peri-implant marginal bone loss",[9] one "bone loss in the posterior mandible"[5] and another "marginal bone loss".[12]

Pain was defined as "painful aching, uncomfortable to eat, sore spots, and uncomfortable dentures";[3] no definitions were provided for other complications.[11]

CCDs vs IODs: complications

Bone loss in the posterior mandible for the comparison of interest was reported in one study and measured using a variety of methods.[5] Based on five primary studies, the weighted mean difference of bone loss between CCDs and 2-IODs was -0.25 of area index (95%CI -0.85 to 0.36, P=0.43; n=5 observational studies). High heterogeneity between the data was reported. Two other studies reported mean bone loss in CCDs of 2.14 mm (SD 0.19) and 22.3%. Eight other studies reported mean bone loss in 2-IODs of 0.51 mm (SD 0.99; n=1 study), 4.6 cm^2 (SD 2.53 cm^2; n=1) or 0.0102 – 0.139 of area index (n=6). Only one study described in Kutkut 2018[3] was already included in meta-analysis.[5] No evidence for maxillary bone loss was reported.

Based on a narrative summary of studies from one systematic review[3] investigating the impact of CCD and unsplinted 2-IODs on physical pain, mandibular 2-IODs were associated with less physical pain and discomfort than CCDs for edentulous individuals. Compared to the CCDs group, the mean pain and discomfort ratings for the IODs group were significantly lower (n=9 studies) with one study showing no significant difference between the groups in relation to physical pain and discomfort (no effect estimates were reported). No evidence for comparison of CCDs or IODs in maxilla was found.

IODs only: complications

Mandibular bone loss was described in three systematic reviews investigating the impact of the number of implants used in IODs or the loading protocol (Table 7).[5, 9, 12] When compared to 1-IODs and 4-IODs, 2-IODs have significantly higher bone loss.[5, 9] Loading time in 2-4 IODs does not seem to have an impact on the bone loss.[12]

Complications of mandibular 1-IOD prosthesis were reported in one study[11] and included: fracture of the mandibular overdentures at the site of the attachment (reported in n=6 primary studies), wear of the retentive element (n=5), plaque accumulation impeding seating (n=5), and moderate to severe wear of the denture teeth (n=1).

Bleeding on probing, which is a sign of potential periodontal inflammation, was evaluated in one systematic review[12] of mandibular 2-4 IODs for comparison of immediate and delayed loading after three, 6, 12, 24 and 36 months of follow-up. Loading time did not affect the severity of bleeding on probing for the duration of follow-up (three months: standardised mean difference -0.077 [95%CI -0.615 to 0.462], P=0.78; 6: -0.003 [95%CI -0.467 to 0.461], P=0.991; 12: 0.4 [95%CI -0.31 to 0.389], P=0.824; 24: 0.021 [95%CI -0.257 to 0.299], P=0.882; 36: 0.081 [95%CI -0.277 to 0.429], P=0.659, respectively).[11]

No information on other complications were available for patients with maxillary IODs.

Table 7: Mandibular bone loss in edentulous patients reported in systematic reviews of IODs

Population	Reference	Intervention	Follow-up period (months)	No. of studies (type of study)	Nr of implants	Effect estimates (95%CI) and P value for comparison		Notes	Certainty - quality of evidence / Assessment for use in DA
all patients	Elawady 2017[9]	2-IOD	between 12 to 24	3 (RCTs)	32	Mean difference: 0.27 mm (0.2 to 0.34)	<0.00001	more bone loss in 2-IOD	Low (moderate or high risk of bias and inconsistency) / Not applicable - not the main comparison
		1-IOD			34				
	Oh 2020[5]	4-IOD	unclear	3 (observational)	unclear	Mean difference: -0.96 mm (-1.86 to -0.06)	0.04	more bone loss in 2-IODs	
		2-IOD			unclear				
subgroup of patients	Elawady 2017[9]	Immediate/ early: 2-IOD	12	1 (RCT)	10	Mean difference: 0 mm (-0.52 to 0.52)	NA	similar bone loss in 1-IOD and 2-IOD	
		Immediate/ early: 1-IOD			10				
		Delayed: 2-IOD	between 12 to 24	2 (RCTs)	22	Mean difference: 0.28 mm (0.2 to 0.35)	<0.00001	more bone loss in 2-IOD	
		Delayed: 1-IOD			24				
	Borges 2020[12]	Immediate/ early: 2-4 IODs	6	5 (RCTs)	unclear	Standardised mean difference: -0.07 (-0.806 to 0.667)	0.853	similar bone loss between immediate/early vs delayed loading	
		Delayed: 2-4 IODs			unclear				
		Immediate/ early: 2-4 IODs	12	8 (7 RCTs and 1	unclear	Standardised mean difference: -0.338	0.163	similar bone loss between	

Population	Reference	Intervention	Follow-up period (months)	No. of studies (type of study)	Nr of implants	Effect estimates (95%CI) and P value for comparison		Notes	Certainty - quality of evidence / Assessment for use in DA
		Delayed: 2-4 IODs		non-RCT)	unclear	(-0.612 to 0.137)		immediate/early vs delayed loading	
		Immediate/ early: 2-4 IODs	24	4 (RCTs)	unclear	Standardised mean difference: 0.162 (-0.072 to 0.395)	0.176	similar bone loss between immediate/early vs delayed loading	
		Delayed: 2-4 IODs			unclear				
		Immediate/ early: 4-IODs	36	2 (RCTs)	unclear	Standardised mean difference: 0.138 (-0.146 to 0.422)	0.342	similar bone loss between immediate/early vs delayed loading	
		Delayed: 4-IODs			unclear				

CI – confidence interval; DA – decision aid; NA – not applicable; NR – not reported; IODs – implant-supported overdenture; non-RCT – nonrandomised controlled trial; RCT - randomised controlled trial

*p value for 3-IOD vs 4-IOD; **p value for 4-IOD vs 5-IOD; ***p value for 3-IOD vs 5-IOD

The clinical expert highlighted that in clinical practice many patients suffer from peri-implantitis i.e., an inflammation of soft tissues located around a dental implant. The prevalence of peri-implantitis differs in the studies reporting this outcome from 1.1% to 85% (considering both partial and fully edentulous patients). Patients participating in the routine preventative care programmes report a lower prevalence of the disease (median 9%) when compared to patients who are not taking part in such programs (median 18.8%). The median prevalence of peri-implantitis among non-smokers and patients with a history of periodontitis was reported at 11% and 14.3%, respectively. High prevalence was found in patients with implant function time ≥5 and ≥10 years (26% and 21.2%, respectively). The incidence of peri-implantitis was reported at 0.4% at 3 years to 43.9% at 5 years from implant insertion.[21] The risk of peri-implantitis might be higher with the higher number of implants supporting a prosthesis.

3.8 FAQ6: What are the financial costs and/or resource implications to the patient?

This section reports on the financial costs and/or resources use for patients using CCDs or IODs. This outcome was not extensively covered in the literature, with only one systematic review reporting costs mainly from one cost effectiveness analysis[22] in Canadian dollars. No evidence related to German patients was identified.

Very low quality of evidence was reported for costs and/or resource use of mandibular CCDs vs IODs with no information for maxillary prosthesis. IODs are likely to be a more expensive treatment option with more time needed for treatment and preparation of prosthesis.

CCDs vs IODs: costs and/or resource use

Review by Kutkut 2018[3] reported results of cost-effectiveness analysis of mandibular CCDs versus 2-IODs in elderly (≥65 years old) patients who were edentulous for at least five years. The analysis was based on one RCT[22] (n=48 patients that attended one-year follow-up appointment) and costs of treatment and maintenance calculated in Canadian dollars ($) for each patient. The effectiveness of treatment was measured with OHIP-20 questionnaire.

The mean cost (including direct and indirect costs) for mandibular CCD and 2-IOD treatment during the first year following prosthesis delivery was $2,057 and $3,650, respectively. After the first year, the estimated additional cost of 2-IODs was reported at $226 per year (assumed life expectancy of 17.9 years and 3% discount rate).

Evidence from Kutkut 2018[3] shows that prosthodontic maintenance might not differ substantially between CCDs and 2-IODs with potential increases in time and/or costs in 2-IODs due to the use of implants (n=2 studies). The total chairside time needed to treat patients with IODs was approximately 45 minutes longer than patients with CCDs (n=1 study). On average, an additional 20 minutes were required for the technician to prepare IODs in comparison to CCDs (n=1 study).

IODs only: costs and/or resource use

No evidence was found for costs and/or resource use following treatment with mandibular or maxillary IODs only.

4. DISCUSSION

4.1 SUMMARY OF FINDINGS

The report summarises evidence from 12 systematic reviews, two reviews, three online resources and two primary studies on the use of CCDs and IODs in fully edentulous patients. Five systematic reviews provided information for the comparison of CCDs and IODs, six focused on IODs only (mixed number of implants) and one on CCDs only.

Since the publication of the McGill consensus statement on 2-IODs[23], and further work by other experts in the field[24, 25], an IOD use is the established way of treating edentulous patients which impacted the evidence base for the comparison between CCDs and IODs published within the date range specified in this report.

There is an ongoing debate regarding the most advantageous number of implants to be placed in the edentulous jaw. Based on the expert opinion, and available resources, there is some evidence supporting the use of 1-IODs. Even though using 2 and more implants can provide additional benefits i.e., increase in prosthesis stability, some patients might opt for fewer implants due to e.g., economic reasons.[26]

The certainty of evidence included in this report was low due to significant methodological weaknesses of the systematic reviews, specifically limited search strategies and inclusion of articles published in English only.

FAQ1 includes a description of the condition and treatments of interest. The results for other FAQs can be summarised as follows:

FAQ2: What is the denture/implant survival/failure?

- No evidence was found to estimate the size of any difference between mandibular or maxillary CCDs and IODs in terms of prosthesis survival.
- Patients wearing mandibular, maxillary or pair of CCDs reported high mean longevity of their prosthesis and increase in failure rates as expected with longer follow-up time.
- Maxillary IODs have high survival rates with evidence lacking for mandibular IODs.
- Estimated three and five-year survival rates of implants used in IODs are very high. The number of implants used in IODs and loading time have a substantial impact on loss rate with differences reported for maxilla and mandible.
- Based on the long-term study results, implants have high overall cumulative survival rates (CSRs) with better outcomes of implants placed in mandible when compared to maxilla. Long-term implant success is high in both fixed and removable IODs.

FAQ3: What is the functional benefit for a patient?

- Treatment of adult edentulous patients with mandibular IODs, when compared to CCDs, show some increase in patients' masticatory performance based on low quality evidence. The impact of maxillary CCDs or IODs on patients' masticatory performance is unclear.

- Very limited evidence was found for the impact of the number of implants and loading time on masticatory performance or implant stability in IODs.
- Lack of standardised tests to assess function substantially restricted the comparability of results.

FAQ4: What is the impact on QoL and/or satisfaction?

- The evidence shows a substantial increase in QoL and patients' satisfaction following treatment with mandibular IODs in adult edentulous patients (low quality of evidence). The impact of maxillary CCDs or IODs on patients' QoL or satisfaction was unclear.
- Very limited evidence was found for the impact of the number of implants and loading time of IODs on QoL or patients' satisfaction.

FAQ5: What are the short and long-term complications?

- The evidence was insufficient to infer the size of any difference between mandibular CCDs and 2-IODs in terms of bone loss and pain (no other complications were reported; low quality of evidence). No evidence was identified to conclude on the risk of complications for different numbers of implants used in IODs vs CCDs or for comparison of maxillary CCDs vs IODs.
- The number of implants used in IODs was likely to impact bone loss in the mandible (low quality of evidence). Limited evidence was found for other complications following treatment with IODs only.
- Based on the clinical opinion, peri-implantitis is frequently seen in patients with implant-supported prostheses.

FAQ6: What are the financial costs and/or resource implications to the patient?

- Very low quality of evidence was reported for costs and/or resource use of mandibular CCDs vs IODs. IODs were likely to be the more expensive treatment option with more time needed for treatment and preparation of prosthesis.
- No evidence was reported for maxillary CCDs vs IODs.

The literature search identified one German guideline[2] that provided information and recommendations for the treatment options of patients with edentulous maxilla. However, as the guideline had not been updated for >5 years (valid until 29 November 2019) and was currently being revised, the recommendations were not included in the main body of the report. The planned completion date for the new guideline is 31 December 2021.

4.2 Strengths, limitations and uncertainties

The report was developed using evidence from systematic reviews and supplemented by online resources. Its strengths include comprehensive literature searches without language restriction, inclusion of the highest certainty evidence screened by two reviewers as well as coverage of a wide range of FAQs. However, some limitations or/and uncertainties should be taken into consideration.

The use of implants in edentulous patients has been a widely accepted treatment option which could have negatively affected the inclusion of CCDs as a treatment comparator in high-quality studies. Due to the time constraints, only the evidence from the last five years was included in this report which is reflected by the availability of a small number of studies that reported on the comparison of interest. Inclusion of limited and only most up-to-date evidence could create a distorted picture of the actual evidence base available for this topic i.e. capture the shift of published literature towards IOD treatment as opposed to CCD.

High heterogeneity of inclusion and exclusion criteria were present between systematic reviews. One review[4] included only elderly patients (≥65 years). Furthermore, definitions for many outcomes, such as "implant survival", were not clearly described in all systematic reviews and might not be comparable between studies.

Most of the articles included in this report reported outcomes for mandible only due to scarcity of primary articles focused on the treatment outcomes of patients with edentulous maxilla. Conclusions from mandibular prosthesis might not be applicable to maxillary dentures.

Primary studies included in systematic reviews often included highly heterogenous populations (such as patients with mixed removable and fixed prosthesis, mixed number of implants etc) which in many instances restricted the analysis of the results. Moreover, the variability of methods and materials used for denture preparation as well as implant number used in removable and fixed prosthesis further limited the comparisons. The heterogeneity of instruments used to assess outcomes, such as QoL or satisfaction, and lack of consistency in reporting the units of measurements for other outcomes restricted the comparability of the results between studies. A high variability of follow-up length was present in the studies.

Due to differences in the research questions of the systematic reviews, some primary studies might be included in more than one review. Whenever possible, any overlap between studies was checked and studies excluded on this basis.

5. REFERENCES

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APPENDIX 1: SEARCH STRATEGIES

Database	Dates	Results
CDSR	Up to Iss 12, Dec 2020	19
HTA	Up to 31 Mar 2018	0
KSR Evidence	Up to 10 Dec 2020	246
Epistemonikos	Up to 10 Dec 2020	165
INAHTA	Up to 10 Dec 2020	0
GIN	Up to 9 Dec 2020	17
NHS Evidence	Up to 10 Dec 2020	193
NICE	Up to 10 Dec 2020	0
ECRI	Up to 10 Dec 2020	2
TRIP	Up to 9 Dec 2020	12
CADTH	Up to 11 Dec 2020	6
International Team for Implantology	Up to 11 Dec 2020	5
Embase	Up to 10 Dec 2020	76
MEDLINE	Up to 10 Dec 2020	105
Total		**846**
Total after deduplication		**554**

CDSR (Wiley): up to Issue 12, December 2020
Searched 10.12.20

#1 MeSH descriptor: [Jaw, Edentulous] explode all trees 594
#2 MeSH descriptor: [Mouth, Edentulous] explode all trees 757
#3 MeSH descriptor: [Anodontia] explode all trees 23
#4 ("toothless jaw*" or toothlessness or edentulism or edentulous or anodontia*):ti,ab,kw 1796
#5 ((absen* or loss* or missing) near/2 teeth):ti,ab,kw 898
#6 #1 or #2 or #3 or #4 or #5 2536
#7 MeSH descriptor: [Dental Prosthesis] explode all trees 4319
#8 MeSH descriptor: [Dental Implantation] explode all trees 1245
#9 MeSH descriptor: [Prosthodontics] explode all trees4578
#10(denture* or implant* or prosthodontic* or prosthetic* or prostheses or prosthesis or overdenture* or bridge* or abutment* or pontic*):ti,ab,kw 47121
#11 ((dental or oral or teeth) near/2 (restor*)):ti,ab,kw 3258
#12 #7 or #8 or #9 or #10 or #11 49664
#13 #6 and #12 with Cochrane Library publication date Between Jan 2010 and Dec 2020 1705

CDSR = 19
Cochrane Protocols = 2
CENTRAL = 1684

HTA database (www.crd.york.ac.uk/CRDWeb/): up to 31 March 2018
Searched 10.12.20

1	MeSH DESCRIPTOR Jaw, Edentulous EXPLODE ALL TREES	42
2	MeSH DESCRIPTOR Mouth, Edentulous EXPLODE ALL TREES	47
3	MeSH DESCRIPTOR Anodontia EXPLODE ALL TREES	5
4	("toothless jaw*" or toothlessness or edentulism or edentulous or anodontia*):TI OR (((absen* or loss* or missing) and teeth)):TI	41
5	#1 OR #2 OR #3 OR #4	71
6	MeSH DESCRIPTOR Dental Prosthesis EXPLODE ALL TREES	334
7	MeSH DESCRIPTOR Dental Implantation EXPLODE ALL TREES	125
8	MeSH DESCRIPTOR Prosthodontics EXPLODE ALL TREES	343
9	(denture* or implant* or prosthodontic* or prosthetic* or prostheses or prosthesis or overdenture* or bridge* or abutment* or pontic*):TI OR (((dental or oral or teeth) and (restor*))):TI	1193
10	#6 OR #7 OR #8 OR #9	1274
11	#5 AND #10	67
12	(#11) IN HTA FROM 2015 TO 2020	0

KSR Evidence (www.ksrevidence.com): up to 10 December 2020
Searched 10.12.20

1 ("toothless jaw*" or toothlessness or edentulism or edentulous or anodontia*) in All text 183 results

2 ((absen* or loss* or missing) and teeth) in All text 303 results

3 #1 or #2 in All text 467 results

4 (denture* or implant* or prosthodontic* or prosthetic* or prostheses or prosthesis or overdenture* or bridge* or abutment* or pontic*) in All text 5337 results

5 ((dental or oral or teeth) and (restor*)) in All text 528 results

6 #4 or #5 in All text 5621 results

7 #3 and #6 in All text Date published: 2015 - 2020 246 results

Sorted by risk of bias

Search run Thu Dec 10 2020

Epistemonikos (www.epistemonikos.org): up to 10.12.20
Searched 10.12.20

(title:((title:(("toothless jaw*" OR toothlessness OR edentulism OR edentulous OR anodontia*)) OR abstract:(("toothless jaw*" OR toothlessness OR edentulism OR edentulous OR anodontia*))) AND (title:(denture* OR implant* OR prosthodontic* OR prosthetic* OR prostheses OR prosthesis OR overdenture* OR bridge* OR abutment* OR pontic*) OR abstract:(denture* OR implant* OR prosthodontic* OR prosthetic* OR prostheses OR prosthesis OR overdenture* OR bridge* OR

abutment* OR pontic*))) OR abstract:((title:(("toothless jaw*" OR toothlessness OR edentulism OR edentulous OR anodontia*)) OR abstract:(("toothless jaw*" OR toothlessness OR edentulism OR edentulous OR anodontia*))) AND (title:(denture* OR implant* OR prosthodontic* OR prosthetic* OR prostheses OR prosthesis OR overdenture* OR bridge* OR abutment* OR pontic*) OR abstract:(denture* OR implant* OR prosthodontic* OR prosthetic* OR prostheses OR prosthesis OR overdenture* OR bridge* OR abutment* OR pontic*))))

165 filtered 2015-2020, systematic reviews

International HTA Database (www.database.inahta.org): up to 10.12.20
Searched 10.12.20

Line	Query	Hits
14	(#6 AND #13) FROM 2015 TO 2020	0
13	#11 OR #12 OR #10 OR #9 OR #8 OR #7	781
12	(((dental or oral or teeth) AND (restor*)))[Title] OR (((dental or oral or teeth) AND (restor*)))[abs]	11
11	(((dental or oral or teeth) AND (restor*)))[Title] OR (((dental or oral or teeth) AND (restor*)))[abs]	11
10	((denture* or implant* or prosthodontic* or prosthetic* or prostheses or prosthesis or overdenture* or bridge* or abutment* or pontic*))[Title] OR ((denture* or implant* or prosthodontic* or prosthetic* or prostheses or prosthesis or overdenture* or bridge* or abutment* or pontic*))[abs]	763

9	"Prosthodontics"[mhe]	29
8	"Dental Implantation"[mhe]	4
7	"Dental Prosthesis"[mhe]	27
6	#5 OR #4 OR #3 OR #2 OR #1	14
5	(((absen* or loss* or missing) AND teeth))[Title] OR (((absen* or loss* or missing) AND teeth))[abs]	10
4	(("toothless jaw*" or toothlessness or edentulism or edentulous or anodontia*))[Title] OR (("toothless jaw*" or toothlessness or edentulism or edentulous or anodontia*))	5
3	"Anodontia"[mhe]	1
2	"Mouth, Edentulous"[mhe]	0
1	"Jaw, Edentulous"[mhe]	0

Guidelines International Network (www.g-i-n.net): up to 9.12.20
Searched 9.12.20

Search term	Hits
Edentulous	1
Edentulism	1
Toothlessness	0
dental prosthesis	2
Dental prostheses	1
Dental implantation	17

Dental restoration	3
Total	**25**
Total after de-deplication, 2015 publication date limit	**17**

NHS Evidence (www.evidence.nhs.uk): up to 10.12.20
Searched 10.12.20

Search term – limited to guidance / systematic reviews, 2015-2020	**Hits**
Edentulous	93
Edentulism	19
Toothlessness	0
"toothless jaw*"	0
"dental implant*"	104
"dental prosthesis"	0
"dental prostheses"	0
Total	216
Total - duplicates and children/adolescents removed	**193**

National Institute for Health and Care Excellence (www.nice.org.uk): up to 10.12.20
Searched 10.12.20

Search term – restricted to guidance	**Hits**
Edentulism	0
Edentulous	1
"dental implantation"	0
"dental implantations"	0
"dental implant"	0
"dental implants"	1
"dental prosthesis"	0
"dental prostheses"	0
Prosthodontics	0
Total	**2**
Total restricted to 2015 onwards	**0**

ECRI (www.guidelines.ecri.org): up to 10.12.20
Searched 10.12.20

Search terms	**Hits**
"toothless jaw*" OR toothlessness OR edentulism OR edentulous OR anodontia*	1
"dental prosthesis" OR "dental prostheses" OR "dental implant*"	1
Total restricted to 2015 onwards	**2**

Turning Research Into Practice (TRIP) (www.tripdatabase.com): up to 9.12.20
Searched 9.12.20

Search term	**Hits**
"edentulous jaw"	0
Edentulism	20
"dental implant*"	17
"dental prosthesis"	0
"dental prostheses"	7
Duplicates and paediatrics removed, limited to 2015 onwards	**12**

CADTH (https://www.cadth.ca/about-cadth/how-we-do-it/methods-and-guidelines)
Searched: 11.12.20

Search terms, limited to 2015 onwards – scanned for relevancy	Hits
Edentulous	4
Edentulism	0/1
"dental implantation"	0/1
"dental prosthesis"	2/3
Total	**6**

International Team for Implantology (https://www.iti.org/)
Searched: 11.12.20

Search terms – 2015 onwards – scanned for relevancy	Hits
edentulous	2
Edentulism	0/2
Prosthesis	3/4
Total	**5**

Embase (Ovid): 1974 – 10 December 2020
Searched 11.12.20

1 exp edentulousness/ (8664)
2 anodontia/ (391)
3 anodontia/ (391)
4 ("toothless jaw*" or toothlessness or edentulism or edentulous or anodontia*).ti,ab. (12215)
5 ((absen* or loss* or missing) adj2 teeth).ti,ab. (5791)
6 or/1-5 (21296)
7 exp "dental prosthesis and implant"/ (84435)
8 exp dental restoration/ (62741)
9 (denture* or implant* or prosthodontic* or prosthetic* or prostheses or prosthesis or overdenture* or bridge* or abutment* or pontic*).ti,ab. (781696)
10 ((dental or oral or teeth) adj2 restor*).ti,ab. (7842)
11 or/7-10 (840123)
12 6 and 11 (14528)
13 *decision making/ or *patient decision making/ or *shared decision making/ (66971)
14 exp *decision support system/ (12590)
15 ((share$ or sharing$ or inform$) adj3 (decision$ or deciding$ or choice$)).ti,ab. (53447)
16 (decision$ adj2 aid$).ti,ab. (9022)
17 ((decision$ or choice$) adj3 (making$ or support$ or behaviour$ or behavior$)).ti,ab. (239229)
18 ((patient$ or consumer$) adj2 (involve$ or involving or participat$)).ti,ab. (99853)
19 ((patient-centred or patient centred or patient-centered or patient centered) adj2 care).ti,ab. (9253)
20 (person centred or person centered).ti,ab. (6852)
21 sdm.ti,ab. (3582)
22 or/13-21 (415095)
23 12 and 22 (242)
24 limit 23 to yr="2015 -Current" (76)

MEDLINE and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily (Ovid): 1946 - 10 December 2020

Searched 11.12.20

1 exp Jaw, Edentulous/ (8261)
2 exp Mouth, Edentulous/ (12158)
3 Anodontia/ (3690)
4 ("toothless jaw*" or toothlessness or edentulism or edentulous or anodontia*).ti,ab. (12797)
5 ((absen* or loss* or missing) adj2 teeth).ti,ab. (5512)
6 or/1-5 (25578)
7 exp Dental Prosthesis/ (108259)
8 exp Dental Implantation/ (22208)
9 exp Prosthodontics/ (118430)
10 exp Prosthodontics/ (118430)
11 (denture* or implant* or prosthodontic* or prosthetic* or prostheses or prosthesis or overdenture* or bridge* or abutment* or pontic*).ti,ab. (614354)
12 ((dental or oral or teeth) adj2 restor*).ti,ab. (7862)
13 or/7-12 (670063)
14 6 and 13 (16422)
15 exp Decision Making/ (205859)
16 exp decision support techniques/ (78165)
17 exp Decision Theory/ (12238)
18 ((share$ or sharing$ or inform$) adj3 (decision$ or deciding$ or choice$)).ti,ab. (38848)
19 (decision$ adj2 aid$).ti,ab. (6126)
20 ((decision$ or choice$) adj3 (making$ or support$ or behaviour$ or behavior$)).ti,ab. (175742)
21 ((patient$ or consumer$) adj2 (involve$ or involving or participat$)).ti,ab. (63597)
22 ((patient-centred or patient centred or patient-centered or patient centered) adj2 care).ti,ab. (6714)
23 (person centred or person centered).ti,ab. (5612)
24 sdm.ti,ab. (2768)
25 exp Informed Consent/ (41404)
26 (informed adj3 (consent* or agree* or assent*)).ti,ab. (39381)
27 or/15-26 (561912)
28 14 and 27 (368)
29 limit 28 to yr="2015 -Current" (105)

APPENDIX 2: KEY FOR DECISION AID

Type of Arrow	Assessment for use in DA
⇧	**"Proof or strong indication of effect"** **Difference in favour of group A versus B based on high to moderate quality data*** **The effect estimate ideally should be significant, but may sometimes be only borderline significant but from several studies indicating a trend (that according to KSR should be mentioned)**
⇗	**"Indication or hint of effect"** **Difference in favour of group A versus B based on low quality data that appears reportable in the DA (e.g., large effect on survival based on registry data, consistently very convincing effects from observational studies supported by one small RCT with same direction of effect)**
⇔	**"No Proof/Indication of effect or a hint of effect that is too weak to report"** **No difference shown among groups based on moderate to high quality data** **or difference shown but does not seem reliable enough to be reported based on low or very low quality data**
.	**No data to report: no difference shown from low/very low quality studies or no studies**
⇩	**Proof of harm, i.e., risks outweigh benefits**

*The term "Data Quality" includes assessment of evidence (level of evidence, risk of bias assessment) as well as transferability of study results to our target population. This should be either taken from original reviews/meta-analyses or provided by KSR for studies where no external evidence assessment exists.