

Quality of Life of Endodontically Treated versus Implant Treated Patients: A University-based Qualitative Research Study

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Abstract

Introduction: Up-to-date studies comparing endodontic treatment versus implant-supported prosthesis have shown similar clinical outcome and survival rates. However, no data are available comparing both treatment modalities based on the patient's perception of quality of life. This study was designed to qualitatively describe and compare the quality of life of patients with restored, single endodontically treated teeth versus patients with single implant-supported fixed prostheses.

Methods: Forty-eight patients agreed to participate in the study ($n = 24$ from each treatment modality). Of those, 37 actually participated in the study: 17 were endodontically treated and 20 had an implant-supported prosthesis. Patients in each of the two groups were randomly selected from the Graduate Endodontics and Graduate Periodontics Departments, respectively. Six focus group discussions ($n = 3$ per treatment group) were held and audio-recorded for subsequent thematic analysis. Data were analyzed to identify common themes within each category and compared to assess any differences in quality of life between the two treatments. Additionally, a quality of life survey, the shortened version of the Oral Health Impact Profile (OHIP-14), was given before the discussion group and the responses analyzed. **Results:** The results obtained from this study show similar overall OHIP scores and show a high rate of satisfaction with both treatment modalities. Content analysis of the discussion groups revealed several themes and subthemes. The major themes were importance of overall health, financial implications of the treatments, perception of the treatments and its outcomes, time since treatment, and follow-up dental visits. **Conclusions:** The results help identify patients' perception and concerns with each treatment modality and assist the clinician and patient in the selection of an optimal treatment for their given

situation. In addition to the prognosis and outcomes, clinicians should consider patients' perceptions and preferences as well as the influence each therapy may have on their quality of life, both short- and long-term. Overall, all the participants in this study were pleased with the treatment received and expressed a clear message to save their natural dentition whenever possible. (*J Endod* 2011;37:903–909)

Key Words

Endodontics, implants, Oral Health Impact Profile, quality of life, root canal

It is now a very common occurrence for a clinician and a patient to be confronted by the following treatment question: "Should a tooth be saved through root canal treatment and restoration or be extracted and replaced with a single implant-based supported prosthesis?" Every patient has a unique case prohibiting a perfect answer that fits everyone's situation. Although the decision-making process is critical because of the irreversible consequence of losing a tooth, guidelines are lacking to assist the clinicians and patients in making an informed, evidenced-based decision (1–3).

Clinicians are ethically bound to inform patients of all reasonable treatment options, inform them of benefits and risk factors involving available treatment options, and obtain informed consent before initiating treatment. Clinical treatment decisions regarding endodontic or implant therapy must always be made in the best interest of the patient as well as be based on the best, most currently available evidence.

Several factors should be considered when treatment planning whether to perform endodontic therapy or extract a tooth and place an implant (4). Among these are patient-related factors (ie, systemic and oral health, esthetic demands, and comfort and treatment perceptions), tooth- and periodontium-related factors (ie, pulpal and periodontal conditions, restorability of the tooth, color characteristics of the teeth, quantity and quality of bone, and soft-tissue anatomy), and treatment-related factors (ie, cost-benefit ratio, the potential for procedural complications, required adjunctive procedures, and treatment outcomes) (4–6).

It is also important to remember that there are multiple risk factors for both implant and endodontic treatment. For implant treatment, risk factors include smoking, diabetes, decreased estrogen levels in postmenopausal women, bone quantity and quality, and use of intravenous bisphosphonates (7–14). Risk factors for nonsurgical endodontic therapy include smoking, diabetes, apical periodontitis, and inadequate coronal restoration (14–16). These risk factors need to be taken into consideration when treatment planning for either treatment.

Several outcome studies have investigated both implant and endodontic therapy. Retrospective, meta-analysis, and systematic review studies have all shown similarly high success rates between the two treatment types (6, 17, 18). However, it is difficult to compare the two because studies vary considerably in design, success definition, assessment methods, operator type, and sample size (18). Outcomes of root canal treatment are usually assessed by stringent criteria including complete healing of periapical disease and clinical function without signs or symptoms. A tooth that has incomplete radiographic healing at the time of re-evaluation would not be considered a success by this definition, even if it was asymptomatic and fully functional (19, 20). Outcome criteria for implants have been primarily judged by the implants'

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survival and functionality in the mouth. An implant with a draining sinus tract would be considered surviving. This leads to the important question, “Can endodontic and implant success rates really be compared?”

Both nonsurgical root canal therapy followed by an appropriate restoration and single-tooth implants are excellent treatment modalities for the treatment of compromised teeth (1, 17). Although current studies have evaluated and compared outcomes of both procedures in a quantitative manner (ie, success rates) (6, 17, 18) and have evaluated risk factors associated with each treatment modality (7–15), no data are available comparing both treatment modalities in a qualitative manner. Evaluating patients’ perceptions and the psychosocial effect on their quality of life are likely critical to patients and therefore should be taken into consideration by the clinician (18).

Qualitative research can provide a deeper understanding of, or insight into, a particular problem (21). Focus group discussions are “interviews” with small groups of relatively homogeneous people with similar backgrounds and experiences. Participants are asked to reflect on the moderators’ questions, provide their own comments, listen to what the rest of the group has to say, and react to their observations. The main purpose is to elicit ideas, insights, and experiences in a social context in which people stimulate each other and consider their own views along with the views of others (22). The results obtained from qualitative studies help to identify and contextualize patients’ perceptions and concerns with each treatment modality and may assist the clinician and patient in the selection of an optimal treatment for their given situation. The purpose of this study was to compare the perceived quality of life of patients who received single-tooth endodontic therapy versus those that received single implant-supported prosthesis.

Materials and Methods

Subject Recruitment and Inclusion Criteria

Patients treated at either the Graduate Endodontic Clinic or Graduate Periodontic Clinic were considered for this study. Patients’ charts were randomly selected from the database of the respective departments and screened for eligibility based on the predetermined criteria. No clinical or radiographic examination was conducted as part of this study.

Patients were telephoned using a detailed recruitment script and invited to participate in the study. Twenty-four patients in each treatment modality (single-tooth nonsurgical endodontic therapy vs single implant-supported prosthesis) were approached for participation. Patients who were willing to participate were asked to choose one of three focus group discussion dates. All study materials and approaches were approved by the University Institutional Review Board. Consent was obtained by all participants before their participation.

Inclusion criteria included the following: (1) patients who received one root canal therapy or a single implant-based rehabilitation, (2) patients with a coronal restoration with at least 1 year in occlusal function, (3) patients whose treatment was provided by clinicians with the same level of proficiency (ie, graduate students in the respective departments), (4) patients who were ≥ 18 years old, and (5) patients who were American Society of Anesthesiology I and II.

Quality of Life Assessment (Oral Health Impact Profile)

Immediately before the focus group discussion, all participants were asked to complete a quality of life survey, a shortened version of the Oral Health Impact Profile (OHIP-14) (23). The OHIP measures people’s perceptions of the social impact of oral disorders on their well-being (24). The aim of this index is to provide a comprehensive measure of self-reported dysfunction, discomfort, and disability arising from oral conditions. It is based on Locker’s adaptation of the World

Health Organization’s classification of impairments, disabilities, and handicaps (25). In the World Health Organization model, impacts are organized linearly to move from a biological, to a behavioral, to a social level of analysis. Slade and Spencer (24) adapted this by proposing seven dimensions of impact of oral conditions on the patients’ well-being (7 items within each dimension for a total of 49 items: OHIP-49). The seven dimensions include the following: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. A shortened version (OHIP-14) was later developed based on controlled stepwise regression analyses that yielded a subset of 14 items (two items within each of the seven dimensions, $R^2 = 0.94$) (23). The short form of the OHIP was found to be valid ($P < .05$, associated with clinical oral status and sociodemographic variables) and reliable (Cronbach alpha = 0.88). Each item is scored on a five-point scale ranging from “never” (coded 0) to “very often” (coded 4). Table 1 lists the OHIP-14 dimensions and individual items.

Focus Group Discussions

A semistructured discussion guide was constructed and used by the moderator during the focus groups. The guide included questions related to oral health quality of life, perception of oral health/teeth in general, and treatment experiences (Table 2). The same moderator and comoderator conducted all three discussion groups. The discussions were audio-recorded for data-analysis purposes using a digital recorder. The discussions lasted approximately 90 minutes for each group. All participants were provided food and beverages during the discussion and were compensated for their time and travel expenses.

TABLE 1. OHIP-14 Items

During the last year, how often have the following occurred?	
1. Functional limitation	Have you had trouble pronouncing any words because of problems with your teeth, mouth, or dentures? Have you felt that your sense of taste has worsened because of problems with your teeth, mouth, or dentures?
2. Physical pain	Have you had painful aching in your mouth? Have you found it uncomfortable to eat any foods because of problems with your teeth, mouth, or dentures?
3. Psychological discomfort	Have you been self-conscious because of your teeth, mouth, or dentures? Have you felt tense because of problems with your teeth, mouth, or dentures?
4. Physical disability	Has your diet been unsatisfactory because of problems with your teeth, mouth, or dentures? Have you had to interrupt meals because of problems with your teeth, mouth, or dentures?
5. Psychological disability	Have you found it difficult to relax because of problems with your teeth, mouth, or dentures? Have you been a bit embarrassed because of problems with your teeth, mouth, or dentures?
6. Social disability	Have you been a bit irritable with other people because of problems with your teeth, mouth, or dentures? Have you had difficulty doing your usual jobs because of problems with your teeth, mouth or dentures?
7. Handicap	Have you felt that life in general was less satisfying because of problems with your teeth, mouth, or dentures? Have you been totally unable to function because of problems with your teeth, mouth, or dentures?

0 = never, 1 = hardly ever, 2 = occasionally, 3 = fairly often, and 4 = very often.

TABLE 2. Discussion Guide Questions

1. Before you received your endodontic treatment or implant, how did you feel about the importance of keeping your own teeth?
2. Before your treatment, how often did you visit the dentist? What was your main reason for visiting the dentist?
3. After your treatment, how often have you visited the dentist? What has been your main reason for visiting?
4. Describe your daily life experience since having your treatment.
5. How does your endodontically treated tooth or implant feel compared with your other teeth?
6. How does your endodontically treated tooth or implant affect your eating? Drinking? Does it feel different to eat or drink now?
7. How does your endodontically treated tooth or implant affect your appearance? How has it affected your appearance and smile?
8. Thinking back to the procedure when you had your endodontic treatment or implant, how would you rate the pain? What was your level of pain after the procedure? Currently?
9. Can you describe any issues or concerns with maintaining your implant or endodontically treated tooth?
10. If you had to go back for maintenance, how many times and what type of procedures were done?
11. Are you satisfied with the result of your root canal-treated tooth or implant?

Data Analysis

The OHIP-14 data were coded and entered into SPSS (v.16; IBM Corp, Somers, NY) for analysis. The dependent variables were based on the responses to the OHIP-14 made on a five-point ordinal scale (“never” coded “0”, “hardly ever” coded “1”, “occasionally” coded “2”, “fairly often” coded “3”, and “very often” coded “4”). Two variables were calculated; prevalence was defined as the percent of individuals who responded “occasionally” to “very often” on any of the items, and severity was defined as the sum of the ordinal values of the 14 items. Statistical significance of the prevalence scores and the mean levels of the severity scores between treatment groups and between sexes were calculated using the chi-square, Fisher exact test, and Mann-Whitney *U* tests, respectively. Descriptive statistics (mean and standard deviation) and frequency counts were run for the items and dimensions. The level of significance was set at $\alpha = .05$.

Analysis of the discussion of the focus groups was transcript based. Digital recordings of the discussions were uploaded and transcribed by an individual unaffiliated with the study. The resulting transcripts were reviewed for accuracy and analyzed for content. All of the transcripts were reviewed by two individuals to establish a thematic coding scheme; any disagreements on the themes and subthemes were discussed and mutually resolved. Codes and subcodes were assigned for the mutually agreed-upon identified themes and subthemes, respectively. Furthermore, other thematic categories that were identified during the coding process were added to the coding scheme. As described by Bailey and Jackson (26), analysis of the transcripts used a mixed-method approach using both inductive (eg, grounded theory) and a priori (eg, theory driven from the literature) procedures. This approach was used because researchers inevitably bring their prior theoretical stance or research experience to the coding process. Coding of the transcripts was performed by the principal investigator (DG). A second individual coded slightly less than 20% of the transcripts to compare agreement. The transcripts were analyzed to identify common themes and subthemes within the discussion groups and compared with each type of treatment to a sufficient level of saturation. After coding was completed, the content within each thematic code and subcode

was collated and summarized. Participants’ quotes were used to highlight relevant themes and subthemes.

Results

Overall, there were 37 individuals who participated in the six focus group discussions. Patients from both treatment categories were divided into three groups based on their scheduled session. The implant-treated groups ($n = 20$) included 12 women and 8 men, whereas the endodontically treated groups ($n = 17$) included 12 men and 5 women. The overall mean age was 57. The implant-treated patients included 4 anterior and 16 posterior implants. The endodontically treated patients included 3 anterior- and 14 posterior-treated teeth.

All participants completed the entire OHIP-14 instrument before the discussion group. All OHIP items had a majority of individuals who responded that they never experienced the oral health-related quality of life impact after their treatment (range across items, 60%–94%). Figure 1 shows the percent distribution of responses across the seven dimensions for the categories “occasionally” to “very often.” (Responses within each OHIP-14 item do not equal 100 because the “never” and “hardly ever” categories are not included). In this study, very few individuals experienced the impacts “fairly often” or “very often.” The most commonly experienced oral health-related quality of life impacts across participants were in the dimensions of physical pain (painful aching, 22%; uncomfortable to eat, 30%), and psychological discomfort (self-conscious, 30%; felt tense, 22%).

The treatment groups were not significantly different across the items. There was a significant difference in the mean severity score (range, 0–24) between the two treatment categories (endodontic treatment group mean = 7.5, implant treatment group mean = 3.8). Further analyses examining the mean severity score within each of the seven dimensions found a significant difference between treatment groups in the following two of the seven dimension scores: psychological discomfort ($P = .01$) and psychological disability ($P = .02$) scores, with the endodontic treatment group reporting higher scores. Higher scores indicate worse oral health-related quality of life. Upon further investigation, when comparing male with female scores within the endodontic treatment group, women reported a significantly higher score in psychological disability ($P = .04$). The comparison between male and female mean severity scores within the implant-treated group revealed a significantly higher score for women in the physical disability dimension ($P = .04$).

Content analysis of the discussion groups revealed commonly mentioned participant remarks (Table 3). These data were organized into several themes and subthemes (Table 4). The most significant themes were importance of overall health, financial implications of the treatments, perception of the treatments and its outcomes, time since treatment, esthetics, functionality, and follow-up dental visits.

Importance of Overall Health

Overall, most participants in both groups either mentioned or agreed that keeping their teeth and having a healthy smile was important to and an indicator for their overall health. They made the connection of their dental health to their overall health.

Keeping Teeth in General

All participants except one individual in the endodontic group felt it was important to keep their teeth and they see it as a high priority (97.3%). They would do whatever they could to keep their teeth. Common statements were made such as, “Well, I’ll say this okay, I want to keep every tooth I got, okay.”

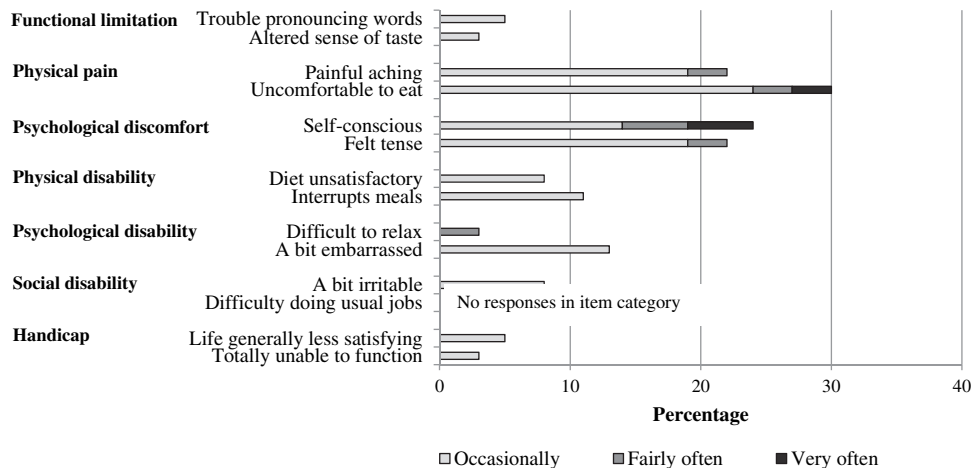


Figure 1. The distribution (%) of responses to each of the OHIP-14 items for all participants. Note that the responses within each OHIP-14 item do not equal 100 because the “never” and “hardly ever” categories are not included.

Family/Peer Influence

Family or peers have a strong influence on what treatment patients elect to receive. Participants mentioned this as their reason to have certain treatments performed or how well they took care of their teeth at certain times in their lives. A few participants talked about family and friends who have lost their teeth and that they are “paying for it now.” This helped influence them to keep their teeth.

Oral Hygiene Prevention

Overall, most participants in both the implant and endodontic group seem to clean their teeth better and see the dentist more often for regular cleanings and checkups since the time of their treatment.

Financial Implications of Procedure/Cost of Treatment

The financial aspect and cost of dental treatments guides people in their treatment decisions. Most participants in both groups felt that the cost of their respective treatment was expensive. Many participants in both groups chose to come to the dental school for treatment because it was less expensive than outside the dental school. In the implant group, a few individuals commented on the fact that when they were younger and could not afford certain treatments, they just had teeth extracted. Later in life, finances still influence their treatment decisions, but they are more likely to do things like get implants because they can afford them now. The issue of cost came up as the rationale to

protect the implant or clean it better, or led to the feeling that “they better hold on to it for a long time.” The endodontic group also weighed the financial aspect of treatment before deciding on getting endodontic treatment and keeping a tooth.

Insurance Coverage

Whether a treatment is covered by insurance or not plays a key role as to whether patients will get a certain dental treatment. Almost all participants that have dental insurance in the implant group stated that their insurance does not cover the cost of an implant. Participants in the endodontically treated group who had insurance stated that insurance covered most of the cost of their root canal and crown. Although many in the endodontically treated group thought treatment was expensive, those that had insurance said it really helped.

Additional Costs

Several participants from both groups mentioned that they were surprised about additional costs on top of the initial price quoted to them for their implant or root canal. Some endodontically treated participants stated that their insurance does not cover as much of the crown as the root canal. One individual stated, “The cost was a big thing when I got into it. The crown, even with insurance...I don’t think the root canal was that bad with our insurance but the crown portion

TABLE 3. Commonly Mentioned Remarks within the Endodontically Treated Root Canal Therapy (RCT) Group, Implant-treated Group, and within Both Groups

RCT groups	Implant groups	Implant and RCT groups
Patient with preoperative pain are happy with little or no pain during and after treatment	Tendency to protect the implant while eating (ie, eat on the other side)	Both groups feel it is important to keep their teeth
Complain of having to open mouth a long time	Difference in cleaning than other teeth (ie, floss more, toothpicks, and so on)	Part of their overall health
Surprised of less pain with procedure than what they had heard from other people	Esthetics, dark area near the gums	Surprised of cost of crown on top of the treatment
The worst pain during treatment was from the anesthetic injection	Long time to get everything done	Trouble flossing because of tight contact of new crown
Follow-ups are short appointments	The worst pain from the procedure was the extraction	Those with treatment in the anterior feel better esthetically
Peace of mind that infection is gone	Multiple appointments	Peer influence of getting respective treatment done
Tooth feels “numb”; no sensitivity to hot or cold		Minimal pain during treatment
No change in maintenance compared with the other teeth		Patients go to the dentist more regularly after treatment
		Satisfied overall with treatment

was just...the copy was a lot...and I only had one. I can't imagine if you had a lot more than that."

Perception of Treatment and Its Outcome

Keeping the Tooth/Implant. Most participants were very happy with the implant treatment and its outcome. Even participants that experienced minor problems during the procedure or after including pain were still pleased with the overall outcome.

In the endodontic group, keeping the tooth in question was a primary reason for most of the participants to get endodontic treatment as well as the reason for their satisfaction with the treatment. All participants were happy at the overall outcome of their treatment, even if there were mishaps along the way. It was not uncommon to get comments like, "I was delighted to have that opportunity to save the tooth."

Physical Pain. Two participants within the implant discussion groups said they had pain after the implant placement, after crown placement, and still continue to have pain in the area although the implant is functional. It seemed as though the postoperative pain the participants described was more of a dull, nagging pain. Some participants described their pain as coming from the bone or jaw, and a couple of people stated that they had pain in the gingival tissue next to the implant. Some said they also noticed some numbness in certain areas of the mouth and face for some time after the procedure. A couple of individuals in the endodontic discussions also commented that they can still feel "sensation" or "sensitivity" at times but that it is not painful.

Physical Pain of Procedure. Although most individuals in the implant group agree that there is only minor pain during the procedure, an overwhelming number of participants stated that the worst pain of the whole procedure was the extraction of the tooth before implant placement. A few participants classified the pain during the procedure as more than mild, and a couple participants mentioned postoperative swelling. Some participants made comments about pain medications helping reduce their pain after the procedure.

Some participants in the endodontic treatment category stated having sensation during the procedure but no pain. Some stated having a little pain during or after the procedure, but they said it was manageable. One person even stated they were surprised at the "lack of pain" during the procedure. The issue came up that root canal treatment has somewhat of a bad rap, and participants stated that they always heard how terrible root canals were. However, they were surprised because the procedure was tolerable.

Reduction of Prior Pain. Participants mentioned implant treatment as reducing any pain experienced before the procedure. Others

in the endodontic group stated that the main reason they were happy with the treatment was because it completely eliminated their previous pain.

Length of Treatment

Open Mouth in Chair Process. Within the implant groups, there was a common complaint of how long it took to get everything completed, including the crown placement. Most participants recall at least a 3- to 6-month gap between the time of implant placement and receiving their crown. Those that had bone grafts done before the implant placement had to wait an extra 4 months after the bone graft to get the implant. Others said they had a tooth extracted and had to wait a few months for their site to be ready for an implant. For the actual length of the implant placement procedure, most felt it took a long time. Overall, the general consensus was that participants felt the overall process took a long time. However, it seems that patients are happier when they know what to expect beforehand.

For the endodontic groups, the most common complaint was the length of time they had to spend with their mouth open. One participant commented that "The only thing I think that I didn't feel very comfortable about, you have to keep your mouth open for a while." Some commented that if a bite block was used to help them stay open it did help, but they were still uncomfortable. A few participants commented that their jaw was sore or that it was hard to close after the procedure. Another concern that came up was that the crown took a couple of appointments after the endodontic treatment.

Time Since Treatment. The time since treatment in the implant group varied from 1 to 6 years. The time since treatment in the endodontic group varied from 1 to 3.5 years. Overall, the average time since treatment was longer in the implant group than in the endodontic group.

Esthetics. Many participants got their implants in order to improve the esthetics of their mouth and/or to keep other teeth from shifting or moving in their mouth. In some cases in which participants were missing a tooth or had a broken tooth in the site of the implant, they were happy to have a "tooth" again. One participant stated, "Well after going around with no tooth, you're in a position where you can talk and smile again. It was wonderful." Some also said that the implant and crown added some fullness to their face where they noticed a concavity where their tooth was missing. Other participants said that they open their mouth more, smile more, and feel more confident. Some participants were positively surprised how much their implants looked like their natural teeth.

The position of the implant in the mouth also seemed to dictate how satisfied patients were with the esthetics of their implant. Patients

TABLE 4. Data Organized into Several Themes and Subthemes

Themes	Implant groups	ENDO groups
Importance of overall oral health	Both groups felt that it was important to keep their teeth; part of their overall health.	
Financial implications of treatment	Cost of treatment is high. Insurance does not cover implant treatment. Surprised about the additional costs of the crown.	Cost of treatment is high. Insurance usually covers most of the endodontic treatment. Surprised about additional costs of the crown.
Perception of the treatment and its outcomes	All participants were pleased overall with the treatment received. Most felt treatment took a long time (ie, time mouth was open and length of treatment).	
Time since treatment	1-6 years	1-3.5 years
Follow-up dental visits	Follow-up visits consisted of crown and normal recall appointments. No follow-up visits for maintenance issues or problems other than regularly scheduled follow-up visits.	Follow-up visits consisted of permanent restoration and/or crown and normal recall appointments. Some participants did not go to their recalls because they were not in pain.

ENDO groups, endodontically treated groups.

with posterior implants seemed less aware of esthetic changes compared with those who had implants placed in the anterior area. Also, in one case, the participant got a full gold crown because it was recommended by the restoring dentist, and he was not happy with how much it stood out. A few others commented on the fact that there is a dark area near the gum line that stands out when they look in the mirror and in pictures. A few participants also noted a concavity or recession of their gingiva around their implants.

All participants in the endodontic group either thought that the endodontic treatment either had no effect on their appearance or made it better. Some stated that considering the alternative of losing the tooth, it made a considerable effect on their appearance, no matter whether the tooth was in the anterior or posterior. Others thought that because their root canal was in the posterior, it had no effect on esthetics. One participant stated they were pleased the root canal could be done through their previous crown and that they did not have to remove it before their root canal was performed.

Functionality

Eating/Drinking. The functional aspect of implant placement is one of the most commented aspects of implant placement. In many cases, participants were happy that they could return function to the area of the mouth where the implant was placed. Many commented that their implant functioned like a real tooth. A few participants said they still chew on the opposite side out of habit or because they are trying to protect the implant. A common complaint was that they get food stuck between the implant and the teeth next to it. A few participants mentioned not eating hard foods such as carrots or not biting directly into an apple because they were told to by their doctor who placed the implant, or they just wanted to protect it.

Many endodontic participants stated that they started using the tooth to eat again or started chewing on that side of their mouth again. Some stated the endodontic treatment had no effect on their eating and drinking.

Psychological Discomfort. Many individuals in the implant group mentioned trying to protect the implant or being more careful with it because of its cost or because they are afraid they might break it or lose it. Others mention that it feels different or looks different, but it might just be psychological. Some individuals who had bone grafting mentioned the fact that the bone was from a pig or cow. They did not like the thought of having animal or foreign material in them.

With any treatment, there is a psychological aspect to consider. Addressing this, one endodontic participant stated, "It's really important for me to keep my teeth. It always has been. It's kind of a combination of things, the psychological aspect; these are body parts of mine I've had my whole life. I'm kind of attached to them, and there's the emotional side too. I wouldn't want to lose a finger or a toe if I could help it." Others commented that they feel more confident now that they saved their tooth and smile more. Some stated they were glad to have the infection or abscess gone.

Physical Disability. As mentioned earlier, there were participants in both groups who said they either protect their tooth or implant by trying to eat in other areas of their mouth or by eating slower.

Cleaning/Maintenance. Most participants in the implant group take better care of their teeth and get their teeth cleaned more often since their implant because they do not want to lose any more teeth. They also brush and floss around the implant more to keep food from getting caught or because they want to take good care of it. Some even mentioned using a toothpick or proxibrush to get between their implant and the teeth next to it. Others mentioned using an electric toothbrush now. A few mentioned that with their new crown, it is harder

to floss between their teeth and that floss gets stuck there. Similar to the implant group, endodontic participants also have not changed their oral hygiene habits or they have improved them. Some say they floss more often, and a couple of people talked about the floss getting stuck between their new crown and the teeth next to it.

Comparison to Other Teeth. Some participants mentioned that their implant felt different than their other teeth. One example of this was, "It doesn't feel real for me. I mean, like, I know which one it is. It operates the same way and it doesn't bother me, but I don't know, I can tell it's not my tooth when I touch it." A couple of people mentioned that it used to feel different to them, but over time they have gotten use to it and it feels more natural now. Those who were missing a tooth for a while before the implant was placed thought that the implant was kind of sticking out and pressing against their tongue and felt wider than normal. A few others mentioned that their implant feels very "strong" and feels like a natural tooth.

Most participants in the endodontic group agree that the tooth feels the same as their other teeth and does not feel any different. A couple of people think it feels stronger. A few people said they notice it sometimes; they do not have pain but rather sensation. Others said they no longer feel hot or cold in the tooth, but they like that.

Permanency of Treatment. Several participants in the implant group stated that they were afraid their crown may come off or that the implant may fail. Others were surprised to hear that their treatment may not be permanent and that problems could ensue in the future. Some just thought once they got it, it was permanent and nothing could happen. Similar to the implant group, the endodontic group seemed to not really know much about the permanency of treatment or how long the tooth would last in their mouth.

Follow-up Dental Visits. In the implant group, no follow-up visits for maintenance issues or problems were mentioned other than regularly scheduled follow-up visits and visits for crown placement. Similarly, most participants in the endodontic group said the follow-up visits consisted of getting the permanent restoration or crown and/or normal recall appointments. Some went to their normal recall visits, but some said they did not go to their scheduled recalls because they were not in pain.

Discussion

Endodontic therapy and single implant-based supported prosthesis are viable treatment options for compromised teeth. Both treatment modalities enjoy high clinical success rates and favorable long-term outcomes supported by evidence-based quantitative research (6, 17, 18). This study provides qualitative data showing a high rate of patient satisfaction with both treatment options. It is important to realize that implant therapy and endodontic therapy are two different treatment modalities with their own unique indications and contraindications; therefore, they should not be in competition with each other.

When analyzing the comments and concerns raised by the participants, we should weight them based on how their severity and duration will affect the quality of life of our patients. The most common themes raised by the participants were transient and had a short-term effect on their quality of life. For example, opening the mouth for a long period was a common concern for both groups. Although important, this concern will cause minimal or no effect on the patient's quality of life. Moreover, because this study was conducted on patients attending the graduate student clinics, it may not be as much of a concern in the private sector where practitioners have more experience and may be more proficient during treatment than in a university-based setting.

The data presented in this study provide a very unique insight into our patients' feelings and perceptions and should be considered by the

providers when evaluating different treatment options. In addition to the prognosis and outcomes, clinicians should consider patients' perceptions and preferences as well as the influence each therapy may have on their quality of life, both short- and long-term. Overall, all the participants in this study were pleased with the treatment received and expressed a clear message to save their natural dentition whenever possible.

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The authors deny any conflicts of interest related to this study.

References

1. Bader HI. Treatment planning for implants versus root canal therapy: a contemporary dilemma. *Implant Dent* 2002;11:217–23.
2. Morris MF, Kirkpatrick TC, Rutledge RE, Schindler WG. Comparison of nonsurgical root canal treatment and single-tooth implants. *J Endod* 2009;35:1325–30.
3. Zitzmann NU, Krastl G, Hecker H, Walter C, Weiger R. Endodontics or implants? A review of decisive criteria and guidelines for single tooth restorations and full arch reconstructions. *Int Endod J* 2009;42:757–74.
4. Torabinejad M, Goodacre CJ. Endodontic or dental implant therapy: the factors affecting treatment planning. *J Am Dent Assoc* 2006;137:973–7.
5. Iqbal MK, Kim S. A review of factors influencing treatment planning decisions of single-tooth implants versus preserving natural teeth with nonsurgical endodontic therapy. *J Endod* 2008;34:519–29.
6. Doyle SL, Hodges JS, Pesun IJ, Law AS, Bowles WR. Retrospective cross sectional comparison of initial nonsurgical endodontic treatment and single-tooth implants. *J Endod* 2006;32:822–7.
7. Vehemente VA, Chuang SK, Daher S, Muftu A, Dodson TB. Risk factors affecting dental implant survival. *J Oral Implantol* 2002;28:74–81.
8. McDermott NE, Chuang SK, Woo VV, Dodson TB. Complications of dental implants: identification, frequency, and associated risk factors. *Int J Oral Maxillofac Implants* 2003;18:848–55.
9. Morris HF, Ochi S, Winkler S. Implant survival in patients with type 2 diabetes: placement to 36 months. *Ann Periodontol* 2000;5:157–65.
10. August M, Chung K, Chang Y, Glowacki J. Influence of estrogen status on endosseous implant osseointegration. *J Oral Maxillofac Surg* 2001;59:1285–9.
11. Herrmann I, Lekholm U, Holm S, Kultje C. Evaluation of patient and implant characteristics as potential prognostic factors for oral implant failures. *Int J Oral Maxillofac Implants* 2005;20:220–30.
12. Starck WJ, Epker BN. Failure of osseointegrated dental implants after diphosphonate therapy for osteoporosis: a case report. *Int J Oral Maxillofac Implants* 1995;10:74–8.
13. Migliorati CA, Casiglia J, Epstein J, Jacobsen PL, Siegel MA, Woo SB. Managing the care of patients with bisphosphonate-associated osteonecrosis: an American Academy of Oral Medicine position paper. *J Am Dent Assoc* 2005;136:1658–68.
14. Doyle SL, Hodges JS, Pesun IJ, Baisden MK, Bowles WR. Factors affecting outcomes for single-tooth implants and endodontic restorations. *J Endod* 2007;33:399–402.
15. Fouad AF, Burleson J. The effect of diabetes mellitus on endodontic treatment outcome: data from an electronic patient record. *J Am Dent Assoc* 2003;134:43–51.
16. Ray HA, Trope M. Periapical status of endodontically treated teeth in relation to the technical quality of the root filling and the coronal restoration. *Int Endod J* 1995;28:12–8.
17. Iqbal MK, Kim S. For teeth requiring endodontic treatment, what are the differences in outcomes of restored endodontically treated teeth compared to implant-supported restorations? *Int J Oral Maxillofac Implants* 2007;22(suppl):96–116.
18. Torabinejad M, Anderson P, Bader J, et al. Outcomes of root canal treatment and restoration, implant-supported single crowns, fixed partial dentures, and extraction without replacement: a systematic review. *J Prosthet Dent* 2007;98:285–311.
19. Friedman S, Mor C. The success of endodontic therapy—healing and functionality. *J Calif Dent Assoc* 2004;32:493–503.
20. Kvist T. Endodontic retreatment. Aspects of decision making and clinical outcome. *Swed Dent J Suppl* 2001;144:1–57.
21. Basch CE. Focus group interview: an underutilized research technique for improving theory and practice in health education. *Health Educ Q* 1987;14:411–48.
22. Patton MQ. *Qualitative evaluation and research methods*. 2nd ed. Newbury Park, CA: Sage Publications; 1990.
23. Slade GD. Derivation and validation of a short-form oral health impact profile. *Community Dent Oral Epidemiol* 1997;25:284–90.
24. Slade GD, Spencer AJ. Development and evaluation of the Oral Health Impact Profile. *Community Dent Health* 1994;11:3–11.
25. Locker D. Measuring oral health: a conceptual framework. *Community Dent Health* 1988;5:3–18.
26. Bailey DM, Jackson JM. Qualitative data analysis: challenges and dilemmas related to theory and method. *Am J Occup Ther* 2003;57:57–65.