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Patient perceived burden of implant placement compared to surgical tooth removal and apicectomy

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ABSTRACT

Objective: To assess how patients actually perceive implant placement, to evaluate whether patients' perceived burdens are related to specific stages during implant placement, and to compare patients' perceptions during implant placement with other surgical procedures.

Methods: A sample of 287 patients was consecutively recruited. Only patients with implantations ($n = 45$), surgical tooth removal ($n = 147$), or apicectomies ($n = 95$) were included. Patients' perceptions during oral surgery and implantation were assessed using the Burdens in Oral Surgery Questionnaire (BiOS-Q). Effects of treatment on BiOS-Q total and domain scores were assessed using multivariate linear regression analyses, and effect sizes (Cohen's d) were computed.

Results: Overall, patients' perceived burdens during oral surgery were low indicated by a mean BiOS-Q total score of 28.5 points, with lowest scores for *Side effects* (19.4) and highest scores for *Anesthesia* (34.1). Among treatment groups, implantation was perceived least unpleasant. This was related to lower burdens during *Bone and soft tissue manipulation* during implantation than during surgical tooth removal (difference: 14.8 points; $d = 0.8$) or apicectomy (difference: 13.1 points; $d = 0.7$).

Conclusions: Implantation has a low overall perceived burden and is significantly less burdensome during bone and soft tissue manipulation than surgical tooth removal or apicectomy.

Clinical significance: Patients can be informed that implant placement is less unpleasing than other commonly performed oral surgery procedures.

1. Introduction

The patients' perspective, *i.e.*, how patients perceive their oral health, is increasingly being recognized as an important outcome in modern implant dentistry [1]. The focus for a number of years in the early phases of implant development was more on biomedical outcomes such as implant survival and success rates. This was understandable given the need at that time to provide evidence for survival of implants and corresponding prosthodontic restorations [2–4]. This established, there has been a subtle but definite shift to increased interest in the biopsychosocial outcomes associated with implantation and therefore patient-reported outcomes (PRO), *i.e.*, how patients actually benefit from the implants in a multi-dimensional manner [5]. Most of the studies focusing on PROs evaluate patients' satisfaction with the provision of dental implants and assess the implantation and subsequent prosthetic rehabilitation's effects on oral health-related quality of life (OHRQoL) [6]. These studies demonstrate the positive effects of implants on patients' perceptions for several clinical conditions and various types of implant-based prosthodontic restorations [7–14].

However, while most studies in implant dentistry focused solely on PROs [5] as part of outcome-related quality of care [15], patients' perceptions pre-, peri-, and post-treatment have become of more interest as part of a set of important indicators of process-related quality of care [15] both in general dentistry and implantology. Clearly, surgical procedures are invasive and therefore result in at least a temporal injury of the oral tissues and consequently they are likely to impact on patient's perceptions of the process of care, especially the peri-operative phase. Initial studies on process-related perceptions in general dental and

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implant-based treatment have understandably had a focus on two elements of process-related perceptions: pain [16–18], and the effect of psychosocial characteristics such as anxiety on pain perceptions [19–22]. No one study has, however, examined implantation in comparison to other common oral surgical procedures that are as similarly invasive as implantation, nor has any of the studies examining the implantation process differentiated between different stages or steps of the treatment process. The combination of the differing perceptions of the patient through the pre-, peri-, and post-treatment phases of care is key as there is evidence that each, when assessed individually, will play a role in the overall perception of the implantation process [23–26]. Furthermore, no one of the studies applied validated instruments such as the Burdens in Oral Surgery Questionnaire (BiOS-Q) [27]. This is important as a recent study in prosthodontic patients demonstrated that treatment-related burdens differed not only with respect to treatments performed, for example fixed *versus* removable prosthesis, but also regarding treatment stages with higher burdens identified for anesthesia, followed by tooth preparation and impression taking [28]. This study suggests that patients can differentiate between different treatment stages and allocate perceived discomfort or unpleasantness to specific treatment steps.

Given that patients have been shown to be able to distinguish between stages and form differing perceptions of stages of the treatment process it is important that we systematically examine the burdens of the stages of treatment so we can better inform our patients. We also may then be able to tackle any unrealistic expectations of implant treatments [29,30], and potential barriers such as lack of knowledge, anxiety, and fear of pain [30–32] that prevent patients undergoing an implant-based treatment plan. In addition, if we understand the most burdensome stages of treatment we may be able to adopt differing techniques or modify current techniques to reduce this burden to the patient, thereby improving overall quality of care.

The aims of this study were (i) to assess how patients perceive the peri-operative stages of implantation and whether the overall perceived burden of the surgical implantation process is related to specific stages, and (ii) to compare patients' perceptions during implant placement with other common oral surgical procedures.

2. Material and methods

2.1. Subjects, study design and setting

In this non-randomized study, a convenience sample of 287 patients was consecutively recruited from a private oral and maxillofacial surgery practice in Bremerhaven, Germany. To allow a comparison to be made between burdens in implant placement and other common oral surgical procedures, patients undergoing implantation ($n = 45$), surgical tooth extractions involving bone removal ($n = 147$), and apicectomies ($n = 95$) were included. All implants were placed without additional major surgical intervention such as bone augmentation or sinus floor evaluation. Surgery was performed by a single operator. Patients did not receive prescribed premedication such as sedative pharmacological agents that could potentially affect perceptions during surgery, and no surgery was performed under general anesthesia. A formal sample-size calculation could not be performed due to the lack of available data in the target population before the study started. For further details regarding study design and recruitment see Reissmann et al. [27].

This research was conducted in accordance with accepted ethical standards for research practice, undergoing review and approval by the Institutional Review Board of the Medical Association in Hamburg, Germany (PV3302). Written informed consent was obtained from all participants prior to their enrollment.

2.2. Assessment of patients' perception

Patients' perceptions during oral surgery and implantation were assessed immediately after treatment using the BiOS-Q [27]. It consists of 16 items that can be combined in three separate composite scores for the domains *Anesthesia* (*e.g.*, "puncture for anesthesia" and "numbness during anesthesia"), *Bone and soft tissue manipulation* (*e.g.*, "pressure of cut" and "vibration during osteotomy"), and *Side effects* (*e.g.*, "pressure of cheek retractor" and "joint pain"). Responses for each item were made on a visual analogue scale ranging from 0 for no expression of the specific perception (*e.g.*, not unpleasant at all) to 100 for the maximum expression (*e.g.*, very unpleasant). Since the BiOS-Q is conceptualized to assess negative perceptions such as pain, higher scores equate to greater burdens. Domain scores are calculated as the mean of the contributing items and the total score is the mean of all items. The BiOS-Q has undergone validity and reliability testing in a previous study and been found to be satisfactory in both respects [27].

2.3. Data analyses

Our analytic approach to investigate patients' burdens during implant placement involved several steps: first, we compared patients with implantations (intervention group) with patients undergoing surgical tooth removal or apicectomy (control groups) to examine whether groups differed with respect to demography or treatment characteristic, using non-parametric statistics (chi-square test [sex]), and parametric statistics (independent sample *t*-test [age, number of teeth/implants/regions, duration of treatment]).

Second, we computed BiOS-Q total scores and examined differences in total burden between gender and age groups (defined using the median age of the entire sample of 34 years as a cutoff point) using independent sample *t*-tests. Differences in total burden between intervention and control groups were examined to test whether patients with implantations had differing perceptions of total burden in comparison to patients undergoing surgical tooth removal or apicectomy using one-way analysis of variance (ANOVA).

Third, burden at domain-level (*Anesthesia*, *Bone and soft tissue manipulation*, *Side effects*) across the sample were examined using repeated-measures ANOVA and between intervention and control subgroups using one-way ANOVA, respectively.

As a final stage, we computed several linear regression models with BiOS-Q total or BiOS-Q domain scores, respectively, as criterion (or dependent) variables and treatment type as the predictor (or independent) variable. To do this, we used dummy variables for surgical tooth removal and apicectomy in order to assess whether BiOS-Q scores in these two groups differed from those of the implantation group. All regression models were constructed in an unadjusted manner as a first stage and then were subsequently adjusted for the potential confounders: gender, age, number of teeth/implants/regions, and duration of the intervention. Regression coefficients were computed with 95% confidence intervals (CI). Additionally, Cohen's *d* effect size (ES) was computed as the standardized linear regression coefficient (beta) for all predictor variables using standardized BiOS-Q total or domain scores in the regression models and compared to accepted values: 0.2 is small, 0.5 is medium, and 0.8 is large [33]. For health-related outcomes, an ES of 0.5 is considered clinically relevant [34].

All analyses were performed using the statistical software package STATA MP 13.1 (Stata Statistical Software StataCorp., LP,