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Quality of life improves among post-menopausal women who received bone augmentation during dental implant therapy

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Abstract

Quality of life outcomes among patients receiving implants have been well studied, but little is known about the effects of bone augmentation in this therapy. The purpose of the paper was to assess quality of life changes among postmenopausal women receiving dental implants with bone augmentation during implant therapy. This was a prospective cohort study. Forty-eight patients were recruited at the University of Connecticut Health Center and received one of three surgical augmentation methods: dehiscence repair, expansion alone or expansion with dehiscence repair. The predictor variable was type of augmentation procedure. Quality of life measured by the Oral Health Impact Profile-14 (OHIP-14) was the outcome measure and was assessed prior to treatment, one week, eight weeks and nine months post surgery. Changes in OHIP-14 were evaluated by repeated measures analysis of variance. The mean initial OHIP-14 scores on total items checked was 4.6 (SD=3.0) and declined significantly to 2.0 (SD=2.0) at nine months. The mean baseline severity score was 15.4 (SD=8.9) improving significantly to 7.5 (SD=7.6) at nine months. Type of augmentation procedure did not affect quality of life. The participants' quality of life improved continuously from the pretreatment to the nine-month assessment, including improvements one week after implant placement.

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Keywords

quality of life; dental implants; bone augmentation

INTRODUCTION

A literature review of patient-based outcomes in dental implant research conducted in 1998¹ illustrates the relative paucity of data on patient perceptions of implant therapy with only 19 studies published at that time. Locker's assessment of the literature (1998) indicates that the studies suffer from weak designs and are limited by using unvalidated measures of patient satisfaction. Quality of life impacts are not systematically assessed. A more recent review² indicates that the literature on patient satisfaction with dental implants is expanding, but the quality of the studies remains generally poor. Some studies use their own questions that assess chewing ability, self-image and esthetics^{3,4,5} or use adaptations of generic measures of health related quality of life⁶. Other studies employ standardized and validated measures to assess oral health related quality of life, including the Oral Health Impact Profile^{7,8} and Groningen Activity Restriction Scale –Dentistry⁹. Results from these studies are mixed with some reporting significant improvement in quality of life among patients receiving implant therapy while other studies do not find any differences between those receiving implant supported prostheses and those receiving conventional dentures⁷.

The literature on quality of life or patient-based outcomes in dental implant research assesses the effects of implant-supported overdentures with or without a comparison to patients receiving conventional dentures. Relatively few studies investigate quality of life outcomes among patients receiving single-tooth replacements. Gibard and Zarb¹⁰ report the results of a five-year follow-up of patients receiving one or more single tooth implants; 30 of 49 (61%) patients originally included in the study completed the follow-up survey. Five items assess patient satisfaction with appearance, functioning, cleaning ease, willingness to undergo another implant procedure and willingness to recommend implant therapy. Responses range from extremely dissatisfied (score = 1) to extremely satisfied (score = 5). Total scores could range from 5-25; respondents were very satisfied with outcomes of therapy with a mean score of 23 (SD=1.44). A study conducted in Germany with the German version of Oral Health Impact Profile (OHIP-G 21) compares oral health related quality of life among dentate (n=124) and partially edentulous patients (n=219) and evaluates changes in quality of life after implant therapy¹¹. Partially edentulous patients report significantly worse quality of life prior to treatment compared to the fully dentate group with mean scores on the OHIP-21 of 17.1 and 3.4, respectively. The most common problems are chewing function, worry and dissatisfaction with appearance. Post treatment scores on the OHIP-21 improve significantly to a mean of 5.4, close to the scores of the dentate group.

A recent multi-center trial¹² of single implant placements evaluates the outcomes of implants placed immediately after extractions compared to placement in healed alveolar ridges. The 14-item Oral Health Impact Profile (OHIP-14) is used to assess quality of life outcomes. OHIP-14 is calculated such that higher scores indicate better quality of life. Ninety-six patients received 102 implants and completed the OHIP-14 at four time points: prior to treatment, one, six and 12 months post-treatment. OHIP-14 scores improve significantly over time; mean scores on items are 4.5 at baseline, 4.7 at one month, 4.8 at six months and 4.8 at twelve months. There are no differences between patients treated immediately post extraction compared to those placed after healing.

Studies of single-tooth implants indicate that oral health related quality of life improves after therapy, but none of these studies addresses the effect of bone augmentation on perceived quality of life. The purpose of this study is to evaluate oral health related quality of life among post-menopausal women prior to implant placement with simultaneous bone augmentation and to assess changes in quality of life during and post treatment. We hypothesize that quality of life will decline post surgery when patients may experience discomfort but will improve at eight weeks and nine months as the implant heals and the restoration is completed. We also hypothesize that more invasive bone augmentation treatment, combined expansion/dehiscence, will have more negative impacts on quality of life compared to less invasive methods, such as singular expansion or dehiscence repair. The specific aim of the study was to compare outcomes associated with type of bone augmentation.

MATERIALS AND METHODS

Study Design

This was a prospective cohort study, structured as a “best clinical practice” study. The research team chose the grafting technique according to clinical assessments and radiographic data. . The three surgical augmentation methods were used as follows 1) Dehiscence repair combined with implant placement (slightly deficient alveolar ridges); or 2) Expansion combined with implant placement (moderately deficient alveolar ridge width); or 3) Expansion in conjunction with dehiscence repair combined with implant placement. Ridge width assessment and consequent choice of surgical method were made as a research team utilizing clinical assessments, clinical photographs, panoramic and periapical radiographs and three-dimensional radiographic dicom images acquired using Cone Beam Computed Tomography (CBCT) (CB MercuRay, Hitachi Corp, Japan) obtained at the screening/baseline exams. Alveolar bone morphology at the edentulous area was visually confirmed at the time of surgical entry. Dental treatment included bone augmentation, simultaneous implant placement and implant restoration procedures. For all subjects, treatment included the surgical placement of roughened titanium (Ti) solid screw implants (3.3 mm, 4.1 mm or 4.8 mm diameter). Prosthetic procedures (including placing load and torque through abutment placement) were started eight to ten weeks after surgical implant placement; three participants received provisional replacements prior to final restorations. Prosthetic reconstruction consisted of either single crown or (up to three unit) multiple unit fixed prosthesis placement. Questionnaires were administered by trained research staff at baseline (prior to treatment), one week, eight weeks and nine months post implant placement. Questionnaire instructions were reviewed at each time point.

Sample

The study was approved by the University of Connecticut Health Center’s Institutional Review Board. Patients were recruited at the University of Connecticut Health Center through newspaper, newsletter, internet, broadcast messages at the Health Center and radio advertisements as well as through the Osteoporosis Center and Dental Implant Center. To be eligible, patients had to: 1) be female; 2) age 55 to 80 years; 3) have had at least twelve remaining teeth; 4) one intra-oral edentulous area with a narrow alveolar ridge. Patients were excluded if they: 1) had been diagnosed with bone metastasis, Paget’s disease, hyperparathyroidism; 2) were undergoing long-term corticosteroid therapy; 3) were receiving PTH treatment. Forty-eight patients have completed the nine-month assessment.

Study Variables

Predictor Variable—The predictor variable was type of bone augmentation: 1) Dehiscence repair combined with implant placement; or 2) Expansion combined with

implant placement; 3) Expansion in conjunction with dehiscence repair combined with implant placement.

Outcome Variables—The main outcome variable was oral health related quality of life which was measured by the Oral Health Impact Profile-14¹³. It consisted of 14 items and assessed the frequency of problems with pain, eating, speaking, self esteem, functional status and psychological well-being. The response set was a 5 point scale from “Very often” (score of 5) to “Never” (score of 1). Two scoring methods were used: 1) Total items checked, a count of the number of items when the participant responded “Very often, fairly often and occasionally”; 2) Severity, the sum of the total score, ranging from 14-70. This scale has been used in previous studies of implant therapy¹⁴ and has well-established validity and reliability¹⁵. The items are listed in Table 1 although it should be noted that item #7 is slightly different from the original OHIP which stated unsatisfactory rather than satisfactory. However, internal reliability was very high with Cronbah’s alpha at 0.860 at the baseline measure, 0.872 at week 1 and 0.84 at week 8 and 0.877 at 9 months. This item had no effect on internal reliability.

Demographic characteristics

Data were collected on age in years, marital status (married, divorced, widowed and single/never married), education (high school or less; some college and college education or more), employment status, race (White, African American, Asian, Native American, Pacific Islander, Other) and family income (<\$20,000, \$20-29,999, \$30-39,999, \$49-49,999, \$50-74,999, \$75-99,999, >\$100,000). Because of small numbers in some categories, marital status was dichotomized as married/not married; race also was dichotomized as white/other; and family income was grouped into four categories as \$<30,000, \$30-74,999, \$75-99,999, >=\$100,000

Data Analysis

The analysis began with the description of the sample, including the distribution of demographic characteristics, type of bone augmentation and OHIP scores of the sample. This was followed by analysis of the bivariate relationships between demographic characteristics, type of bone augmentation and OHIP scores. Repeated measures analysis of variance assessed trends over time in OHIP and the effects of type of bone augmentation on OHIP over time adjusting for demographic characteristics.

RESULTS

Table 2 presents the descriptive characteristics of the sample. The mean age was 61.9 (SD=5.5), the majority were married (52.1%), had a college education (56.3%), were white (85.4%), employed (62.5%) and had family incomes between \$30,000 and \$99,999 (53.5%). Half of the sample received a combined expansion with dehiscence procedure, 22% received dehiscence only and 27.1% received expansion only. There were no significant differences in the demographic characteristics by type of grafting technique assuring that these factors were equally distributed among the surgical groups.

Table 2 presents the unadjusted means scores of the OHIP at four time points. The initial score on total items checked was SD4.6 (SD=3.0) and declined to 2.0 (SD=2.5) at nine months. The baseline severity score was 15.4 (SD=8.9) and improved to 7.5 (SD=7.6) at nine months. Both measures of change over time assessed by repeated measures analysis of variance were significant (F=46.1; df:1;47; <0.00 for counts; F=51.2; df:1;47; p<0.001 for total severity). Both scores declined, indicating improvement at each time point. A paired t-test showed that the changes in the total counts and total severity scores from baseline to one

week were not significant ($p>0.05$) With the exception of age, none of the demographic characteristics were significantly related to the OHIP measures at any time point or to changes over time. Those who were younger had significantly worse scores on total counts and severity compared to older age groups. Those 55-59 had a means score of 5.8 (SD=2.4) on total counts compared to 4.2 (SD=2.9) for 60-64 year olds and 3.4 (SD=3.6) for those over 65 ($F=3.2$; $p<0.05$). For severity, means score for those 55-59 years was 19.0 (SD=6.2) compared to 13.1 (SD=8.9) for 60-64 year olds and 12.7 (SD=11.1) for those over 65 ($F=3.4$; $p<0.05$)

We assessed the effects of procedure type on quality of life outcomes hypothesizing that more invasive procedures, such as combined expansion with dehiscence, might have greater impacts on quality of life. Figures 1 and 2 present the means of the number of items checked and severity scores at each assessment point by type of procedure adjusting for covariates. The interaction of time by surgical procedure was not significant) indicating that there were no significant differences by procedure type by time. None of the covariates were significant in the multivariate analyses.

DISCUSSION

The specific aim of the study was to compare quality of life outcomes associated with type of bone augmentation among post-menopausal women receiving implant therapy. We hypothesized that quality of life will decline post surgery when patients may experience discomfort but will improve at eight weeks and nine months as the implant heals and the restoration is completed. We also hypothesized that more invasive bone augmentation treatment, combined expansion/dehiscence, will have more negative impacts on quality of life compared to less invasive methods, such as singular expansion or dehiscence repair.

Our hypotheses were partially supported. The participants' quality of life improved continuously from the pretreatment to the nine-month assessment. We anticipated improvements over time, but it was surprising that the scores improved or did not change significantly at the one-week post therapy point when we expected patients to experience transitory negative QOL impacts from the therapy, due to post-operative pain/discomfort, particularly since bone augmentation procedures were employed. Perhaps the *anticipated* esthetic and functional benefits from the implants led to improvements or maintenance in perceived quality of life. However, it is a positive finding that implant therapy does not appear to negatively impact well-being in the short term and enhances well-being in the longer term.

We also expected type of augmentation procedure to affect outcomes. However, there were no significant differences in QOL over time related to procedure type. Participants who received dehiscence, only, tended to have more improved QOL scores over time, but these differences were not significant.

A challenge confronting our ability to place our findings in the context of the literature on oral health related quality of life is that studies have used various versions of the OHIP and methods of calculating scores. For example, previous studies have used the OHIP-49 to assess quality of life¹⁶ or, in the case of the National Health and Nutrition Examination Survey 2002-4, only seven OHIP items were used to assess quality of life making, comparisons to our study difficult¹⁷. Two large cross-sectional international community-based studies used the OHIP-14 to assess quality of life. Findings from these studies showed that mean severity scores of a cross-section of adults was 7.4 (se=0.13) in Australia (n=3,406) and 5.1 (se=0.11) in the UK (n=3,662)^{16,17}. The mean OHIP-14 severity score for our sample at baseline was 16.4 (SD=3.4). Compared to these international studies, our

participants reported a high level of impact on quality of life at baseline but had substantially improved OHIP scores at eight weeks and nine months post implant placement. The scores in our sample at nine months (mean = 7.6; SD=7.3) approximated the scores in Australia and the UK.

CONCLUSIONS

Participants' oral health related quality of life improve significantly over time. There are several limitations to the study. This was a relatively small sample of convenience and included only postmenopausal women limiting the generalizability of the findings. This was an observational study and there was no control or comparison group against which to gauge these improvements. Tooth replacement by other methods could yield similar improvements in perceived quality of life.

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Figure 1.
Adjusted mean values of OHIP-14 total count scores with standard errors at each assessment point by type of procedure

Figure 2.
Adjusted mean values of OHIP-14 total severity scores with standard errors at each assessment point by type of procedure

Table 1**Oral Health Impact Profile – 14 Items**

1. Have you had trouble pronouncing any words because of problems with your teeth, mouth or dentures?
2. Have you felt that your sense of taste has worsened because of problems with your teeth, mouth or dentures?
3. Have you had painful aching in your mouth?
4. Have you found it uncomfortable to eat any foods because of problems with your teeth, mouth or dentures?
5. Have you been self conscious because of your teeth, mouth or dentures?
6. Have you felt tense because of problems with your teeth, mouth or dentures?
7. Has your diet been satisfactory because of your teeth, mouth or dentures?
8. Have you had to interrupt meals because of your teeth, mouth or dentures?
9. Have you found it difficult to relax because of your teeth, mouth or dentures?
10. Have you been a bit embarrassed because of your teeth, mouth or dentures?
11. Have you been a bit irritable because of your teeth, mouth or dentures?
12. Have you had difficulty doing your usual jobs because of your teeth, mouth or dentures?
13. Have you felt that life in general was less satisfying because of your teeth, mouth or dentures?
14. Have you been totally unable to function because of your teeth, mouth or dentures?

Table 2

Descriptive Characteristics of the Sample

Variable	Mean (SD)	Percent (n=48)
Age		
Mean (sd)	61.9 (5.5)	
55-59		44.7
60-64		25.5
65+		29.8
Marital Status		
Married		46.9 52.1
Not Married		
Education		
High School		16.7
Some College		27.1
College +		56.3
Race		
White		85.4 14.6
Other		
Employment Status		
Employed		62.5 37.5
Not Employed		
Family Income		
<\$30,000		23.3 32.6 20.9 23.3
\$30-74,999		
\$75-99,999		
>=\$100,000		
Procedure Type		
Dehiscence		22.9 27.1 50.0
Expansion		
Expansion w-Dehiscence		
Unadjusted OHIP Scores		
Pretreatment		
Total checked	4.6 (3.0)	
Severity	15.4 (8.9)	
One Week		
Total checked	4.5 (3.2)	
Severity	13.7 (8.2)	
Eight Weeks		
Total checked	3.1 (2.7)	

Variable	Mean (SD)	Percent (n=48)
Severity	10.6 (7.5)	
Nine Months		
Total checked	2.0 (2.5)	
Severity	7.5 (6.6)	