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Prosthetic Complications and Maintenance Requirements in Locator-attached Implant-Supported Overdentures: A Retrospective Study

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ABSTRACT

Retrospective data of 32 patients supplied with implant-supported and Locator-attached overdentures were screened for prosthetic complications and maintenance requirements, which were recorded and statistically analyzed. Mean observation time was 4.78 (± 1.72) years. Loss of retention was the most frequently observed event (n=22). Damage and exchange of the insert holders (n=4) and loosening of locator attachments (n=2) and fracture of the insert holder (n=2) were uncommon events; no loss of locator attachments was observed. Loss of retention in Locator-attached overdentures is frequent; correlating patient-specific parameters with prosthetic complications is necessary to define recommendations for the use of Locator attachments.

INTRODUCTION

Demographic changes in industrialized countries coincide with an ever increasing number of elderly patients. Although the recent national survey on dental health issues in Germany from 2006 indicated a tendency towards an increasing number of teeth in elderly patients, edentulism and patients with complete dentures are still common.[1] An increasing number of edentulous patients are supplied with implant-supported denture prostheses,[1] which feature different advantages in comparison to conventional gum-supported removable denture prostheses. These include improved denture retention particularly in patients with low residual crestal bone height[2] and higher patient satisfaction as well as quality of life.[3,4,5,6,7] Regarding the treatment of edentulous patients with implants, two interforaminal implants are currently regarded as the treatment option of choice in the lower jaw, whereas four implants are commonly demanded in the upper jaw.[8,9]

Different systems for the attachment of removable denture prostheses on implants are currently available on the market, including magnets, ball attachments, bar-clip attachments, telescopic or conical crowns, and self-aligning attachments (locator). The self-aligning Locator attachment has been introduced in 2001 and is regarded as a simple, flexible, and cheap treatment option. The Locator system consists of three parts, which include a nylon insert, the insert holder (patrice) fixed in the removable denture prosthesis, and the locator attachment (abutment). Several differently shaped nylon inserts are available, which differ in the retention forces supplied and can compensate differences in the implant angulations up to 40°.

There are numerous studies that report on prosthetic complications and the need for prosthetic maintenance associated with attachment systems for removable denture prostheses on implants.[10,11,12,13,14,15,16] With regard to the Locator attachment system and associated prosthetic complications, loss of retention is an issue that has been frequently addressed both *in vitro*[18,19] and *in vivo*.[14,20] A recent review in the literature concludes that the Locator attachment system can be a useful treatment alternative to other attachment systems, yet evidence-based data on its long-term performance, complications, and maintenance requirements remain scarce.[16] Several studies employed a prospective approach for evaluating the performance of the Locator attachment system, yet to date only data after one or two years of clinical observation have been published.[14,9,7]

Thus, the aim of the present study was to evaluate the prosthetic complications and maintenance requirements associated with the use of the Locator system for the attachment of implant-supported overdentures employing a retrospective approach. We hypothesized that loss of retention is a frequently reported event during the long-term clinical service of Locator-attached implant supported overdentures.

MATERIALS AND METHODS

STUDY DESIGN

Retrospective data were collected from the individual health records of all patients that had been supplied with implant-supported removable dentures with Locator attachments in the Department of Prosthetic Dentistry at the Regensburg University Medical Center between 2005 and 2013. All dentists involved in the clinical procedure were specialized in prosthetic dentistry. The prostheses were manufactured from cold-curing polymethyl methacrylate resin in local dental laboratories skilled in implant restorations; resin denture teeth were employed. In all cases, a standardized clinical and laboratory process in accordance with the manufacturers` recommendations was employed. Locator attachments were either inserted in the dental laboratory after taking an implant impression or directly in the oral cavity after insertion of the abutment using cold curing acrylic resin.

The only inclusion criteria was that patients had to have taken part in a regular recall programme offered by the clinic for at least one year after insertion of the dentures.

Each individual patient data set was analyzed systematically for prosthetic complications by two calibrated independent experienced dentists specialized in prosthodontics; discrepancies in the interpretation of data sets were solved by discussion and consensus. Primary outcome criteria included loss of retention (i.e. change of nylon inserts), damage and exchange of the insert holder (patrice), fracture of the insert holder (patrice) from the denture base, loosening of locator attachment (abutment), and loss of locator attachment (abutment). Secondary outcome criteria included the manufacturing mode (subsequent insertion of locator patrice into an existing denture prosthesis or fabrication of a completely new denture prosthesis with locator patrices), the localization of the locator-supported denture in the upper or lower jaw, and the prosthetic status in the antagonistic jaw. Prosthetic status was classified as either tooth-supported (patients without or with fixed dentures), partially tooth-supported (patients with removable denture prosthesis supported by at least four abutment teeth), partially implant-supported (patients with removable dentures supported by implants), or gum-supported (patients with removable dentures supported by less than four teeth or complete dentures).

The design of the study was approved by the local ethics committee of the University of Regensburg (no. 15-104-0119).

STATISTICAL ANALYSS

Continuous data are presented as means ± standard deviations (SD). Differences in the occurrence of prosthetic complications between modes of fabrication, localizations of prostheses, and the prosthetic status of the antagonistic jaw were analyzed using the log-rank test and are displayed graphically with Kaplan-Meier curves. A p-value <0.05 was considered statistically significant. All analyses were performed using SPSS 23.0 and R 3.2.1.

RESULTS

A total of 40 patients that had been supplied with implant-supported dentures with locator attachments were identified; 32 patients (14 female, 18 male) with a mean age of 63.18 (±10.41) met the inclusion criteria. The observation period ranged between 1.13 and 7.45 years, with a mean of 4.78 (± 1.72) years and a median of 5.15 years. 27 locator-attached denture prostheses were located in the lower jaw with a mean of 2.26 locator abutments (± .66) fixed on a minimum of two and a maximum of four interforaminal implants; five prostheses were located in the upper jaw with a mean of 4.00 locator abutments (± 2.00) fixed on a minimum of two and a maximum of six implants.

Figure 1 depicts the prosthetic complications recorded for each of the 32 patients included *(Figure 1)*. Loss of retention was observed frequently (n=22); the mean time after insertion of the locator-attached denture until the first change of the nylon patrices was 2.41 (± 2.09) years. In several cases, loss of retention occurred multiply, and the mean time until the second change of the nylon patrices was 1.27 (± 1.10) years (n=13), third change .55 (± .56) years (n=10), fourth change 0.92 (± 0.66) years (n=6), fifth change 1.75 (± 1.99) years (n=4), sixth change 1.50 (± 0.88) years (n=3), and seventh change.[11] years (n=1). No significant impact of either the mode of fabrication (*P*=0.297), localization (*P*=0.869), or prosthetic status of the antagonistic jaw (*P*=0.427) was identified.

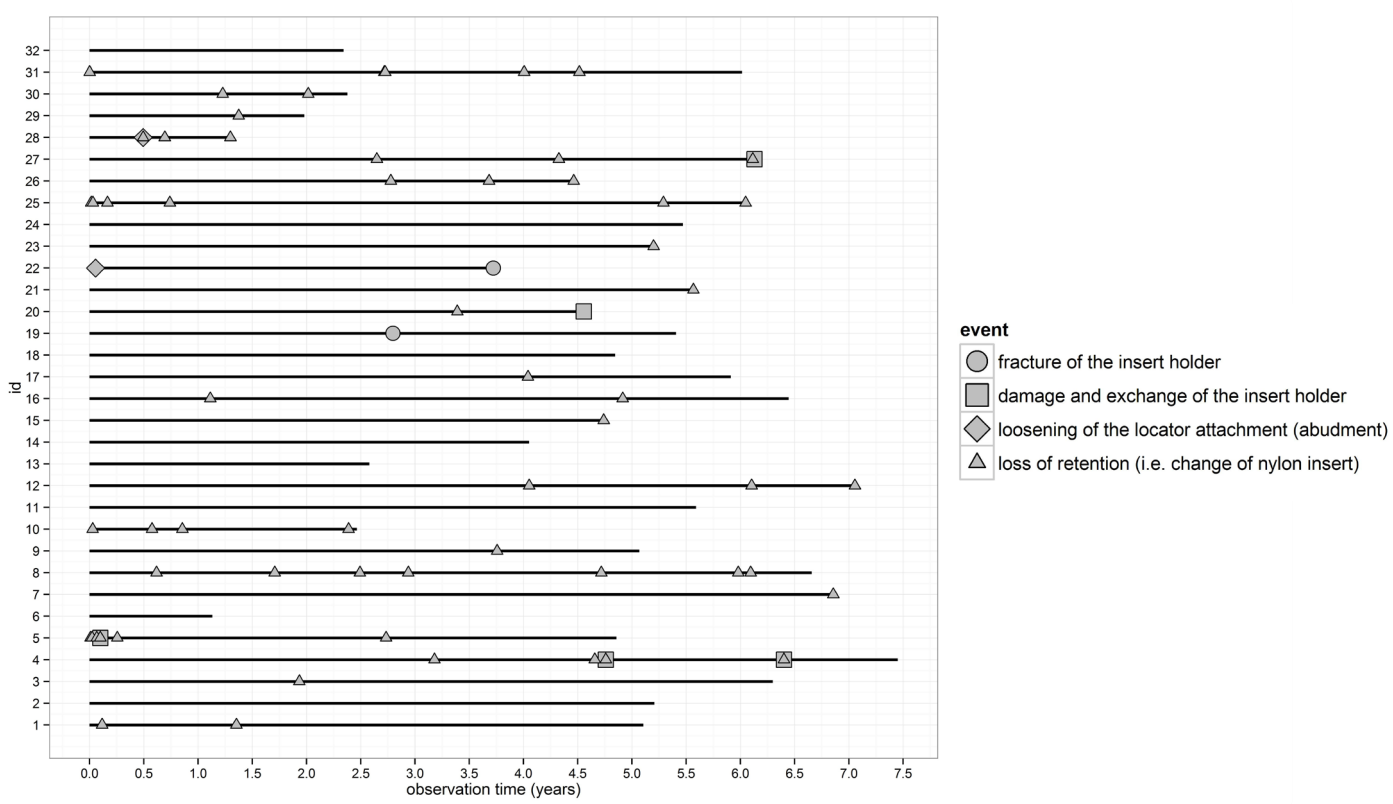

Figure 1: Prosthetic complications recorded for each of the 32 patients included.

Damage and exchange of the insert holder (patrice) was observed in four cases after a mean time of 3.89 (± 2.62) years; no significant impact of either the mode of fabrication (*P*=0.836), localization (*P*=0.346), or prosthetic status of the antagonistic jaw (*P*=0.463) was identified. In one subject, damage and exchange of the insert holder occurred again 1.67 years after the first incident.

Fracture of the insert holder (patrice) from the denture base was observed in two cases after a mean time of 3.26 (± 0.65) years; no significant impact of either the mode of fabrication (*P*=0.792), localization (*P*=0.474), or prosthetic status of the antagonistic jaw (*P*=0.71) was identified.

Loosening of locator abutments occurred in two cases after a mean time of 0.27 (± 0.31) years; no significant impact of either the mode of fabrication (*P*=0.102), localization (*P*=.539), or prosthetic status of the antagonistic jaw (*P*=0.745) was identified.

No loss of locator attachments (abutment) was observed.

DISCUSSION

The results of this retrospective study advise acceptance of the research hypothesis, suggesting that loss of retention is a frequently observed event during the clinical service of Locator-attached implant supported denture prostheses.

The authors are aware that the retrospective approach employed in the present study has some weaknesses. All dental prostheses have been manufactured by different dentists – who were, however, all specially trained in prosthodontics – and dental laboratories. In addition to that, the angulation of the implants as well as the character of the nylon inserts employed has been documented rather poorly in the individual patient records. Nevertheless, these phenomena appear to resemble a typical clinical setting more closely than a prospective trial with strict treatment criteria, and particularly for material-based problems, prospective studies are associated with numerous problems,[17] which justify retrospective studies particular in prosthetic dentistry. Correlations between the degree of retention of the nylon inserts employed and the occurrence of the event loss of retention would be wishful, yet these observations would require a prospective approach and standardization of the event loss of retention.

The focus of this study was set on loss of retention and complications with the Locator attachment system; thus, no prosthetic complications associated with the denture base resin such as fractures or relining of the denture base were displayed in the present study. Almost 85% of the Locator-attached dentures investigated were in the lower jaw, which indicates that Locator-attached maxillary prostheses are underrepresented in this study.

However, the edentulous mandibula is more frequently supplied with implants than the maxilla, which is due to the fact that particularly in atrophic jaws the retention of complete dentures is worse in the lower than in the upper jaw; thus, supplying the edentulous mandibula with two or four implants and a simple attachment system has become a frequently performed treatment option that contributes to improve the quality of life.[14] Due to the small number of prostheses in the upper jaw included in the present study, prostheses in the upper and lower jaw and prostheses with two and four implants have been pooled for statistical analyses; however, the authors are aware that the loading conditions can differ significantly in dependence on the localization of the denture as well as the number and distribution of implants.

Two major advantages of this retrospective study include the mean observation period of almost five years, which is – with the exception of one single study published by Cristache and co-workers[20] in 2014 – by far longer than the observation period of the prospective studies that have been published on that issue, and the larger number of cases, as at least 32 patients with Locator-attached implant supported overdentures were included in the analysis.

In the present study, loss of retention occurred in 69% of the included cases and was by far the most frequently observed complication associated with the Locator-attachment system. These results support the laboratory and clinical data published by other groups.[18,19,14,7,20] In contrast to the long-term prospective trial published by Christache, who observed an accumulation of prosthetic complications during the first year and after at least four years after insertion of the prosthesis,[20] no accumulation of events could be identified in the present study. Interestingly, loss of retention occurred multiple times in approximately 40% of the cases included in the study, whereas in 31% no change of inserts was performed at all. This phenomenon indicates that under certain clinical conditions the Locator attachment system has a limited clinical efficacy, which might be due to adverse patient-specific parameters such as the implant angulation, position of denture teeth, or occlusion.

Relining is a frequently performed maintenance procedure in overdentures. With regard to this aspect, the manufacturer of the Locator system recommends an exchange of all nylon inserts when relining the prosthesis. In the present study,[21] denture prostheses were relined during the observation time; in these cases, an exchange of the nylon inserts has not been included in the statistical analyses as an event "loss of retention".

Previous clinical studies investigating loss of retention of Locator-attached denture prostheses either had an observation period shorter than two years or did not report on the time spans between repeated changes of the nylon inserts. For the data gathered in the present study, we observed that the time span between insertion of the Locator-attached denture and the first change of the nylon inserts was decisively longer than the time spans between the first change and any subsequent replacement. This observation might be caused by a random statistical error, as in ten cases no replacement of the nylon insert was performed at all, which contributes to an overall increase in the time span until the first replacement of the nylon inserts. However, the outcome of this retrospective study might also be explained by variations in the retention forces provided by the nylon inserts, as it has been reported that the retention forces of Locator attachment feature high variability in comparison to various ball attachment systems.[19] Nevertheless, further clinical data including previously neglected information such as the angulation of the supporting implants, bone loss, chewing habits, and compliance of the patient, which might have an impact on the wear behaviour of the nylon inserts,[21,22] are wishful to identify and define indications and contraindications of the Locator attachment system. Moreover, position and occlusal design of the denture teeth as well as the type of occlusion might impact the retention of the Locator-attached prostheses. In the present study, most patients were partly or completely edentulous and about 63% were supplied with gum-based prostheses in the antagonistic jaw. With regard to this aspect, no significant impact of the prosthetic status of the antagonistic jaw or the localization of the denture in the upper or lower jaw could be identified. In addition to that, no clinically visible signs of wear of the Locator abutments which might have affected retention values had been documented in the data sets investigated in the present study.

With a prevalence of 6%, fracture of the insert holder was a rarely reported event; most likely, this complication can be attributed to errors in the manufacturing process or deterioration processes. Due to the limited amount of events, data have to interpreted with caution; however, no impact of the manufacturing mode (intraoral or laboratory approach) was identified and fractures of the insert holders did not occur more frequently with prolonged clinical service.

Loosening of the Locator abutment was a rarely observed event and occurred in two cases with different implant systems (Camlog/Astra/Straumann), although the abutments had been fixed with the torque recommended. The results of this study corroborate the outcome of previous studies, which reported loosening of the abutment in one of nine patients after one year,[7 14] loose or lost abutments in 50 patients during a 12-35 month observation period,[23] or no loosening of the abutment in 23 patients during five years of observation.[20]

For the various attachment systems available on the market including balls, magnets, and Locator attachments, similar maintenance costs and prosthetic success rates after five years of clinical service have been reported,[20] which suggests that Locator-attached overdentures are a sufficient restoration that is particularly suitable for the lower jaw of geriatric patients with reduced manual skills. Although complications associated with the Locator attachment system can usually be solved easily, frequent and regular recall examinations are necessary. In addition to that, the results of the present study underline that despite of the low initial costs for supplying patients with the Locator attachment system the frequent need for replacement of the nylon inserts may cause substantial and repeated maintenance costs.

Approximated costs for the exchange of two worn insert holders range around 2.5% of the costs for the initial fabrication of the denture prosthesis without implant placement. Dentists skilled in working with the Locator attachment system can exchange two insert holders within five minutes. Within the limitations of this retrospective study, the frequency of the loss of retention observed in a number of patients highlights the need for prospective studies which correlate patient-specific parameters with prosthetic complications and maintenance requirements associated with Locator attachments.

MANUFACTURERS' DETAILS

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