Received: 16 March 2022 | Revised: 5 July 2022 | Accepted: 22 August 2022

DOI: 10.1111/joor.13364

ORIGINAL ARTICLE

JOURNAL OF ORAL REHABILITATION WILEY

Maxillary overdenture on three implants retained by low-profile stud attachments – A prospective cohort study

Arild Mo[1] | Carl Hjortsjö[2] | Asbjørn Jokstad[1]

[1]Department of Clinical Dentistry, Faculty of Health Sciences, UiT The Arctic University of Norway, Tromsø, Norway

[2]Department of Prosthetic Dentistry and Oral Function, Institute of Clinical Dentistry, University of Oslo, Oslo, Norway

Correspondence
Asbjørn Jokstad, Department of Clinical Dentistry, Faculty of Health Sciences, UiT The Arctic University of Norway, 9037 Tromsø, Norway.
Email: asbjorn.jokstad@uit.no

Abstract

Background: Clinical data are needed on long-term outcomes of removable implant-supported prostheses in the fully edentulous maxilla as a function of the number of implants, effects of the attachment system and other clinical variables.

Objective: To restore individuals with an edentate maxilla with a metal-reinforced removable prosthesis without palatal coverage retained by low-profile stud attachments on three implants.

Methods: The regional ethics committee approved a prospective cohort study that included all consecutive patients treated in a private speciality clinic. Primary outcomes were patients reported, that is denture satisfaction scale and oral health-related quality of life – OHIP-20. Secondary outcomes were implant- (bone loss, implant complications and peri-implant conditions) and prosthesis-related (prosthesis complications, maintenance needs and mucosa condition).

Results: Thirty-two study participants were recruited between March 2007 and October 2016 and followed for a minimum of five years. According to Kruskal–Wallis tests, the OHIP-20 and Denture Satisfaction Scale questionnaire pre-treatment scores differed significantly. After an average of 6.7 years, peri-implant bone loss of more than 2 mm was observed on 17% of all implants, while no or minor bone loss was seen on 38%. The estimated success of implants was 0.95 at 168 months. The estimated success of the prosthesis, that is no adverse events or need for any repairs, was 0.55 at 156 months.

Conclusion: The positive findings in the current clinical study strengthen the notion that for many individuals with an edentulous maxilla, a removable prosthesis retained by three implants fitted with low-profile stud-attachment is a reliable technical solution.

KEYWORDS
edentulous, oral implant, patient satisfaction, prospective studies, quality of life, self report

1 | INTRODUCTION

Individuals with an edentulous maxilla suffer from loss of stomatognathic functions and aesthetics, at times leading to physical and psychological impairments. A properly designed and fitted conventional prosthesis can partially restore functions and aesthetics, as reflected by regained patient-reported oral health-related quality of life.[1] A premise, however, is that the individual must be capable of stabilising a relatively moveable prosthesis by orofacial muscular activity during stomatognathic functions.[2] The ability may be compromised for different reasons, including a resorbed alveolar ridge, unfavourable maxilla-mandibular dimensional relationship and a frail or dry mucosa.[3] Although many consider that a conventional prosthesis restores their oral functions and aesthetics adequately, others experience that the solution does not align with their expectations.

The alternative solutions rely on the surgical placement of dental implants to support a fixed or removable prosthesis. Already in 1986, expert clinicians emphasised the need to adopt 'overdenture principles…necessitated by either economic considerations or patient compromise'.[4] Similar sentiments are repeated today, with the additional knowledge that a removable solution may be more cost-effective than a fixed solution[5] and show comparable peri-implant marginal bone loss.[6] Other arguments demonstrate high implant and prosthesis survival[7,8] and satisfy many patients' expectations and desires.[9] However, the proportion of clinical studies that describe long-term outcomes of overdentures is modest amongst the currently ~1300 publications on implant-supported maxillary complete prostheses.[10,11]

More robust clinical data are needed on long-term outcomes of removable implant-supported prostheses in the fully edentulous maxilla as a function of a minimum number of implants,[12,13] attachment system[14] and other clinical variables,[15] to estimate the value for money and contingent valuation of alternative prosthesis modalities.[16,17]

The current investigators have previously described the clinical experiences of patients receiving a palate-free metal-reinforced maxillary overdenture retained by three implants fitted with low-profile stud attachments.[18] It was recognised that more long-term prospective data were required to determine this technical solution's potential merits and disadvantages. Hence, the objective of the current cohort study is to present the long-term data over a minimum of five years of clinical observation.

2 | MATERIALS AND METHODS

This clinical study is reported according to the STROBE guidelines (Strengthening the Reporting of Observational Studies in Epidemiology) (https://www.strobe-statement.org).[19]

2.1 | Study design, setting and participants

A prospective cohort study was conducted strictly to all ethical research principles. The Norwegian regional research ethics board approved the research protocol, invitation letter for study participation and case-report forms (ref. 2013/1446/REK Nord). Questionnaire response data were managed according to directives established by the Norwegian patient privacy ombudsperson.

The clinical study was conducted in a single private specialist clinic in Drammen, Norway.

The study cohort consisted of all consecutive patients with an edentate maxilla that received implants before 2017 and subsequently were restored with a metal-reinforced removable prosthesis without palatal coverage retained by low-profile stud attachments. All patients were invited to participate in annual follow-up examinations without any costs. Study participation received no additional fiduciary benefits. A request was also made for permission to contact their referring dentist for updated status information.

The study inclusion criteria were a need for full-arch reconstruction in an edentulous maxilla, general health adequate to tolerate surgery physically, sufficient bone quantity and quality for the placement of three implants with at least 8 mm length without the need for any further bone augmentation, provision of written informed consent to the planned treatment. The participants were requested to sign an informed consent form for participation and permission to use obtained data for research purposes. There was no age limitation or restriction regarding current and past smoking history. Exclusion criteria were previous radiation therapy or prior bone grafting in the maxilla.

2.2 | Pre-treatment examination

All study participants provided information on their general health status, specifically systemic diseases, smoking status and medications that could risk-averse treatment outcomes. Recordings were made of other general and local factors that could affect the prognosis of the implants or prostheses.

Clinical examinations included adverse oral mucosal findings in the maxilla, including cheilitis, flabby ridge, hyperplasia, sore spots (decubitus) or ulcers. The dentition in the mandible was examined for caries and marginal periodontitis using a manual periodontal probe (American Eagle 2-12B probe, Young Innovations, Germany). The clinical examination was combined with a panoramic radiograph to detect pathological conditions and local bone availability. Any oral hygiene limitations, high plaque and bleeding scores and active periodontitis in the mandible or local inflammation or mucosal diseases in the maxilla were managed before active implant prosthetic treatment.

The study participants reported their experiences with the existing maxillary prosthesis by completing the Denture Satisfaction Scale questionnaire,[20] and a short-form version of the Oral Health Impact Profile questionnaire (OHIP-20).[21] The denture satisfaction scale reflects the individuals' opinions on general satisfaction, retention, comfort, stability, speech, appearance and occlusion using a Likert response format scale ranging from 1 to 5 ('totally satisfied' to 'not at all satisfied', respectively). The OHIP-20 questionnaire

consists of twenty questions with the response options 'never' (0), 'hardly ever' (1), 'occasionally' (2), 'fairly often' (3) or 'very often' (4). In addition to a total score, the scores are detailed in seven subscales: that is functional limitation, physical pain/discomfort, psychological discomfort, physical disability, psychological disability, social disability and handicap.

2.3 | Surgical procedures

The surgical procedures involved local anaesthetics and full flap incisions. Antibiotics were used at the discretion of the oral surgeon. Two implants with at least 8 mm length were placed posteriorly in bone bilaterally as far as possible, considered radiographically acceptable quantitatively and qualitatively. Attention was made to not enter the sinus cavity without intentionally distally tilting the implants. So, the most distally placed implants were in the 15 and 25 regions. A third implant with relative parallelism to the two posterior implants was placed anteriorly in the bone, considered to be the best quantitatively and qualitatively. The implants were placed surgically by a certified oral surgeon strictly according to the manufacturer's instructions regarding the osteotomy approach with rotating instruments, torque recommendations and minimum primary stability.

Six different implant types from four manufacturers were used. The implants were made from commercially pure titanium, that is Osseospeed (n = 14×3 implants) (Astra Tech), Bone level SLA (n = 10×3 imp.) and Tissue level SLA (n = 2×3 imp.) (Straumann), and Osstem (n = 1×3 imp.) (Osstem), or from a zirconium-titanium alloy, that is Tissue level Roxolid (n = 1×3 imp.) and Bone level Roxolid (n = 1×3 imp.) (Straumann, Waldenburg, Switzerland). All implants had a microrough surface, and the diameter ranged between ø3.3 and ø4.5 mm, with implant lengths varying between 8 and 13 mm (Table 1).

A two-stage approach was adopted with submerged implants. At the same time, the existing removable prosthesis was relieved and lined with a soft silicone-based reline material (G.C. Reline Soft, G.C. Corp.) when necessary. Post-operative panoramic radiographs were taken on the day of implant surgery, complemented with radiographs taken at the second-stage surgery.

2.4 | Prosthodontic procedures

After approximately 3–4 months of healing, the implants were fitted to low-profile stud attachments (Locator, ZEST Anchors LLC). The attachment cuff height was selected to match the mucosa thickness, so only the male seating area extended above the mucosa (Figure 1). New prostheses were made from heat-cured poly-methylmethacrylate (PMMA) reinforced with a metal alloy framework created from cobalt-chromium. The matrix housings were attached to the prosthesis by being wholly incorporated into the PMMA, that is not connected to the metal framework. All prostheses included prefabricated acrylic teeth (Premium and Mondial PALA Teeth, Heraeus Kulzer GmbH) that were carefully adjusted for a balanced occlusion bilaterally and in protrusion and with no anterior contacts in habitual occlusion. All study participants were instructed on best practices for maintaining good oral health and motivated to uphold good oral hygiene, according to the specialist clinic's routine protocols. They were also advised to seek regular maintenance care. All study participants were offered to return to the specialist clinic for follow-up examinations. The referring dentists received a written treatment history synopsis, prognosis estimate and a summary of the oral health guidance provided to the study participants.

TABLE 1 Implant lengths and diameters (mm) (n = 32 study participants × 3 implants)

L (mm) ø (mm)	8 or 9	10	11	12 or 13	Total
3.3	0	30	0	5	35
3.5	1	0	9	12	22
4.0/4.1	6	13	2	0	21
4.5	0	0	13	5	18
Total	7	43	24	22	96

2.5 | Data collection and follow-up consultations

All follow-up consultations included a clinical and radiological examination to assess the implants and the prosthesis status. The study participants were invited to complete the denture satisfaction scale questionnaire and the OHIP-20 questionnaire.

2.6 | Implant outcomes

The stability of all implants was assessed, and signs of mobility, pain or discomfort were defined as an implant failure. Measurements were made of the presence or absence of peri-implant suppuration or fistula, the modified plaque and sulcus bleeding indices,[22] and the probing depth.[23]

The clinical examination was complemented with a radiographic examination of an orthopantomogram. Reference bone levels on the mesial and distal sides were determined by measuring the distance between the implant platform and the most apical point of the alveolar crestal bone surrounding the implant. The loss in crestal bone height over the observation period was calculated relative to the bone level measured on the radiographs made at implant placement.

Implant success was defined as the absence of persistent subjective complaints, absence of recurrent peri-implant infection with suppuration, absence of mobility, lack of continuous radiolucency around the implant and the possibility for restoration.[23]

2.7 | Prosthetic outcomes

The prosthesis was carefully examined for technical flaws, and the mucosa was inspected for signs of rubor or inflammation. Adverse

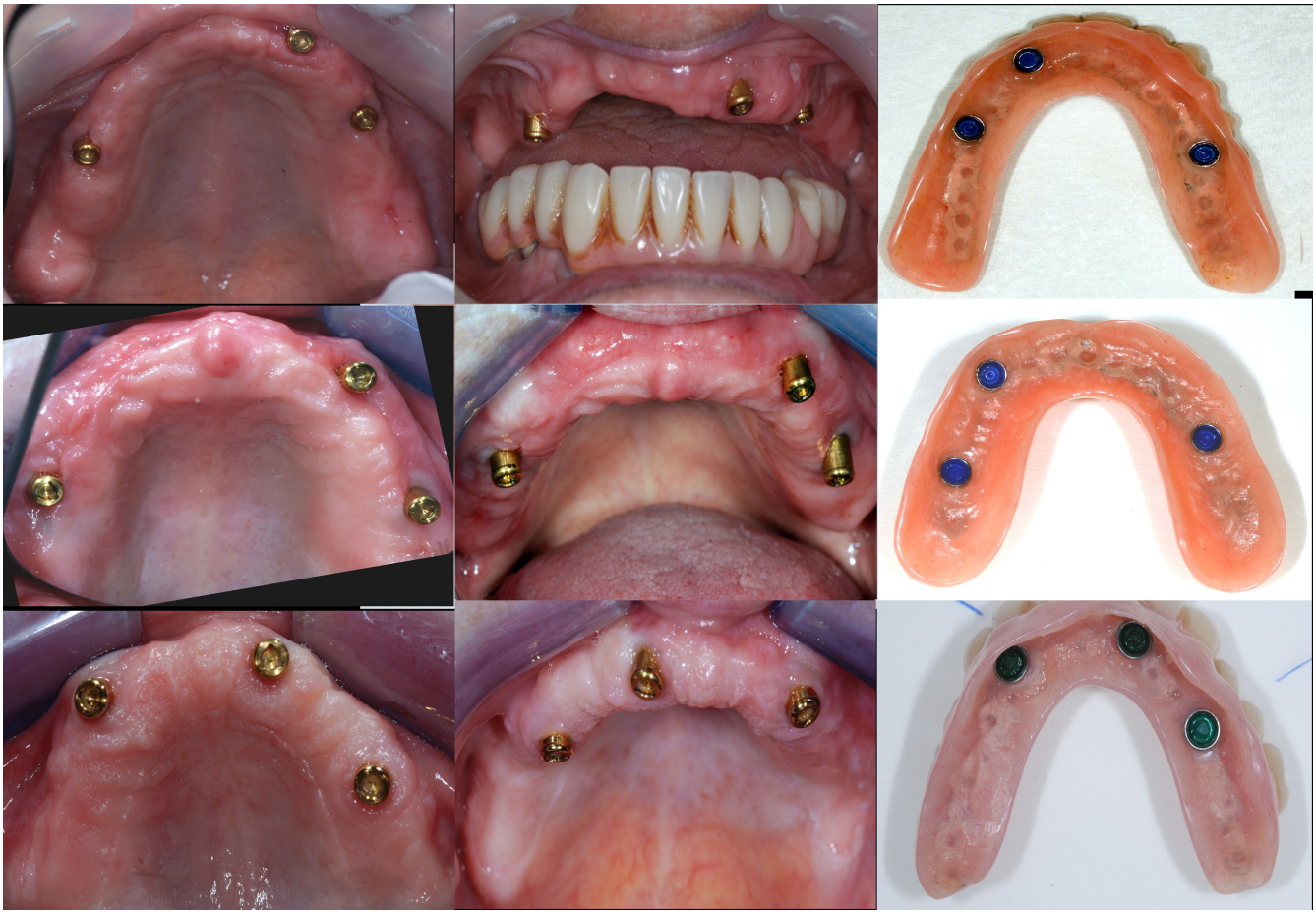

FIGURE 1 Three representative patients with an edentate maxilla with three implants spread anteriorly–posteriorly to form a triangular support zone for a full removable prosthesis. Top and centre row, one week following prosthesis delivery, bottom row, 14 months following prosthesis delivery

technical events were defined as poor retention, fracture or chipping of the removable prosthesis. Adverse mechanical events included loosening the attachment or an implant's fracture. Any flaws were corrected by repairing or relining the prosthesis or replacing worn nylon ring inserts. Prosthesis success was defined according to the most relevant Cochrane systematic review criteria.[14] I.e., no occurrence of patrix or matrix becoming dislodged, worn, or loose, nor any need to be activated, replaced, or fractured more than twice in the first year or more than five replacements in the first five years. Repair includes replacement of worn or fractured overdenture teeth/fractured overdentures, relining of overdenture more than once in 5 years, or excision of patrix-associated mucosal enlargement because of infringement on the shoulder/undersurface of the patrix. Retreatment denotes the need for a replacement prosthesis if part or all the implant overdenture is no longer serviceable because of either loss of implants or irreparable mechanical breakdown.

2.8 | Patient-reported outcomes

The study participants reported their experiences with the new implant-supported prosthesis by completing the Denture Satisfaction Scale questionnaire,[20] and the short-form version of the Oral Health Impact Profile questionnaire (OHIP-20).[21]

2.9 | Statistical analyses

The success and survival estimates of implants and removable prostheses were based on Kaplan–Meier survival statistics. Nonparametric Kruskal–Wallis tests were used to compare group medians of prosthesis satisfaction and OHIP scores before the treatment started and after delivery of the implant-stabilised prostheses. Statistical analysis was performed using SPSS software version 28 (SPSS Inc.).

3 | RESULTS

3.1 | Demographics

Thirty-two study participants received three maxillary implants between March 2007 and October 2016. The baseline data of the study participants are shown in Table 2.

TABLE 2 Baseline data, $n = 32$ study participants

Variable	Categories	Number (%)
Gender	Male	13
	Female	19
Age (years)	Mean (SD)	65 (9.2)
	Min-max	38–83
Edentulous (months)	Mean (SD)	4 (9)
	Min-max	3–540
Smoking habits	Never/previous smoke	23
	Smoke	9
Mucosal health	Healthy	14
	Stomatitis	18
Oral/Denture hygiene	Good	3
	Adequate	17
	Poor	12
Denture use during sleep	Yes	25
	No	7
Sign of bruxism	Yes	2
	No	30
Chronic systemic condition	Yes	20
	No	12
Prescribed medication	Yes > 5 (polypharmacy)	7
	Yes	11
	No	14
Mandible dentition	Natural teeth 35–45	8
	Partial, no prosthesis	4
	Partial, fixed	5
	Partial, removable	2
	Full, implant-denture	10
	Full, implant-fixed	3

Since the treatment completion, six study participants have passed away (after 9, 10, 19, 21, 72 and 107 months). Contact has been lost with three participants (after 33, 57 and 87 months), likely attributed to age and frailty (aged 81, 75 and 65 years). None of the study participants has declined to undergo annual clinical examinations.

3.2 | Implant outcomes

Three study participants have lost implants after 75, 83 and 97 months. Two lost implants were in quadrant one and one in the anterior region. Kaplan–Meier statistics indicate an estimated survival and success at 168 months of 0.95 (SE 0.03) (Figure 2). All three felt no need to replace the implant and continued to use the prosthesis supported by only two implants. Peri-implant bone loss of more than 2 mm was observed on 17% of all implants, while no or minor bone loss occurred on 38% of the implants after an average of 6.7 years (range 11–5 years) (Figure 3). The peri-implant bone loss did not differ between the anterior and posterior implants (Table 3).

3.3 | Prosthetic outcomes

Oral stomatitis was observed for $n = 15$ study participants (47%), but none reported that the condition was considered bothersome. Twenty-five participants reported that they did not store the overdenture extraorally while sleeping.

None of the study participants developed any adverse oral mucosal findings. Three study participants had their prostheses relined to correct for local ridge resorption.

Five study participants had a new prosthesis made after dropping their prosthesis during extraoral cleaning or fall accidents. Discounting these five replacements, the survival of the overdentures was 100%. Eleven individuals required repairs of the prosthesis. In order of frequency, these were due to a delaminated acrylic tooth ($n = 4$), a partial fracture of the prostheses that was repairable ($n = 2$), a matrix housing becoming loose ($n = 2$) and one attachment was replaced due to retention loss caused by wear. Several study participants elected to replace worn nylon ring inserts during their annual clinical consultation to improve prosthesis retention. No inserts were replaced due to breakage.

Since delivery of the prosthesis, the mean observation period is 111 months (range 9–154 months). According to Kaplan–Meier calculations, the estimated success of the prosthesis, that is no need for any repairs or retreatments, is 0.55 (SE 0.10) at 156 months (Figure 4).

3.4 | Patient-reported outcomes

The study participants reported significant statistical differences in OHIP scores between the pre- and post-treatment. The OHIP scores remained high when the participants completed the subsequent questionnaire after several years (Figure 5). The patients also reported high denture satisfaction scores with their new maxillary overdenture, which remained high over the following 4–5 years (Figure 6)

4 | DISCUSSION

4.1 | Study design

Data obtained in a prospective single cohort study can indicate benefits and risks. However, it is acknowledged that it is risky to make robust statistical inferences. A strength of this study is a follow-up period beyond five years of study participants that were not required to satisfy meticulous inclusion and exclusion criteria, which are otherwise often applied in more strictly controlled

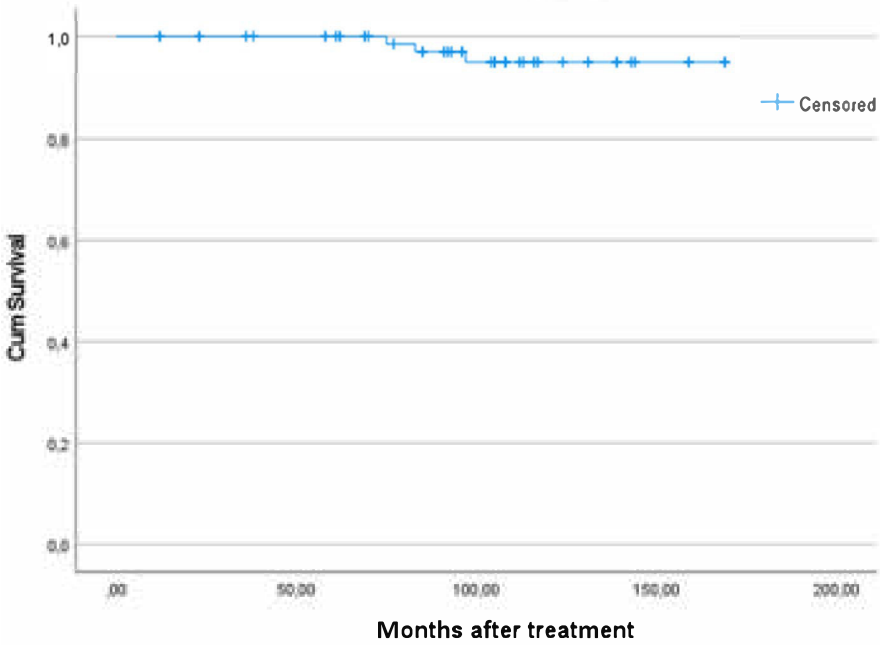

FIGURE 2 The success and survival of the implants ($n = 32$ patients × 3 implants)

trials. Table 1 shows that a high proportion of the study participants had a chronic systemic condition and prescribed medication combined with a manifestation of stomatitis and inadequate oral and denture hygiene. The study participant cohort likely represents average patients seeking care in a private dental clinic. Therefore, despite the less-than-ideal intraoral situations, a superconstruction retained by stud attachments on two posterior plus one anterior implant with a good anterior–posterior spread appears to be a good solution – at least for some individuals with an edentulous maxilla.

4.2 | Implant outcome

The implant outcomes in this study are comparable with the most favourable estimates of success and survival of implant-supported maxillary overdentures,[13] and better than estimates based on pooled meta-analyses of clinical studies on maxillary overdentures supported by three implants.[15] The precise reasons for the positive outcomes of this current clinical study remain uncertain. Still, the combination of some key elements may have been crucial.

The anterior–posterior spread of the implants was maximised to create the largest possible triangular support area. Determining the support zone is essential when planning for or addressing the prognosis of telescopic prostheses on very few remaining teeth.[24,25] The best prognosis is obtained when the support zone is triangular or quadrangular, that is corresponding to class E and class F, respectively, in the classification system intended to design removable partial prostheses.[26] Four individual attachments with a good anterior–posterior spread create a quadrangular support zone. In comparison, three attachments make a triangular support zone. No scientific literature shows that a quadrangular is superior to a triangular support zone regarding telescopic prostheses or removable partial prostheses on teeth. The same applies to the limited number of clinical studies that have examined combined maxillary tooth-implant removable partial prostheses,[27,28] and telescopic solutions.[29–32] In these studies, implants are placed 'in strategic positions to create a missing favorable support zone', that is to create a quadrangular or triangular support zone.

While there is a lack of studies reporting on using three stud attachments with an anterior–posterior spread that creates a triangular support zone, several papers report using four stud attachments to create a quadrangular support zone.[33–45] Only one of these studies discussed the relevancy of implant number and forwarded the following: 'Interestingly, the use of three implants may also provide sufficient retention to satisfy the patient during function, if the anterior-posterior spread is large enough'.[40]

4.3 | Prosthetic outcomes

Low-profile stud attachments do not require extensive hollowing out of the intaglio surface of the overdenture to create enough vertical space to accommodate the attachment components. A stud attachment metal housing containing a nylon insert requires ~3.2 mm, ball attachments require around ~6 mm and milled or cast bar solutions even more than 6 mm vertical space. The prostheses were reinforced by a metallic mesh made from cobalt-chromium, increasing the stiffness. The improved flexural properties reduce the overdenture base deformation. It has been postulated that a metal reinforcement decreases and distributes evenly strains on the underlying supporting structures.[46,47]

The occlusion of the overdentures was balanced to avoid tilting the prosthesis during biting off and eccentric chewing. Correctly adjusting the occlusion is crucial and requires clinical skill and competency.

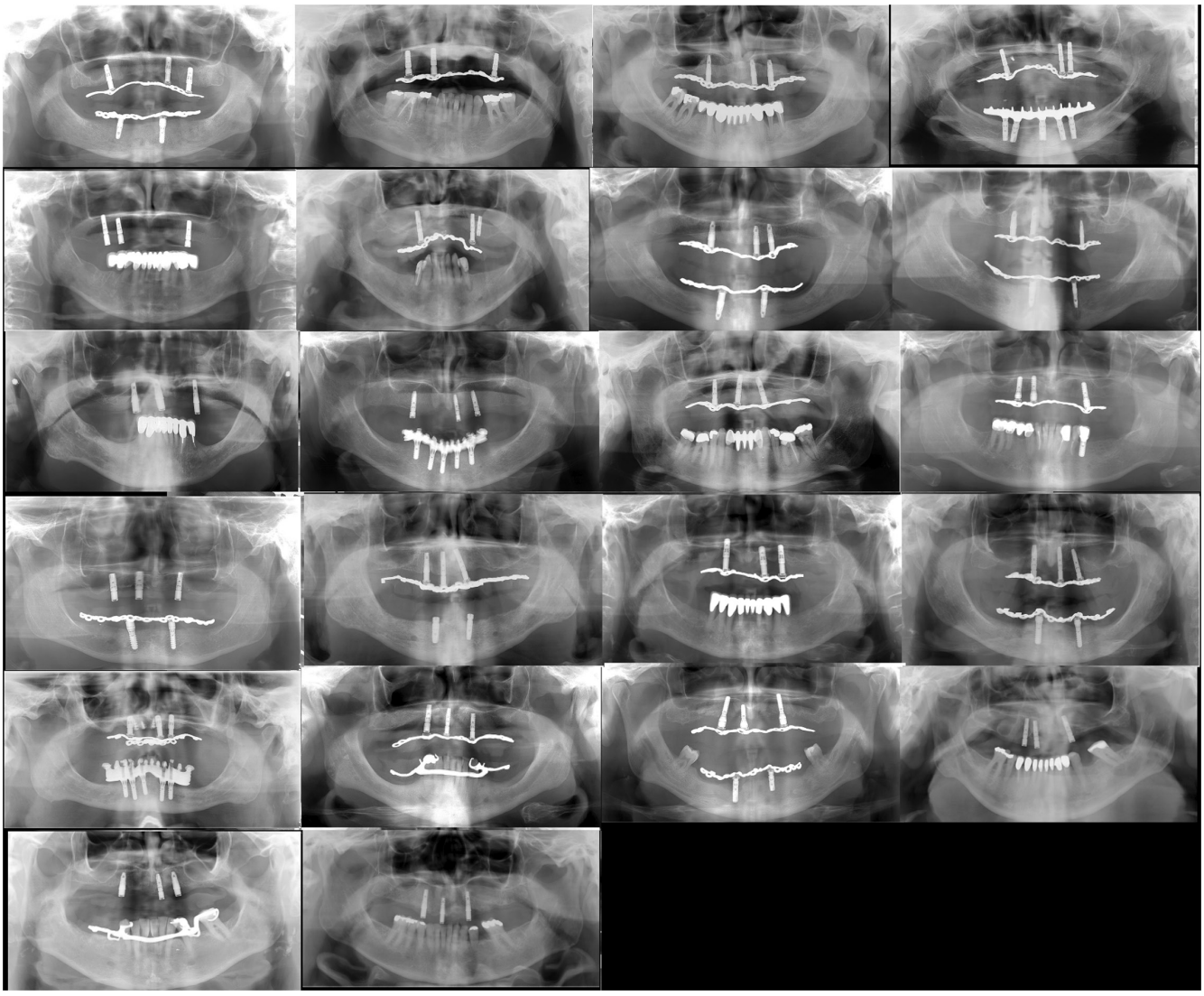

FIGURE 3 Panoramic radiographs from the latest clinical follow-up examination ($n = 23$, mean, 6.7 years (range 11–5 years). Radiographs are sorted by the extent of the anterior–posterior spread of the three supporting implants (one flawed X-ray not shown)

TABLE 3 Marginal bone change at latest follow-up examination with radiographs (mean, 6.7 years (range 11–5 years)

Bone change	Frequency Q1–Anter.–Q2	Per cent Q1–Anter.–Q2	Total (%)
Bone gain/no loss (<0.1 mm)	7–10–8	32–45–38	25 (38)
0.1–≤2 mm bone loss	12–9–8	54–41–38	29 (45)
>2 mm bone loss	3–3–5[a]	14–14–24	11 (17)
Total	22–22–21[a]	100–100–100	65

Note: Mean of mesial and distal measurements around implants in quadrants 1 and 2 and anteriorly ($n = 22$ study participants ×3 implants).

[a]One implant lost, last measurement before implant loss was 2.1 mm.

Milled bars with or without additional stud attachments are optimal in several circumstances when there is extensive hard and soft tissue loss. At the same time, such solutions may be considered over-engineered in other situations. In this perspective, an overruling consideration is that patients must maintain good oral hygiene and biofilm control to minimise the risk of developing peri-implantitis[48] since peri-implantitis is a biofilm-associated pathological condition.[49] It follows that prosthesis elements or attachments that impede the patient's ability to remove biofilms from all surfaces are potentially detrimental. Daily peri-implant cleaning under a fixed prosthesis or around a bar used as a meso-structure requires eye-hand coordination ability, finger dexterity

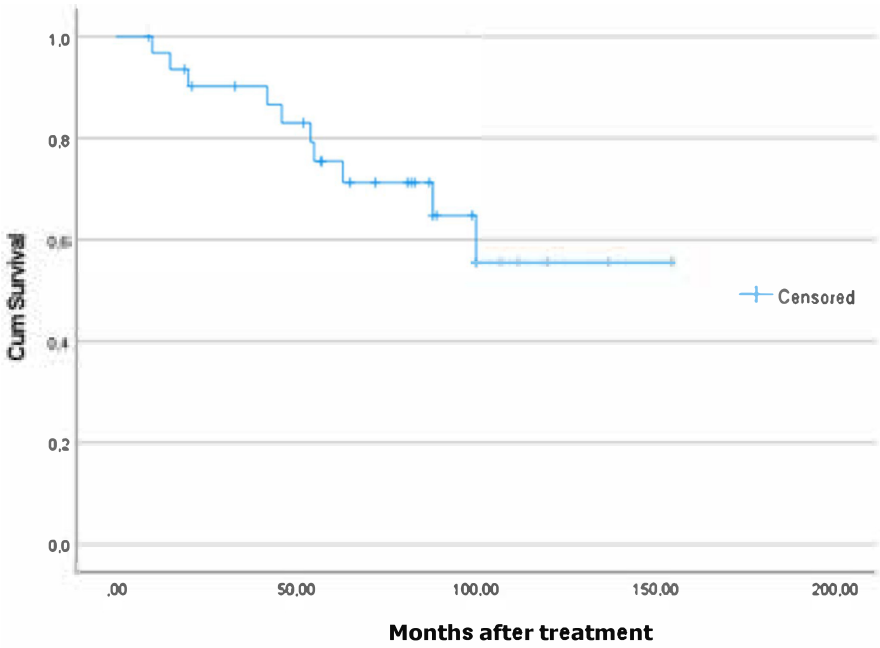

FIGURE 4 The success of prosthesis, that is prosthesis with no complications or need for any repairs ($n = 32$ patients)

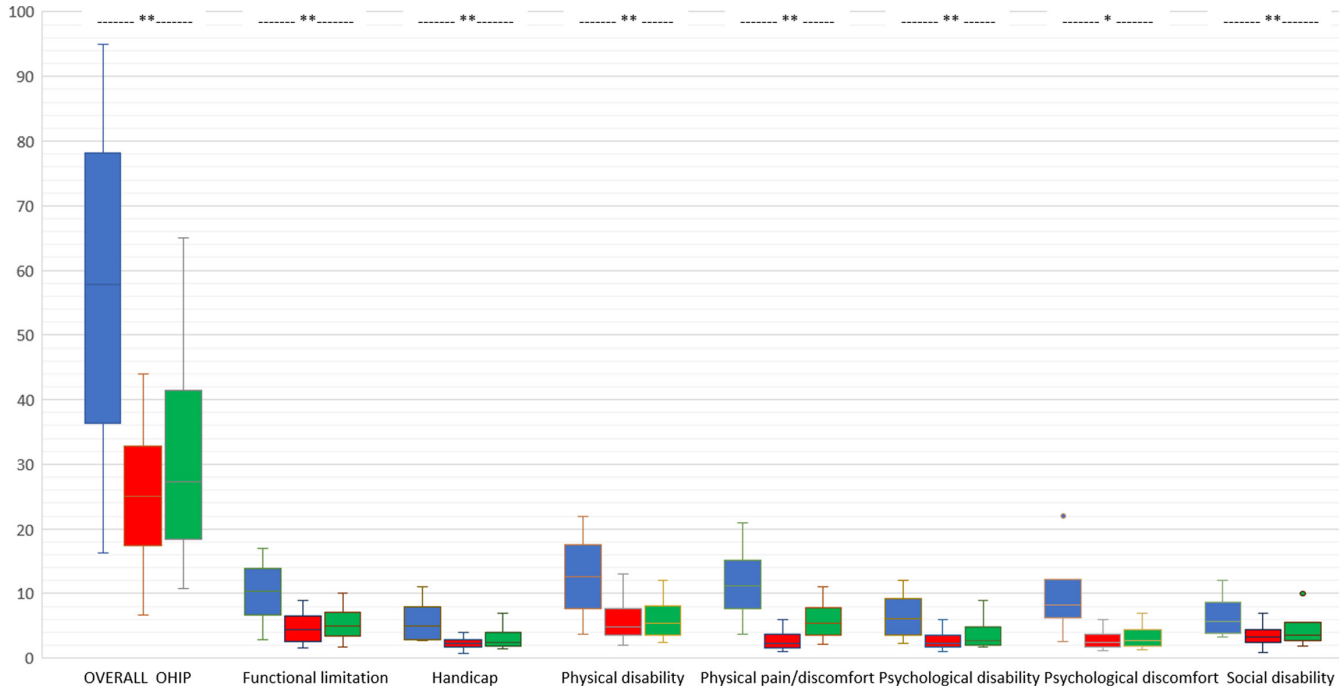

FIGURE 5 OHIP-20 total and subscale scores. $n = 12$, $n = 32$ and $n = 22$ study participants reported OHIP, respectively pre-, 0.5–1 year post- and 4–5 years post-treatment. Statistically significant differences between post and pre-treatment OHIP scores according to the Kruskal–Wallis tests marked * denotes $p < .01$ and **$p < .001$.

and correct use of specially designed intraoral cleaning instruments. Particularly, elderly individuals will experience difficulties with increased development of frailty.[50] On the other hand, most patients will use a conventional toothbrush to remove biofilms intraorally on individual attachments or copings, and the biofilm on the prosthesis surfaces extraorally.

In this context, the insertion path of an overdenture should facilitate easy removal and replacement of the prosthesis twice daily for extraoral cleaning. While magnets were favoured for this reason in the past, low-profile stud attachments allow easy removal if the nylon ring retention level has been adjusted to the users' finger strength.[50]

4.4 | Maintenance needs

Clinical studies on stud-attachments report different incidences of adverse events, complications and maintenance needs. The

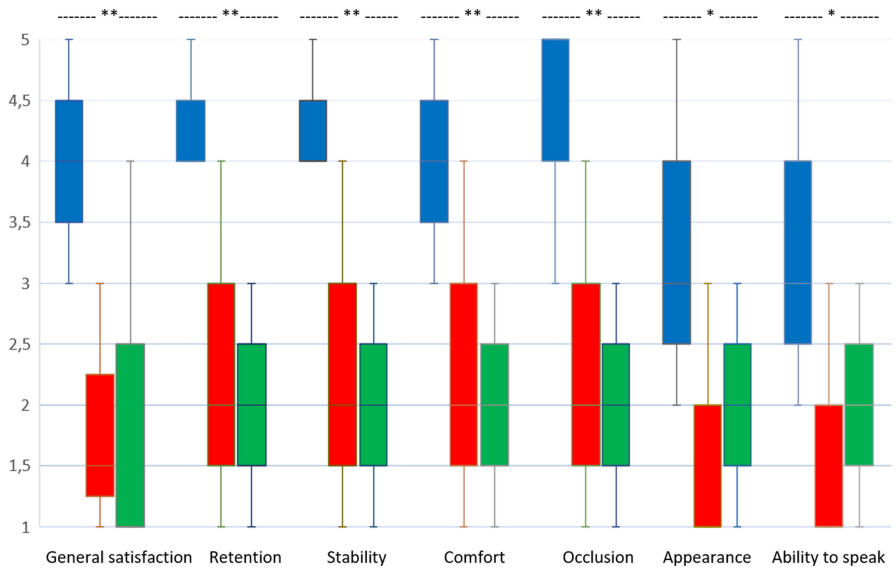

FIGURE 6 Denture Satisfaction Scale scores (median (range)). $n = 12$, $n = 32$ and $n = 22$ study participants reported OHIP, respectively pre-, 0.5–1 year post- and 4–5 years post-treatment. Statistically significant differences between post and pre-treatment satisfaction scores according to the Kruskal–Wallis tests marked * denotes $p < .01$ and ** $p < .001$.

differences may be related to underlying clinical variables such as patient selection, the number of implants to retain the overdenture and support zone configurations.[51] However, it also seems that the estimates reflect the everlasting debate in prosthodontics on what constitutes a complication versus what should be expected maintenance.[5,7,52,53] The concept behind the Locator attachment system is that the nylon ring insert is the weakest part that needs to be replaced, as it gradually, after use, will exhibit wear while protecting the more costly stud attachment from wear. The nylon ring needs to be replaced because lost retention force varies from individual to individual. In this study, the replacement of nylon inserts was on average every two years, with further details presented in an earlier report.[18] The few situations in the current study that arguably could be labelled as complications were quickly correctable and did not entail remakes of the prosthesis.

4.5 | Patient-reported outcomes

Various factors determine patients' choice of implant-supported prostheses.[54] One element is that patients' valuation of oral health outcomes differs, which is reflected in their decision of whether the perceived additional health benefits of a particular prosthetic solution outweigh the higher costs.[16] Another critical consideration in the treatment decision process is fear of pain or complications related to invasive surgery.[55] Patients' preferences are that any intraoral surgery should be minimally invasive.[56] Hence, it is not unexpected that patient-reported outcome measures are inconsistent when comparing implant-supported fixed versus removable prostheses for fully edentulous patients.[57]

Several studies emphasise affordability and opportunity costs as core elements.[58] However, this assumption is disputed, and for patients needing maxillary implant-supported prostheses, there are no contingent valuation studies.[17] This study findings indicate that the three stud retained solution results in clinical and patient-reported outcomes comparable to those obtained with the alternative overdenture solutions on four implants, but at a lower cost. In Norway, the price for surgical placement of three versus four implants and the associated range of implant components creates a patient fee difference of around 20%. This difference increases further if a need is to graft an implant site to create a quadrangular support zone. Any bar solution increases the costs even further due to the additional expenses for dental laboratory services.

5 | CONCLUSION

In many clinical situations, it is acknowledged that a bar-splinted solution, with or without the use of a milled bar with or without additional retentive attachments, on more than three implants is a more predictable solution than the described solution in this paper. However, a more engineered superconstruction on added implants increases the manufacturing price and the patient and possible third-party stakeholders must always trade-off between simplicity and costs versus predictability of clinical performance. The positive findings in this clinical study strengthen the notion that for many individuals with an edentulous maxilla, a removable prosthesis retained by three implants fitted with low-profile stud-attachment is an optimal technical solution.

AUTHOR CONTRIBUTIONS

AM and CH: Participant recruitment, prosthodontic treatment, clinical data collection and measurements. AJ: Ethics approval, statistical analysis, AM, CH and AJ: Research design, manuscript preparation and final manuscript review.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

PEER REVIEW

The peer review history for this article is available at https://publons.com/publon/10.1111/joor.13364.

DATA AVAILABILITY STATEMENT

The data supporting this study's findings are available from the corresponding author upon reasonable request and following the approval of the local Regional Ethics Committee. The data are not publicly available due to privacy or ethical restrictions.

ORCID

Asbjørn Jokstad https://orcid.org/0000-0002-5902-4520

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How to cite this article: Mo A, Hjortsjö C, Jokstad A. Maxillary overdenture on three implants retained by low-profile stud attachments – A prospective cohort study. *J Oral Rehabil*. 2022;49:1069-1079. doi: 10.1111/joor.13364