prosthesis

MDPI

Article

Implant Survival Rate and Prosthetic Complications of OT Equator Retained Maxillary Overdenture: A Cohort Study

Rodolfo Reda [1,2], Alessio Zanza [1], Dario Di Nardo [1,3,*], Valentina Bellanova [1], Edit Xhajanka [4] and Luca Testarelli [1]

[1] Department of Oral and Maxillo Facial Sciences, Sapienza University of Rome, 00161 Rome, Italy
[2] Department of Prosthodontics and Implantology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Chennai 600077, India
[3] Operative Research Unit of Dentistry, Policlinico Universitario Campus Bio-Medico Foundation, Via Alvaro del Portillo 200, 00128 Roma, Italy
[4] Department of Prostethic Dentistry, Faculty of Dentistry, Medical University of Tirana, 1001 Tirana, Albania
* Correspondence: dario.dinardo@uniroma1.it

Abstract: (1) Background: The overdenture is a complete denture, an implant-supported prosthesis, that the patient can remove at home for the usual oral hygiene procedures, thanks to a simple and intuitive anchoring system. Clinically, the execution of this rehabilitation for the lower arch is often favored, but when it is necessary to limit the extension of the palate in the upper arch, it can represent the least invasive and economic solution. The aim of the study is to analyze post-loading implant loss for implant-supported prostheses in the edentulous upper jaw. (2) Methods: This retrospective study was carried out on patients who received a superior overdenture on four implants for rehabilitation. A total of 42 patients were included in this study and initially evaluated clinically and radiographically. The follow-up period for patients after delivery of the upper overdenture is between 48 and 72 months. A total of 168 implants were inserted and monitored in this period. Clinical and radiographic tests were carried out on all 168 implants, with constant re-evaluation. (3) Results: The overall implant survival rate is 92.9%, a value that corresponds to those present in the literature in previously published studies. There were few prosthetic complications, mainly the detachment of anterior prosthetic teeth. (4) Conclusions: Most of these complete prostheses, which as antagonist had another previously made overdenture on four or on two implants, achieved excellent success rates in this study at 72 months.

Keywords: overdenture; OVD; edentulous maxilla; survival rate; OT equator; implant

check for updates

Citation: Reda, R.; Zanza, A.; Di Nardo, D.; Bellanova, V.; Xhajanka, E.; Testarelli, L. Implant Survival Rate and Prosthetic Complications of OT Equator Retained Maxillary Overdenture: A Cohort Study. *Prosthesis* **2022**, *4*, 730–738. https://doi.org/10.3390/prosthesis4040057

Academic Editors: Andrea Scribante, Maurizio Pascadopoli and Simone Gallo

Received: 1 October 2022
Accepted: 12 December 2022
Published: 16 December 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

1. Introduction

Edentulism still represents an important public health problem today, although the incidence of this condition in the population has been decreasing dramatically in recent years [1]. Among the main problems following the complete loss of teeth, in addition to the decrease in chewing abilities, joint problems and aesthetic difficulties that cause social impairment and psychic strain, there is also a decrease in the information afferent to the central system coming from the stomatognathic district [2]. Oral rehabilitation aims to restore orofacial sensory and motor function and improve a person's sense of well-being and quality of life. To date, the classic therapy for total edentulism, recommended for more than 20 years by Feine et al., is a complete upper denture and a lower overdenture with at least two implants [3].

After the delivery of implant-supported prostheses, patients reported a significant improvement in their quality of life [4]. In the last ten years, the systematic reviews of the biological aspects and technical complications of fixed implants restorations in edentulous jaws and implant and prosthodontics survival rate reported an implant survival rate from 96.7% to 99.2% at 10 years [5–8].

There are several possibilities to rehabilitate an edentulous arch, depending on the number of surgeries, the patient's ability to maintain the prosthesis that is delivered, and the economic possibilities.

In light of these considerations, the overdentures represent a complete prosthesis that is made of materials that are certainly economic, which is held on with attachments that are simply screwed in at the implant level, without anti-rotational connection, and in some cases even fixed through a screw from the prosthesis to the attachment [9–11].

This kind of rehabilitation allows patients to obtain important results in terms of the stabilization of the complete dentures, often avoiding bone regeneration interventions, especially in the posterior areas. This condition allows patients to avoid and considerably limit the number of implants necessary for the retention of the prosthesis, a favorable condition in light of the levels of greater tissue inflammation resulting from implant placement, and increase the inter-implant distance, a favorable condition for implant survival [12–15]. In addition to the reduced number of implants that can be used in this type of rehabilitation, it is also necessary to consider the type of attachments used in this study and the different alternatives findable in the market that certainly offer different biomechanical solutions [16–18].

The need to insert and remove the prosthesis several times a day requires an adequate amount of keratinized tissue around the prosthetic solution chosen for anchoring in order not to injure the adjacent soft tissues and, as demonstrated by recent studies, also with a view to implant success [19–21].

In cases where it is possible to screw in implants for favorable clinical conditions; this type of solution allows you to have a fixed prosthesis with extremely simple components, avoiding the use of cements, the residues of which are often difficult to remove in the undercuts of this kind of prosthesis and capable of compromising long-term implant survival [9,22].

The number of implants to choose from for this type of rehabilitation is a subject of great debate. The variables on the 3D positioning of the implants, as well as on their reciprocal inclination can lead to the choice of different prosthetic solutions [23].

In this study, only the implant survival and prosthetic complications of overdentures in the upper jaw were evaluated, along with another overdenture antagonist. These upper jaw overdentures are all evolutions of a previously made complete denture, to reduce the intraoral dimensions of the rehabilitation and improve rehabilitation retention.

The aim of this study was to evaluate the survival rate and prosthetic complications for implant-supported overdentures in the edentulous upper jaw.

2. Materials and Methods

This retrospective cohort study was carried out on patients who received for rehabilitation an upper jaw overdenture retained on four implants.

2.1. Ethical Approval

This study was approved by the Ethics Committee of the Campus Bio-Medico University of Rome.

2.2. Patients Selection and Inclusion/Exclusion Criteria

All patients had lower jaw dentures or lower jaw overdentures retained on two or four implants for at least 2 years. All the implants inserted, therefore, are inserted in arches that have remained edentulous for years. A total of 168 implants Tapered Internal Laser-Lok® (BioHorizons, Birmingham, AL, USA) were inserted and monitored in this period with clinical and radiographic tests.

Implants of different diameters and lengths were used, all of the same series.

2.3. Implants Placement

In this study, computer-assisted image analysis was used to evaluate mesial and distal bone levels on periapical intraoral radiography. For the radiograph procedure, an

individualized acrylic resin device was fixed, as much as possible, parallel to the fix under study, and a radiograph holder was constructed for each patient. This technique ensured the most precise position possible of the radiograph film in the edentulous patient, and it could be reproduced at each visit and, the angle of the radiograph would not deviate.

Patients scheduled for surgery were prescribed systemic amoxicillin/clavulanic acid (Augmentin, GlaxoSmithkline, London, UK), 1 g, twice a day for 6 days, and a chlorhexidine digluconate solution 0.12% (Dentosan 0, 12%, Johnson & Johnson, New Brunswic, NJ, USA) rinse (twice daily for 1 min). After local anesthesia by infiltration using articaine/epinephrine (Ecocain 20 mg/mL, Molteni Dental, Milano, Italy), surgical access with a mid-crestal incision in the center of the edentulous ridge was performed. A full-thickness flap was carried out to expose the crest and the vestibular limit of the alveolar bone.

Following implant placement, the flap was sutured without tension using 4.0 or 5.0 monofilament sutures, which were left in place for 10 days. As the first part of a two-stage technique, the implant was submerged, and the second surgical stage was carried out after 4 months.

Once the healing screw was inserted, suturing was not necessary in most cases, and where a larger flap was needed, mainly for soft tissue management, the flap was sutured without tension using 4.0 or 5.0 monofilament sutures which were left in place for 10 days.

2.4. Prosthesis Delivery

At this point, after an open-tray impression on a custom tray, the heights of the mucous cones were measured for the choice of the height of the OT Equator retention devices (Rhein'83, Bologna, Italy) used in all rehabilitations. An acrylic resin overdenture with a metal reinforcement (CoCr) was produced in a conventional way, with a full analog workflow. A total of 40 days after uncovering and 5 months after implant placement, the definitive overdenture connected with the OT Equators was delivered.

2.5. Patients' Evaluation

The follow-up period for patients after the delivery of the upper overdenture is between 48 and 72 months. Patients were recalled after the first month following the setting and then every 4 months in the first year. The follow-up visit for the following years was variable, but, for all patients, follow-up visits occurred at least twice a year. The implant survival criteria followed the Pisa consensus statement of the ICOI Conference 2007. The implant is considered 'survived' if its superstructures function normally when clinically evaluated.

The implant was considered 'failed' if at least one of the following signs were present.

(a) Pain on palpation, percussion or function of the implant
(b) Any mobility (horizontal and/or vertical) of the implant
(c) Purulent exudate
(d) Uncontrolled progressive bone loss
(e) Radiographic bone loss ½ length of implant
(f) Removed, no longer in mouth

2.6. Statistic Analisys

Descriptive statistics were provided by presenting means and standard deviation data and frequencies for categorical variables.

3. Results

A total of 54 patients (30 males and 24 females) were included in this study and initially evaluated clinically and radiographically. A total of 12 patients were excluded as they had not followed the agreed recall schedule. After this selection, the results of 42 patients (22 males and 20 females) were processed. The follow-up period for patients after delivery of the upper overdenture was between 48 and 72 months. During the observational period, 12 implants failed (Table 1). The overall implant survival rate was 92.9%. For this type of

rehabilitation, implants with diameters 3.8 mm and 4.2 mm were widely used and showed a higher survival rate.

Table 1. Characteristics and positions (anterior or posterior) of the failed fixtures. Each implant was removed with pain, bone loss, exudate. * Months before implant failure occurrence. ** M = male/F = female.

		Posterior	Anterior	Months *	Patient Age/Sex **
1	3.0 × 10.5	X		9	67 (M)
2	3.0 × 10.5	X		12	72 (F)
3	3.0 × 10.5		X	12	78 (M)
4	3.0 × 12		X	24	72 (F)
5	3.0 × 12		X	0	54 (M)
6	3.8 × 10.5	X		12	60 (M)
7	3.8 × 10.5		X	36	62 (F)
8	4.2 × 12	X		12	72 (F)
9	4.2 × 12	X		0	54 (M)
10	4.6 × 7.5	X		24	70 (F)
11	4.6 × 9	X		0	56 (M)
12	4.6 × 12	X		36	58 (M)

The implant diameters used were 3.0 mm, 3.8 mm, 4.2 mm, and 4.6 mm. The implant lengths used were 7.5 mm, 9 mm, 10.5 mm, 12 mm, and 15 mm. It is interesting to note that the thinnest diameter implants have the lowest success rate for this kind of rehabilitation (3.0 mm diameters had 5 implant failures, 41% of the implants were removed).

Table 2 shows the implant survival rate and other conditions studied on surviving implants. It should be noted that, excluding the failed implants, the marginal bone loss around implants was 1.2 ± 0.9 mm in the first 48 months. It is always necessary to consider how, in this type of evaluation, only a mesial or distal bone loss to the implant is evident, i.e., only 50% of the bone loss can be noted. A total of 70% of the placed and surviving implants show a marginal bone loss of less than 2 mm in the observation period. In posterior implants, the level of distal marginal bone was, on average, lower (as shown in Table 2) than the mesial in terms of stability during the observation period.

Table 2. Implant survival rate and Marginal Bone Loss (MBL) at 48 months.

					Bone Loss	
		N. Implants	Failed	Survival Rate	M	D
Implant diameter	3.0 mm	12	5	58%	1.2 ± 1.1 mm	1.4 ± 0.9 mm
	3.8 mm	40	2	95%	1.1 ± 1.0 mm	1.3 ± 1 mm
	4.2 mm	70	2	97.1%	1.2 ± 1 mm	1.3 ± 0.6 mm
	4.6 mm	46	3	93.5%	1.3 ± 0.7 mm	1.4 ± 0.9 mm
Location	Ant	84	4	95.2	1.0 ± 1 mm	1.2 ± 0.7 mm
	Post	84	8	90.51	1.2 ± 1 mm	1.6 ± 0.7 mm

As can be seen, a greater number of complications occurred in posterior implants; 67% of the failed implants are in the posterior areas, and 33% are in the anterior areas. As can be seen from Table 3, there are also a greater number of problems in the intermediate prosthetic components.

Table 3. Prosthetic complications in overdentures during the 72 months of observation. Right rear areas (Post dx), Left rear (Post sx), Right front (Ant dx), Left front (Ant sx).

	Post dx	**Ant dx**	**Ant sx**	**Post sx**	**TOT**
Ot-Equator Damage	(0)	0	0	(0)	(0)
Screw loosening Ot-Equator	(1)	0	0	(1)	(2)
Baskets damage	(1)	0	0	(1)	(2)
Premature wear of gaskets	(4)	(2)	(2)	(6)	(14)
Prosthetic Teeth Fractures (n.)	(0)	6 (1.2) 4 (1.1) 2 (1.3)	5 (1.2) 2 (2.1) 3 (2.3)	(0)	(22)
Prosthesis Flanges Damages	(2)	(1)	(2)	(2)	(7)

The problems of the prosthetheses were relatively greater in the anterior area.

In terms of mechanical complications of the implant-prosthetics complex, concerning the intermediate prosthetic components, there were two screw-loosenings of the Ot-Equator, always on distal implants. Note the breakage of two baskets used to compensate for disparallelisms in conditions of severe wear of the sealing gaskets. During the period of observation, it was never necessary to replace any Ot Equator. The most frequent prosthetic complication was the fracture of one of the prosthetic teeth from 2.3 to 1.3, with greater frequency in the first 24 months after delivery.

All fractures of the prosthetic flanges or of the prosthesis with exposure of the metal reinforcement were caused by accidental falls of the overdenture during home oral hygiene procedures.

4. Discussion

The present study examined the survival rate of the implants and the prosthetic complications of the overdentures (on four implants) and its components with an Ot Equator (Rhein'83, Bologna, Italy) retention system, with another overdenture as antagonist. With the implant survival criteria used, the results were in line with the data reported in the literature, and this solution guaranteed an excellent level of success. From the results obtained, the success rate of smaller-diameter implants is lower, especially if placed in posterior areas, compared to medium-diameter implants.

In a previous finite-element analysis study on the effect of the diameter and length of the implant in the distal extension removable partial dentures, Verri et al. reported that the diameter of the implant does not influence the implant displacement values when the length was ensured [24]. Large-diameter implants were not found to be more effective; indeed, among those with larger diameters, the shorter the length, the shorter the survival, as indicated in previous studies [24,25].

The explanation of this difference is certainly not obtainable from these studies; under the same load conditions and implant inclination it would be necessary to test different diameters or lengths implants to understand the different response to this type of loads (with connections with gaskets on each single implant in non-solidarized rehabilitations).

It is also important to underline that, out of 168 implants placed, and out of 12 failed implants, three implants failed in the first month after insertion. This eventuality is perhaps due to the wrong choice of the implant site related to position and quality or to excessive surgical trauma. A probable explanation for the higher implant failure rate is perhaps attributable to the angled position of these implants and the divergent angulation (relative to the other contralateral posterior implant). To avoid this possibility, which could make it possible not to use the angled baskets to compensate for dis-parallelisms, guided implant planning could guarantee the insertion of straighter but shorter implants, which, however, do not seem to have a higher success rate [26,27].

Moreover, considering the success rate obtained in this study regarding the implants with a narrow diameter (3.0 mm in this study), these too deserve to be considered for this type of rehabilitation. We always remember that it represents a simple and economical prosthetic choice, on which it is not always possible, or convenient, to place the burden of bone augmentation procedures, in order to place implants of standard diameters and lengths [25,27–29]. Moreover, it is increasingly evident in the literature that an implant with a narrow diameter, in addition to a greater thickness of the mucous tissues fundamental for a correct seal and preservation of the crestal bone, allows for less violation of the medullary component of the bone, leaving more vascularization around the implant, and thus improving its blood supply [30–33].

This kind of prosthesis is still almost completely made in an analog way, but further steps for the future represent the inclusion of this method in a digital workflow, perhaps with the introduction of resins with elasticity modules more similar to those of the bone, able to immediately load the implant, perhaps also taking advantage of the possibility of screwing this type of complete prosthesis [9,31].

The marginal bone loss around implants was 1.2 $\pm$ 0.9 mm. In detail, 1.4 $\pm$ 0.7 mm as regards the distal bone level and 1.1 $\pm$ 1.0 mm as regards the mesial bone level after a 48 months observation. The implants were positioned in the posterior areas especially at the level of the prosthetic emergence of the first upper molars, in such a way as to minimize the distal cantilever as much as possible, and the most mesial position of the posterior implants was at most between the second premolar and first molar. The second prosthetic molar was positioned only when present on the antagonist arch or when the resin distal to the first molar was raised to avoid occlusal trauma on the cheek [24,32].

As a mechanical complication of implant-prosthetics complex, in this study there were two screw-loosenings of the Ot-Equator, always on distal implants. This result can be explained by considering that, often with diverging implant axes, the diverging prosthetic insertion axes are compensated for by the oscillating baskets and gaskets, which are the most stressed components in the insertion and disengagement movements of the prosthesis [32]. No Ot-Equator has been ruined in these years of observation, which confirms the excellent reliability of this product. On the other hand, where the maintenance of the prosthesis was not punctual, or due to occlusal overload, two fractures of the oscillating baskets were diagnosed. Surely this component is the most delicate of the implant-prosthetic complex of the overdenture, and it is possible to use it not only if the implants inserted have an extremely low degree of mutual divergence. This condition can be achieved more easily with shorter-length implants, in the posterior lateral areas, which, however, seem to have a lower survival rate in this type of rehabilitation [25].

From the prosthetic point of view, the only breakage relevant for its frequency is due to the detachment of prosthetic teeth of the upper anterior group, probably due to the larger size of the teeth, due to the fracturing of the resin retention pin.

Regarding this topic, in several cases, the teeth were mounted buccally away from the residual crestal ridge for aesthetic and functional reasons, thus stressing the resistance of the support resin in protrusive contacts, which are extremely delicate in this regard.

Furthermore, as previously mentioned, the combination between the size of the tooth (upper incisors versus lower incisors) and the relationship with the size of the retention pin inserted to offer stability to the teeth against non-axial forces made the fracture of these prosthetic teeth more frequent. The fractures of these prosthetic teeth consist of the detachment of the tooth from the bonding surface, exposing the retention pin, rarely of its fracture. The authors of the present study, in another study in publication conducted on a similar patient population but on fixed rehabilitations, cemented on four or six upper implants and found a lower incidence of fracture of the upper frontal prosthetic teeth. This was despite the presence of the seals and their shock absorption potential. The explanation is brought back to the Cr-Co bar with metal retention pins, which offer greater support to the resin pin that is usually used in this type of prosthesis.

In some ways, the solution of an overdenture on four implants may seem limiting, being able, in some cases, to carry out a cement- or screw-retained complete prosthesis. In these cases, this prosthetic solution was favored due to a combination of factors, including the level and possibility of oral hygiene of the patients; the possibility of inserting a maximum of four implants without grafting procedures for increased bone volumes, ease in clinical, and home management of the prosthesis; and the reduced cost to have a rehabilitation as free of palate as possible. The possibility of rehabilitating the upper arch with an overdenture on two implants was not taken into consideration by the authors of this study, except in rare cases, such that it is not possible to study the survival rate of this type of rehabilitation, which does not seem to be absolutely similar to upper overdentures on four implants [34].

As for limitations of the present study, it is not possible to compare the effects of this type of prosthesis on different implants (diameters and lengths) for the retrospective aspects of the study. Furthermore, the observation period varies from (48 to 72 months), and, therefore, only in the longer term will it be possible to obtain results over large periods across the whole sample. Furthermore, no distinction was made on the type of gaskets fitted and replaced (depending on their hardness), which is a factor that could influence the distribution of loads on this type of attachment.

5. Conclusions

The survival rate of the implants included in this study was 92.9% for upper jaw overdentures. Most of these complete prostheses, which as an antagonist had another previously made overdenture on four or two implants, achieved excellent success rates in this study after at most 72 months. The number of implants removed is in line with the data reported in the literature, with a predisposition to the loss of posterior implants compared to anterior ones. As prosthetic complications, the only noteworthy one in terms of frequency was the detachment of the upper frontal prosthetic teeth.

Within the limitations of this study, the upper jaw overdenture also turned out to be a valid therapy, which was stable over time and economical.

Author Contributions: Conceptualization, R.R. and D.D.N.; methodology, A.Z. and E.X.; software, D.D.N.; validation, R.R., A.Z. and L.T.; formal analysis, E.X.; investigation, V.B. and R.R.; resources, L.T.; data curation, R.R.; writing—original draft preparation, R.R.; writing—review and editing, D.D.N. and E.X.; visualization, R.R.; supervision, D.D.N.; project administration, L.T. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Università Campus Bio-Medico di Roma (protocol code Prot. PAR 30.21 (OSS) ComEt CBM-30/03/2021).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Roberto, L.L.; Crespo, T.S.; Monteiro-Junior, R.S.; Martins, A.M.; De Paula, A.M.; Ferreira, E.F.; Haikal, D.S. Sociodemographic determinants of edentulism in the elderly population: A systematic review and meta-analysis. *Gerodontology* **2019**, *36*, 325–337. [CrossRef]
2. Avivi-Arber, L. Neuroplasticity and the edentulous patient—Toward a paradigm shift in oral rehabilitation. *Int. J. Prosthodont.* **2015**, *28*, 115. [PubMed]
3. Feine, J.S.; Carlsson, G.E.; Awad, M.A.; Chehade, A.; Duncan, W.J.; Gizani, S.; Head, T.; Heydecke, G.; Lund, J.P.; MacEntee, M.; et al. The McGill consensus statement on overdentures. Mandibular two-implant overdentures as first choice standard of care for edentulous patients. *Gerodontology* **2002**, *19*, 3–4. [PubMed]
4. Zitzmann, N.U.; Marinello, C.P. A review of clinical and technical considerations for fixed and removable implant prostheses in the edentulous mandible. *Int. J. Prosthodont.* **2002**, *15*, 65–72. [PubMed]

5. Papaspyridakos, P.; Chen, C.J.; Chuang, S.K.; Weber, H.P.; Gallucci, G.O. A systematic review of biologic and technical complications with fixed implant rehabilitations for edentulous patients. *Int. J. Oral Maxillofac. Implant.* **2012**, *27*, 102–110.
6. Storelli, S.; Del Fabbro, M.; Scanferla, M.; Palandrani, G.; Romeo, E. Implant-supported cantilevered fixed dental rehabilitations in fully edentulous patients: Systematic review of the literature. Part II. *Clin. Oral Implant. Res.* **2018**, *29* (Suppl. S18), 275–294. [CrossRef]
7. Gallardo, Y.N.R.; da Silva-Olivio, I.R.; Gonzaga, L.; Sesma, N.; Martin, W. A Systematic Review of Clinical Outcomes on Patients Rehabilitated with Complete-Arch Fixed Implant-Supported Prostheses According to the Time of Loading. *J. Prosthodont.* **2019**, *28*, 958–968. [CrossRef]
8. Storelli, S.; Del Fabbro, M.; Scanferla, M.; Palandrani, G.; Romeo, E. Implant supported cantilevered fixed dental rehabilitations in partially edentulous patients: Systematic review of the literature. Part I. *Clin. Oral Implant. Res.* **2018**, *29* (Suppl. S18), 253–274. [CrossRef]
9. Acampora, R.; Montanari, M.; Scrascia, R.; Ferrari, E.; Pasi, M.; Cervino, G.; Meloni, S.M.; Lumbau, A.I.; Xhanari, E.; Koshovari, A.; et al. 1-Year Evaluation of OT Bridge Abutments for Immediately Loaded Maxillary Fixed Restorations: A Multicenter Study. *Eur. J. Dent.* **2021**, *15*, 290–294. [CrossRef]
10. Kappel, S.; Klotz, A.L.; Eberhard, L.; Lorenzo Bermejo, J.; Rammelsberg, P.; Giannakopoulos, N.N. Maxillary implant overdentures on two or four implants. A prospective randomized cross-over clinical trial of implant and denture success and survival. *Clin. Oral Implant. Res.* **2021**, *32*, 1061–1071. [CrossRef]
11. Strong, S.M. Conversion of a bar overdenture to an attachment-only overdenture. *Gen. Dent.* **2021**, *69*, 10–13. [PubMed]
12. Guarnieri, R.; Miccoli, G.; Reda, R.; Mazzoni, A.; Di Nardo, D.; Testarelli, L. Sulcus fluid volume, IL-6, and Il-1b concentrations in periodontal and peri-implant tissues comparing machined and laser-microtextured collar/abutment surfaces during 12 weeks of healing: A split-mouth RCT. *Clin. Oral Implant. Res.* **2022**, *33*, 94–104. [CrossRef] [PubMed]
13. Guarnieri, R.; Reda, R.; Di Nardo, D.; Miccoli, G.; Zanza, A.; Testarelli, L. Clinical, radiographic, and biochemical evaluation of two-piece versus one-piece single implants with a laser-microgrooved collar surface after 5 years of functional loading. *Clin. Implant. Dent. Relat. Res.* **2022**, *24*, 676–682. [CrossRef] [PubMed]
14. Guarnieri, R.; Zanza, A.; D'Angelo, M.; Di Nardo, D.; Del Giudice, A.; Mazzoni, A.; Reda, R.; Testarelli, L. Correlation between Peri-Implant Marginal Bone Loss Progression and Peri-Implant Sulcular Fluid Levels of Metalloproteinase-8. *J. Pers. Med.* **2022**, *12*, 58. [CrossRef] [PubMed]
15. Guarnieri, R.; Miccoli, G.; Reda, R.; Mazzoni, A.; Di Nardo, D.; Testarelli, L. Laser microgrooved vs. machined healing abutment disconnection/reconnection: A comparative clinical, radiographical and biochemical study with split-mouth design. *Int. J. Implant. Dent.* **2021**, *7*, 19. [CrossRef]
16. Tallarico, M.; Cervino, G.; Montanari, M.; Scrascia, R.; Ferrari, E.; Casucci, A.; Xhanari, E.; Lupi, S.M.; Meloni, S.; Ceruso, F.M.; et al. OT-Equator® Attachments Comparison for Retaining an Early Loaded Implant Overdenture on Two or Three Implants: 1 Year RCT Preliminary Data. *Appl. Sci.* **2021**, *11*, 8601. [CrossRef]
17. Lupi, S.M.; Cislaghi, M.; Rizzo, S.; Baena, R.R. Rehabilitation with implant-retained removable dentures and its effects on perioral aesthetics: A prospective cohort study. *Clin. Cosmet. Investig. Dent.* **2016**, *8*, 105–110.
18. Sassi, A.N.; Todaro, C.; Isola, G.; Bortolini, I.; Rodriguez y Baena, R.; Storelli, S.; Lupi, S.M. Mastication Wear of Two Low Profile Attachment Systems for Overdenture: An In Vitro Study. *BioMed Res. Int.* **2022**, *2022*, 6469890. [CrossRef]
19. Sculean, A.; Gruber, R.; Bosshardt, D.D. Soft tissue wound healing around teeth and dental implants. *J. Clin. Periodontol.* **2014**, *41* (Suppl. S15), S6–S22. [CrossRef]
20. Narimatsu, I.; Atsuta, I.; Ayukawa, Y.; Oshiro, W.; Yasunami, N.; Furuhashi, A.; Koyano, K. Epithelial and Connective Tissue Sealing around Titanium Implants with Various Typical Surface Finishes. *ACS Biomater. Sci. Eng.* **2019**, *5*, 4976–4984. [CrossRef]
21. Chackartchi, T.; Romanos, G.E.; Sculean, A. Soft tissue-related complications and management around dental implants. *Periodontology 2000* **2019**, *81*, 124–138. [CrossRef] [PubMed]
22. Reda, R.; Zanza, A.; Cicconetti, A.; Bhandi, S.; Guarnieri, R.; Testarelli, L.; Di Nardo, D. A Systematic Review of Cementation Techniques to Minimize Cement Excess in Cement-Retained Implant Restorations. *Methods Protoc.* **2022**, *5*, 9. [CrossRef]
23. Parel, S. Removable and Fixed Fully Edentulous Treatment Options for the Aging Patient. *Compend. Contin. Educ. Dent.* **2018**, *39*, 448–453. [PubMed]
24. Verri, F.R.; Pellizzer, E.P.; Rocha, E.P.; Pereira, J.A. Influence of length and diameter of implants associated with distal extension removable partial dentures. *Implant. Dent.* **2007**, *16*, 270–280. [CrossRef]
25. Kang, S.H.; Kim, S.K.; Heo, S.J.; Koak, J.Y. Survival rate and clinical evaluation of the implants in implant assisted removable partial dentures: Surveyed crown and overdenture. *J. Adv. Prosthodont.* **2020**, *12*, 239–249. [CrossRef]
26. Alhammadi, M.S.; Al-Mashraqi, A.A.; Alnami, R.H.; Ashqar, N.M.; Alamir, O.H.; Halboub, E.; Reda, R.; Testarelli, L.; Patil, S. Accuracy and Reproducibility of Facial Measurements of Digital Photographs and Wrapped Cone Beam Computed Tomography (CBCT) Photographs. *Diagnostics* **2021**, *11*, 757. [CrossRef] [PubMed]
27. Edelmann, A.R.; Hosseini, B.; Byrd, W.C.; Preisser, J.S.; Tyndall, D.A.; Nguyen, T.; Bencharit, S. Exploring Effectiveness of Computer-Aided Planning in Implant Positioning for a Single Immediate Implant Placement. *J. Oral Implantol.* **2016**, *42*, 233–239. [CrossRef]

28. Bouhy, A.; Rompen, E.; Lamy, M.; Legros, C.; Lecloux, G.; Lambert, F. Maxillary implant overdenture retained by four unsplinted attachments and opposed by a natural or fixed dentition: One-year clinical outcomes. *Clin. Oral Implant. Res.* **2020**, *31*, 747–767. [CrossRef]
29. González-Valls, G.; Roca-Millan, E.; Céspedes-Sánchez, J.M.; González-Navarro, B.; Torrejon-Moya, A.; López-López, J. Narrow Diameter Dental Implants as an Alternative Treatment for Atrophic Alveolar Ridges. Systematic Review and Meta-Analysis. *Materials* **2021**, *14*, 3234. [CrossRef]
30. Reda, R.; Zanza, A.; Galli, M.; De Biase, A.; Testarelli, L.; Di Nardo, D. Applications and Clinical Behavior of BioHPP in Prosthetic Dentistry: A Short Review. *J. Compos. Sci.* **2022**, *6*, 90. [CrossRef]
31. Valente, N.A.; Marchio, V.; Troiano, G.; Gasparro, R.; Balice, P.; Marenzi, G.; Laino, L.; Sammartino, G.; Iezzi, G.; Barone, A. Narrow-diameter versus standard-diameter implants placed in horizontally regenerated bone in the rehabilitation of partially and completely edentulous patients: A systematic review. *Int. J. Oral Implantol.* **2022**, *15*, 11–33.
32. Sayed, M.E.; Mugri, M.H.; Almasri, M.A.; Al-Ahmari, M.M.; Bhandi, S.; Madapusi, T.B.; Varadarajan, S.; Raj, A.T.; Reda, R.; Testarelli, L.; et al. Role of Stem Cells in Augmenting Dental Implant Osseointegration: A Systematic Review. *Coatings* **2021**, *11*, 1035. [CrossRef]
33. Mously, H.A. Effect of Two Implant-supported Partial Overdenture Attachment Design on the Periodontal Health. *J. Contemp. Dent. Pract.* **2020**, *21*, 68–72. [CrossRef] [PubMed]
34. Mills, S. How successful are maxillary implant-retained overdentures on two or four implants? *Evid. Based Dent.* **2021**, *22*, 146–147, Erratum in: *Evid Based Dent.* **2022**, *23*, 5. [CrossRef]