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REVIEW ARTICLE

Clinical outcome of removable prostheses supported by mini dental implants. A systematic review

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ABSTRACT

Introduction: For many years, edentulous patients have had no other option than conventional dentures to reestablish their oral function. To avoid the need for bone graft surgery, some professionals have suggested the use of mini dental implants (MDIs) to support prostheses. The MDIs are narrow implants, ranging approximately from 1.8 to 2.9 mm in diameter. Recently, the promising results of mini implants regarding osseointegration and patient satisfaction have led clinicians to accept them as a definitive treatment option. **Objective:** Therefore, the proposition of this systematic review was to assess information on the outcomes of MDIs supporting removable prostheses. Methods:The PubMed and Cochrane databases were searched for articles published before September 2017, which yielded a total of 774 studies for analysis. After exclusion and inclusion criteria, 22 prospective studies were included in this systematic review. **Results:** Most mini implants were placed in a flapless single-stage surgery and loaded immediately. Most studies reported failures in the first year and prosthetic complications. The mean survival rate of the selected studies was 95.6%, and mean follow-up was 22.8 months. **Conclusion:** The MDI-supported removable prostheses successfully improved patients' chewing and speaking ability, quality of life, and satisfaction, suggesting that MDIs are a viable and safe option to support removable prostheses in the mandibular arch.

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Introduction

In the last decades, there has been a revolution concerning the rehabilitation treatments intended for edentulous individuals. The advancements in osseointegration and dental implants conceived a new set of possibilities other than the conventional treatment with complete dentures, even for patients presenting parafunctional activities [1]. The implant-supported dentures enhance retention and stability, which have been demonstrated to improve patients' quality of life (QoL), maximum bite force (mBF) and chewing efficiency, as well as to regulate electromyographic (EMG) activity in the masseter and temporalis [2,3].

For years, edentulous patients have had no other option than conventional dentures to reestablish their oral function [4]. Many individuals report that the mandibular dentures do not fit properly, are frequently unstable, and lack retention [5]. After much discussion, a conference group established that the ideal rehabilitation model for an edentulous individual should be a complete maxillary denture and a two implant-supported mandibular overdenture as an antagonist [6].

One limitation to the implant placement procedure is the lack of bone tissue to sustain and support the dental implants. According to Atwood classification, alveolar ridge resorption and atrophy occur in two dimensions: vertical and horizontal. The alternative in these cases is to perform bone graft surgery to increase the bone volume and height. Mini dental implants (MDIs) are indicated in horizontally atrophied (knife-edge) ridges with sufficient bone height and insufficient bone width. Elderly patients are not always willing to undergo so many surgical procedures and might decline the implant-supported rehabilitation [7–14].

The MDIs are narrow implants, ranging approximately from 1.8 to 2.9 mm in diameter [15]. They present a single-body system with a ball-type attachment incorporated and normally are installed in a one-stage surgery. They were originally designed to be temporary, but their osseointegration results, due to a rough surface, have demonstrated to be similar to conventional implants and were then considered as a permanent alternative [16–18]. There are some drawbacks, as their mechanical properties favour deformation of the ball attachment, the lack of an anti-rotational notch and implant fracture [8]. The incidence of implant fractures is higher for MDIs than for conventional implants and have been reported to be sensitive to high insertion torque [8].

The first studies that evaluated the MDIs with prosthetic purpose assessed their viability to retain single provisional prostheses in anterior regions, as attachment systems in partial removable dentures and as support to retain mandibular overdentures [3,12–15,19,20]. So far, the results are promising, but there is not a consensus yet as to whether these

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MDIs should be accepted as a definitive treatment option. Therefore, the proposition of this systematic review was to investigate the literature to assess information on the outcomes of MDIs supporting removable prostheses, either partial or complete. Some literature reviews have evaluated the MDIs [21] and small diameter implants [22–24], but none include the results regarding partial removable dentures.

Materials and methods

Registry protocol

This review was done according to the PRISMA 2012 checklist. Initially, the study was written at the international prospective register of systematic reviews, 'PROSPERO'.

Eligibility criteria

Studies eligible for inclusion had to present one of the following characteristics: (1) prospective clinical trials, (2) randomized clinical-control trials or (3) prospective randomized studies.

The exclusion criteria were: (1) retrospective studies, (2) case reports, (3) literature reviews, (4) *in vitro* studies, (5) computer simulation and (6) studies in a foreign language other than English.

The PICO process was structured as follows: Can MDIs be applied with a predictable clinical outcome in rehabilitation with removable prostheses? In this case, (P) is for patients using removable partial dentures or overdentures supported by MDIs, (I) is for removable partial dentures or overdentures supported by MDIs, (C) is the comparison to patients using partial removable dentures or overdentures supported by conventional implants, and (O) is the assessment of the survival rate of dental implants and prosthetic complications, patients' QoL, and overall satisfaction.

Information sources

The PubMed and Cochrane databases were searched for articles published before September 2017. Plus, a manual search was performed from July 2017 to October 2017 in the following journals: *The International Journal of Prosthodontics*, *Clinical Oral Implants Research*, *Journal of Dentistry*, *The International Journal of Oral & Maxillofacial Implants*, *The Journal of Prosthetic Dentistry* and *International Journal of Oral and Maxillofacial Surgery*.

Research strategy

Two independent individuals (M.V.S. and J.M.L.G.) performed the electronic search in the selected databases. The uniterms used were '*Mini dental implants AND prostheses*', '*narrow diameter dental implants AND prostheses*', '*Mini dental implants AND dentures*', '*orthodontic AND removable prostheses AND implants*' and '*mini dental implants AND removable prostheses*', separately.

Study selection

The investigation in the databases was performed by two independent researchers (M.V.S. and J.G.), and the studies were selected according to the inclusion and exclusion criteria through the analysis of titles and abstracts. The disagreements were settled through discussion and consensus, and when necessary, a third author's opinion was consulted. Then, the investigators performed a full text read of the selected studies and manually researched the reference list.

The kappa (κ) statistic was calculated to define inter-rater agreement for the process of inclusion of the publications and for the quality assessment scores of the included studies. The level of inter-reader agreement is almost perfect if the value of κ is .81–1.00, substantial if κ is .61–0.80, moderate if κ is .41–.60, fair if κ is .21–.40 and poor if κ is $<$.20.

Data synthesis and risk of bias

One of the authors (M.V.S) collected relevant information about the articles, such as author, year and type of study; implant-related information, such as loading protocol, number of patients and implants, length and diameter of implants, implant system and design, surgical technique, attachment system, follow-up, implant location, study groups and survival rate; and patient/prosthetic information such as QoL, satisfaction, prosthetic complications and study outcome. When data extraction was complete, a second author (E.V.F.S) checked all the information collected. All disagreements between the investigators were settled by a third author (M.C.G) through discussion until a consensus was reached.

Two investigators (M.V.S and J.M.G) assessed the methodological data and quality of the studies according to the Cochrane risk of bias tool. In case of heterogeneity in data among the included studies, 95% confidence intervals (CIs) for pooled data were calculated using the random effects model and presented using forest plots.

Results

The aim of this systematic review was to assess the literature data on MDIs supporting removable dentures. The data found suggests the treatment is a viable option for patients seeking retention improvement to their removable prostheses. Although the mini implants have been used for prosthetic purposes since the early 2000s, there are not many studies that have evaluated their long-term use; the longest follow-up period was 5–6 years.

Most studies compared the MDIs to conventional implants [13,15,25] some compared the number of MDIs supporting the prostheses, and a few compared the MDI overdentures to conventional dentures, in which the patient satisfaction results were more accentuated [26]. There were no differences in satisfaction when comparing the MDIs to conventional implants, and one study that assessed postsurgical pain also stated that there was no difference between implant types when the same number was installed; the pain was only

related to implant number. The patients perceived more pain when more implants were installed [27].

Study selection and characteristics

A total of 774 studies were evaluated through titles and abstracts. We selected a total of 31 studies (inter-reader agreement, $\kappa = .85$ for PubMed/Medline and $\kappa = 1$ for Cochrane Library) for full-text analysis. After the application of inclusion and exclusion criteria, 22 studies were included in the review (Figure 1).

Within the 22 studies selected, there were 14 prospective clinical trials [9,10,16,18,19,25,26,28–37], six randomized controlled trials [16,27,36,38–40] and one parallel group controlled trial [11]. The main findings, aims and conclusions of these studies were synthetized in Table 1. The excluded studies [3,7,12–14,17,41–47], within reason, are shown in Table 2.

Assessment of study quality and registry protocol

The methodological quality assessments for each paper are summarized in Figure 2. From the 22 selected studies, 13 studies had the risk of biased results and were scored as low. The remaining studies were scored as medium and high-quality studies; the blinding of participants and personnel was difficult because the MDIs are easily distinguished from conventional ones. Furthermore, a description of the quality of the studies included according to the Cochrane risk of bias tool is provided in Figure 2. This study is registered in the PROSPERO database under the ID number CRD42017062705.

Qualitative analysis

Nine hundred and sixty-seven (967) patients were evaluated, with ages ranging from 45 to 70, and 2362 mini implants were installed. Some studies had a controlled group with conventional implants, where 271 regular implants were placed. The follow-up period ranged from 7 days to 6 years, with a mean follow-up of 22.8 months. The main results, study groups, implant characteristics, complications and parameters evaluated are described in Table 1.

Implant size, system and surgical protocol

The MDIs used throughout the studies ranged from 1.8 to 2.9 mm in diameter and from 9 to 18 mm in length; the most common configuration was MDIs with 1.8×15 mm. Most studies used MDI 3M ESPE implants and reported choosing

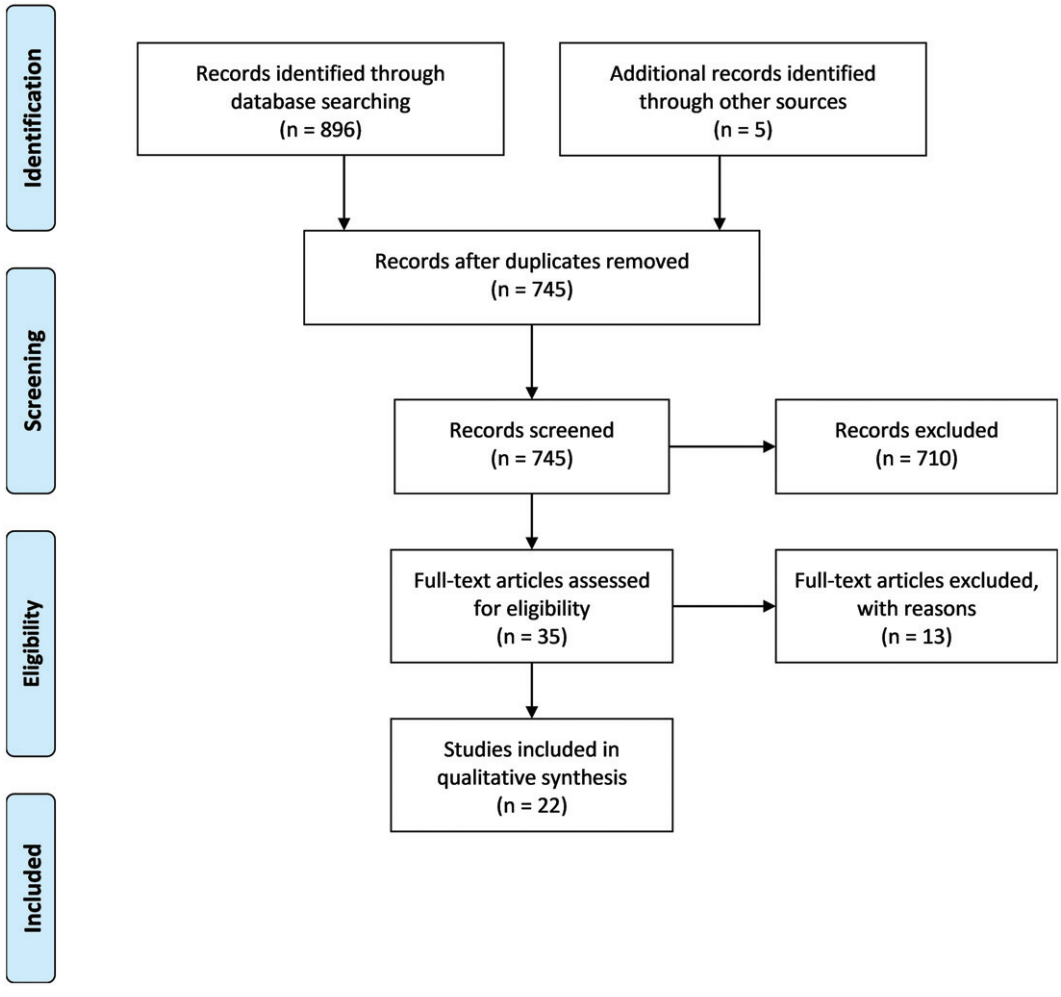

Figure 1. Flow chart and study selection process.

Table 1. Qualitative and quantitative data of the studies selected.

(a)Studies information, participants and implant design.

Author	Year	Study design	Prostheses type	Patient (*n*)	Mean age	*N* implants	Implant
Temizel et al.	2017	Prospective	Overdenture	32	NR	99 MI	MI: 1.8–2.4 × 13–15 mm CI: 3.3–3.7 × 11–13 mm
Jawad et al.	2017	Parallel group controlled trial	Overdenture	46	NR	44 MI/48CI	MI: 2.1 × 10 mm CI: 3 × 11 mm
Aunmeungtong et al.	2017	Prospective	Overdenture	60	69.8	120 MI/40 CI	MI: 3 × 12 mm CI: 3.75 × 10 mm
Zygogiannis et al.	2016	Prospective	Overdenture	10	NR	40 MI	MI: 1.8–2.1 × 10–15 mm
Hasan et al.	2016	Prospective	Overdenture	26	68	70 MI/33 CI	MI: 1.8–2.4 × 13–15 mm CI: 3.3–3.7 × 11–13 mm
Mundt et al.	2016	Prospective	PRDP	80	NR	NR	MI: 1.8–2.4 × 10–18 mm
Elsyad	2016	Prospective	Overdenture	28	62.9	112 MI	MI: 1.8 × 120–18 mm
de Souza et al.	2015	Randomized clinical trial	Overdenture	120	59.5	212 MI/70 CI	MI: 2 × 10 mm CI: 4 × 10 mm
Ribeiro et al.	2015	Randomized clinical trial	Overdenture	120	NR	236 MI/80 CI	MI: 2 × 10 mm CI: 4 × 10 mm
Mangano et al.	2015	Prospective	Overdenture	65	71.1	231 MI	MI: 2.7–3.2 × 10–13 mm
Šćepanović et al.	2015	Prospective	Overdenture	30	46–63	120 MI	MI: 1.8 × 13 mm
Maryod et al.	2014	Randomized clinical trial	Overdenture	36	NR	144	MI: 1.8 × 15 mm
Preoteasa et al.	2014	Prospective	Overdenture	23	62	110 MI	NR
Ashmawy et al.	2014	Prospective	Overdenture	12	NR	48	MI: 1.8 × 15 mm
Tomasi et al.	2013	Prospective	Overdenture	21	71	NR	NR
ELsyad et al.	2013	Prospective	Overdenture	19	63.8	114	MI: 2.4 × 15 mm
Scepanovic et al.	2012	Prospective	Overdenture	30	45–63	120 MI	MI: 1.8 × 13 mm
Elsyad et al.	2011	Prospective	Overdenture	28	62.9	112 MI	MI: 1.8 × 12–18 mm
Jofre et al.	2010	Randomized controlled trial	Overdenture	45	71	90 MI	MI: 1.8 × 15 mm
Jofré et al.	2010	Randomized controlled trial	Overdenture	45	NR	90 MI	MI: 1.8 × 15 mm
Morneburg et al.	2008	Prospective	Overdenture	67	NR	134MI	MI: 2.5 × 9–15 mm
Griffitts et al.	2005	Prospective	Overdenture	24	67	116 MI	MI: 1.8 × 10–18 mm

(b)Implant system, surgical technique, follow up and implant site.

System	Surgical technique	Follow-up	Attachment type	Arch	Groups
NR	Full thickness flap	2 years	Ball	Mandible	G1: 4–5 MI G2: 2–4 CI
MDI, 3M ESPE	Flapless	6 months	Ball	Mandible	G1: 2 MI G2: 2 CI
PW plus	Flapless (MI) Full thickness flap (CI)	1 year	Equator abutment	Mandible	G1: 4 MI G2: 2 MI G3: 2 CI
NR	Full thickness flap	1.5 years	Ball	Mandible	G1: 4 MI overdentures
MDI, 3M ESPE	Full thickness flap	NR	Ball	Mandible	G1: 2–4 CI G2: 4–5 MI
NR	NR	3 years	Ball	Both	G1: MDI RPDP immediate load, G2: MDI RPDP conventional load
MDI, 3M ESPE	Single-stage flapless	5 years	Ball	Mandible	G1: 4 MI overdentures
Mini-Drive Lock MDL	Two-stage protocol	12 months	Ball	Mandible	G1: 4 MI G2: 2 MI G3: 2 CI
Mi: Mini-Drive Lock/ CI: Morse-Locke Straight	MI: flapless/ CI: Two-stage surgery	7 days	Ball	Mandible	G1: 4 MI G2: 2 MI G3: 2 CI
DMLS Titanium Implants	Full thickness flap	48 months	Ball	Both	G1: 3–4 MI overdentures
MDI, 3M ESPE	Flapless in 23 and in 7 patients a flap was required (MI)	18 months	Ball	Mandible	G1: 4 MI overdentures
MDI, 3M ESPE	Single stage, flapless	36 months	Ball	Mandible	G1: immediate load G2: early load
MDI, 3M ESPE	Flapless	3 years	Ball	Both	G1: MI overdentures
MDI, 3M ESPE	Flapless	NR	Ball	Mandible	G1: 4 MI overdentures
Dentatus Atlas	Flapless, one-stage	12 months	Ball	Both	G1: 2–4 MI overdentures

(*continued*)

Sendax, MDI IMTEC	Flapless, one-stage	24 months	Ball	Maxilla	G1: overdentures with full-palatal coverage G2: overdendures without palatal covegare
MDI, 3M ESPE	Flapless, one-stage	18 months	Ball	Both	G1: 4 MI overdentures
NR	Flapless, one-stage	36 months	Ball	Both	G1: 4 MI overdentures
Sendax, MDI IMTEC	Flapless, one-stage	24 months	Ball/bar	Mandible	G1: 2 MI ball overdentures G2: 2 MI bar overdentures
Sendax, MDI IMTEC	Flapless, one-stage	15 months	Ball/bar	Mandible	G1: 2 MI ball overdentures G2: 2 MI bar overdentures
Microplant, Komet Brassler	Two-stage	6 years	Ball/magnet	Mandible	G1: 2 MI magnet overdentures G2: 2 MI ball overdentures
Sendax, MDI IMTEC	Flapless, one-stage	5 months	Ball/magnet	Mandible	G1: 4 MI overdentures

(c)Complications, evaluation parameters and outcomes.

Complications	Parameters evaluated	Survival rate	Outcome
Loss of 1 CI, O'ring replacement 2 CI/4 MI and realignment for MI	Implant stability, modified plaque, bleeding on probing and probing depth	100% MI/90% CI	CI presented better primary stability results, whereas MI probing depth results were better after 12 months follow-up. The authors concluded the MI to be a viable alternative for patients who present a narrow residual ridge.
1 MI failure, O'ring replacement, prostheses related and implant related	QoL, pain and anxiety and chewing evaluation	99.1% MI/100% CI	QoL reports were similar for both groups, MI were perceived as less painful.
Relining of overdenture (1 MI) and fracture (3 MI/7 CI)	Satisfaction, MBL, CIP	100%	Overdentures supported with MDI presented better patient satisfaction rates and CI presented more prosthodontic complications.
–	MBL, patient satisfaction and QoL	100%	The MBL was within the physiologics limit and patients expressed high level of satisfaction and QoL.
NR	Bite force	NR	The bite force improved for both groups after the implant placement, but there was no difference between the groups.
–	1: crestal bone levels, 2: implant success, 3: BOP, implant mobility (Ostell, Periotest), OHIP-14, patient nutrition, chewing efficiency, dental and prosthetic complications	NR	Partial results
	Patient satisfaction, prosthetic complications	100%	The satisfaction with the MDI overdentures decreased with time.
	QoL, patient satisfaction, plaque index and survival rates	G1: 89%, G2: 82%, G3: 99%	The MDI were rated similarly good by the patients, but their survival rate was lower than the conventional implants.
NR	Post-operative pain and discomfort	100%	

(*continued*)

			The use of four mini implants was considered more painful than two mini implants.
6.1% of biologic complications/13% prosthetic complications	Implant failure, marginal bone loss, biologic and prosthetic complications	96.90%	The immediate loading of unsplinted, DMLS titanium mini-implants with ball attachment-supported mandibular ODs is a successful treatment procedure.
NR	Implant stability and MBL	98.30%	After 1 year, MDIs immediately loaded presented MBL within the acceptable range for CI.
NR	Modified plaque index (MPI), modified bleeding index (MBI), probing depth (PD), MBL and survival	G1: 91,7%, G2: 96.7%	Both loading techniques presented satisfied clinical results, but the early load protocol results were preferable.
Fracture of implants and prostheses, detachment of the corresponding housing matrix and overdenture relining	Patient satisfaction, complications	92.7%	The MDI installed in the mandibula presented better results than in the maxila, fractures were the most common complication and patients who only received mandibular overdentures presented more instability on their conventional dentures.
NR	EMG activity	100%	The MDI overdenture increased the activity of masseter muscle and decreased the chewing cycle.
	Adverse events during the first month, patients satisfaction, PD and plaque score	90%	The implant placement in the mandibula presented better results, MDI-improved treatment patients perceived comfort, satisfaction and oral function.
Implant loss	MBL, survival rate, mobility and patient satisfaction	78.4%	The partial palatal coverage is not recommended when MDIs supporting overdentures.
Implant fracture during the instalation, acrylic resin fracture in the metal housing region	Patient satisfaction, QoL and chewing efficiency	98.3%	The MDI overdentures improved patients QoL, chewing ability and satisfaction.
Implant loss	Plaque and gingival index, probing depth, bone level and success	96.4%	The MDI overdentures presented favourable results within the 3 years.
NR	mBF, MBL	NR	The MBL was more significant in the bar-overdenture group.
NR	mBF, MBL	NR	The retention system did not influence the mBF or the MBL results and the mBF is not related to the MBL.
Implant mobility in three implants and two implants with severe bone loss	Periotest, gingival index, attachment level, MBL, patient satisfaction	95.50%	The survival of the MDIs was similar to conventional implants and the results confirmed denture stabilization and patient satisfaction.
NR	Comfort, retention, chewing and speaking ability	97.4%	MDI was successful treatment, improved patients comfort, retention, chewing and speaking ability.

Table 2. Excluded articles within reasons.

Author	Year	Exclusion reason
Peršić et al.	2016	Retrospective
Mundt et al.	2015	Retrospective
Lambert et al.	2015	PPF
Persić et al.	2014	PPF
Müller et al.	2013	Not MDI
Preoteasa et al.	2012	Not available
Jofré, Conrady, Carrasco	2010	*In vitro*
Veltri, Ferrari, Balleri	2008	Not MDI
Ahn et al.	2004	Case series
Hallman	2001	Not MDI
Preoteasa et al.	2010	Study about the epidemiological data on treatment of edentulous patients with MDIs
Payne et al.	2004	Not MDI
Zinsli et al.	2004	Not MDI

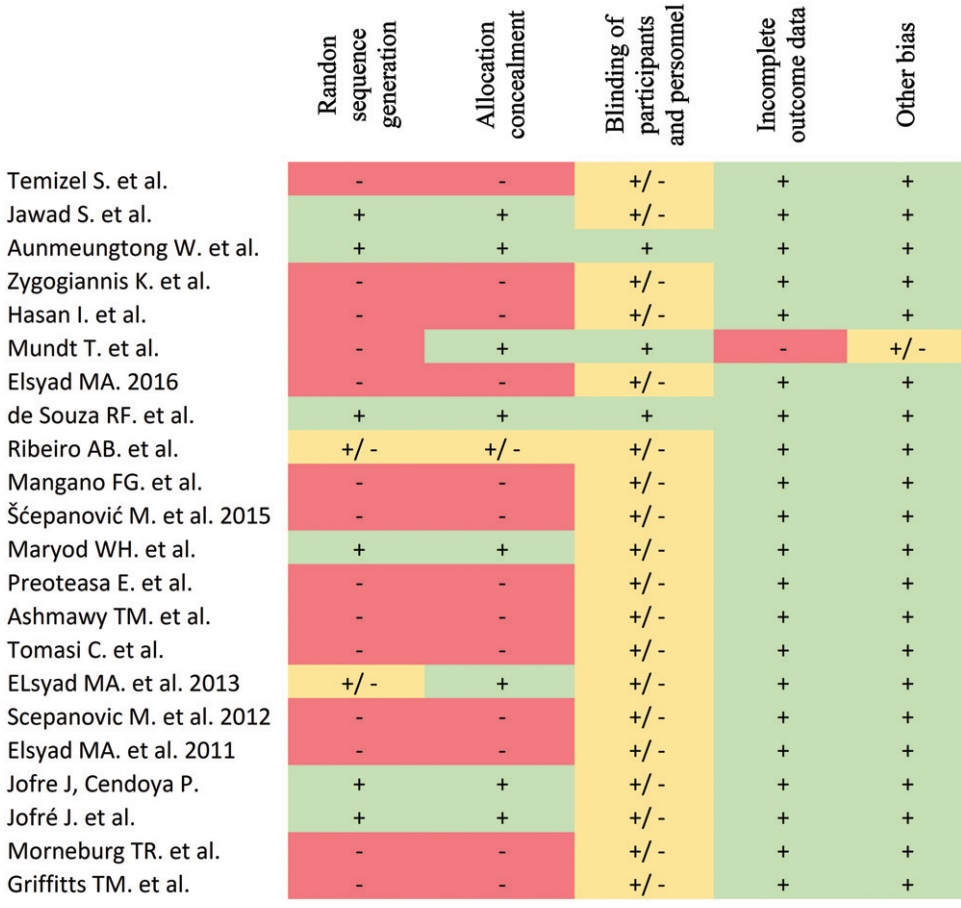

Figure 2. Methodological data and quality assessment of the studies according to the Cochrane risk of bias tool.

he one-stage flapless surgery protocol for the placement of MDIs; only seven studies used the conventional two-stage technique with a full thickness flap.

Implant placement, attachment system and study groups

Fifteen studies placed the MDIs in the mandibula, five placed them on both arches, and just one placed the MDIs exclusively in the maxilla. The attachment type most used was the ball type, while four studies associated the bar and magnet attachment systems, and one used a locator. Most studies compared the number of MDIs, placing two or four mini implants and a control group with two conventional implants.

Parameters evaluated and complications

The most common parameters evaluated were patient satisfaction, QoL, marginal bone loss, probing depth, plaque index, implant success or failure and complications. However, other parameters were also evaluated, such as attachment retention, implant mobility, speaking and chewing ability, mBF, EMG activity and patient nutrition. The complications reported were implant loss, implant mobility, O'ring replacement, acrylic fracture, bone loss and overdenture relining.

Outcomes

The MDI overdentures presented high patient satisfaction, and some studies reported them to be less painful than conventional implants. Patients wearing MDI overdentures exhibited increased mBF as well as masticatory function. The quantitative parameters such as marginal bone loss, plaque index and probing depth were within the limits considered normal for conventional implants.

Discussion

All patient-related data, such as QoL, satisfaction, chewing ability, bite force, EMG activity, comfort and retention had a positive outcome; the removable prostheses improved patients' social status, overall satisfaction, chewing and speaking ability, as well as QoL [9–11]. This indicates that from the patient perspective, the treatment was as successful as conventional implants. The studies that compared both implants did not find differences within the groups [18,29,34,39].

The success rates of conventional implants range from 96 to 100% [9,11,39]. The MDIs evaluated showed similar success rates in most studies, except for three, with reported success rates of 90, 82 and 78.4%, which is very low for an implant treatment [31,33,39]. The authors justified this as due to the poor previous experience of the clinicians with the treatment, lack of relief space for the relining material [31], and excessive load to the implants during the healing phase. The worst results were for MDIs installed in the maxilla, comparing full or partial palatal coverage of the overdentures [33].

As with conventional implants, the installation of MDIs in the maxillary arch hinders the success rate of the treatment. The marginal bone loss was reported higher in the maxilla than in the mandibula, up to 5.3 mm vertically and 1.93 mm horizontally [33]. Three studies had marginal bone loss and survival rates of the MDIs that were inferior to those of conventional implants; two of these had implants installed in the maxilla [31,33] and one exclusively in the mandibula [39]. The mean marginal bone loss for conventional implants is up to 1.9 mm, indicating that these MDIs presented higher marginal bone loss rates.

Only three studies compared the number of MDIs supporting the overdentures, and there was no statistically significant difference among the outcomes evaluated, except for postsurgical pain, for which the four MDIs were considered more painful. Despite Ribeiro et al.'s postsurgical pain results [40], most studies evaluated the overdentures supported by four MDIs. The lack of bone support favours the installation of more supporting implants, and the results in these studies were improved satisfaction, chewing efficiency [34], and EMG activity [32] after implant placement.

The MDI presents a facilitated installation with one perforating drill that results in less intraoperative trauma. There, the preferred surgical technique was the flapless approach; it is considered less painful and favours immediate loading of the dental implants. The full-flap approach is more indicated for conventional implants or in sites with extremely narrow alveolar ridges to avoid accidental perforation of the lingual cortical plate [29]. There was no comparison of the loading and survival rates of MDIs, but a recent systematic review found that the loading did not influence these parameters in conventional implants [48].

Most studies evaluated the placement of MDIs supporting complete removable dentures; only one study evaluated MDIs supporting partial removable dentures. However, the results so far are promising; the studies included in this systematic review affirmed the MDI as a viable option for a definitive treatment supporting removable prostheses and presented results similar to those of conventional implants [9,10,16,18,19,25–40].

The complications reported were equally implant- or prostheses-related, and most occurred in the first year after the implant placement. Some studies reported replacement of lost implants after initial surgery, but most complications were related to the need for relining procedures, O'ring rubber replacement, and some fractures at the housing location of the ball attachment system.

The study limitations were the heterogeneity of the studies included, differences in the evaluation criteria and data, and the fact that most studies were classified as poor due to inadequate reporting of details such as randomization, blinding, sample size calculation and external validity. Blinding was difficult to achieve because both patients and surgeons could easily perceive the implant differences, but further studies with sample size calculation and randomization are necessary.

Further investigation is necessary to evaluate the prosthetic outcome of rehabilitations supported by MDIs with longer follow-up periods and better qualified studies. Another investigation could include data on types of prostheses other than overdentures, such as partial removable prostheses and single fixed prostheses. So far, MDIs are better suited for edentulous patients seeking retention improvements for their mandibular complete prostheses.

Conclusion

MDIs are a viable and safe option to support removable prostheses in the mandibular arch; the survival rates and marginal bone loss in the maxilla are not favourable. MDI-supported removable prostheses successfully improve patients' chewing and speaking ability, QoL and satisfaction.

Disclosure statement

No potential conflict of interest was reported by the authors.

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