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Developing measures of patients' perceptions of orthognathic surgery

Measurements of patients' perceptions of the benefits, costs, and risks of orthognathic treatment are needed to assess the utility of alternative treatments, and to assess and improve patient education to make informed decisions. A two-part study was conducted to develop and evaluate measures assessing patients' perceptions of the benefits and risks of orthognathic surgery in comparison to an orthodontics-only approach or no treatment. The first part of this study included 49 patients who had completed orthodontics and orthognathic surgery and 34 patients considering orthognathic surgery. All patients were asked to complete an open-ended telephone questionnaire about their perceptions of the benefits and risks of orthognathic surgery and of alternative options. Patients' answers were sorted into categories, and the second part of this study included a closed-form written questionnaire to assess the perceived likelihood of possible outcomes in each category. Reliability of the questionnaire was assessed using Cronbach's alpha coefficient of internal consistency reliability. Cronbach's alpha ranged from 0.74 to 0.91 when the instrument was used to assess either overall benefits or risks of orthognathic surgery, orthodontics only, or no treatment, indicating acceptable reliability for each of these uses. Subscales concerning more narrowly defined aspects of benefits and risks were less reliable than the overall scales. (Int J Adult Orthod Orthognath Surg 1994;9:87-94.)

Introduction

A health care service is most meaningful if consumer/patient needs are identified and satisfied. The majority of orthodontic and orthognathic surgery patients have functional, esthetic, and psychosocial needs, as most orthodontic treatment and orthognathic surgery procedures are elective.

When orthodontic treatment is recommended to camouflage an underlying skeletal discrepancy, orthodontic "compensation" is required. In contrast, when preoperative orthodontic treatment is initiated in a combined

orthodontic/surgical approach, the opposite type of movement or "decompensation" of the dentition is needed.^{1,2} It is therefore desirable that the patient make an informed decision between these alternatives before the initiation of treatment. The patient's understanding of the costs (direct and indirect), risks, and benefits of alternative treatments often is inadequate to make an informed decision. When the patient asks the orthodontist and/or oral surgeon for advice concerning which treatment to choose, the option that fulfills the expert's utility/desirability requirements with acceptable risk and cost

levels may not address the patient's needs and expectations. This is a concern because previous studies indicate that orthodontists and oral surgeons rate a larger proportion of the population as having a dentofacial deformity than do lay persons.^{3,4}

A system of decision making as outlined in *Clinical Decision Analysis*⁵ would provide patients with a method of making an informed decision based on the costs, risks, and benefits of each treatment modality. The development of a questionnaire to allow patients' perceptions to be part of the decision making process would permit quantitative analysis and weighting of component variables.

The importance of patients' perceptions in the success of treatment was noted by Peterson and Topazian,⁶ who state: "An important objective of orthognathic surgery is to have a patient who is happy with the results of treatment. Postoperative dissatisfaction is not necessarily related to the surgical skill of the surgeon, but results primarily from mutual failure of the communication between the surgeon and the patient." This apparent lack of concordance between the patient/consumer and clinician/provider may be resolved now that the methodology in health services research is available.

Only a few studies have aimed specifically at determining patients' perceptions of orthognathic surgery.^{7,8} These studies involved the administration of an initial closed-ended questionnaire and a follow-up open-ended telephone interview to clarify the respondents' original answers. While these studies provide a general insight into patients' perceptions of the risks and benefits of surgical treatment, they only elicit those items that were included in the survey and may or may not have measured the outcomes most meaningful to the patients.

Longitudinal studies by Kiyak and coworkers⁹⁻¹³ have reported temporal changes in patients' perceptions of orthognathic surgery before experiencing the treatment intervention and in

the postoperative/orthodontic phase. Comparisons with orthodontics-only and no-treatment groups were included in the design of these studies to provide insights into patients' perceptions of orthognathic surgery.

Motivation for orthognathic surgery is related to esthetic and functional concerns. Expectations for health and psychological improvements also play a role in the motivation to seek orthognathic surgical treatment, and satisfaction has been measured by a patient's willingness to elect the same treatment again after having already undergone the experience.^{8,11,14} Identifying some of the important factors associated with the feelings of satisfaction or dissatisfaction with treatment has been related to allowing patients to make an informed decision on elective treatment.^{8,9} However, the need to determine patients' perceptions of orthognathic surgery requires reliability studies of survey instruments in this field. The methodology of evaluating instruments to assess patients' perceptions relies on measures of internal consistency to determine reliability.¹⁴

In psychometrics, the score on every measure (whether it is a single question or a multi-item scale) is conceptualized as being made up of a true score plus random measurement error. The reliability of a measure is the proportion of variance in the score that is due to differences in true scores (ie, differences between the entities being measured) rather than to random measurement error. The simplest conceptual approach to assessing reliability is the test-retest method: calculating the correlation between the two scores on the measure when it is given twice. Test-retest reliability is biased upward if subjects remember and repeat their answers. It also has the practical disadvantage of requiring two administrations of the instruments.

When the measure consists of multiple items, the reliability of the measure can be assessed by examining the internal consistency of the measure, that is, the correlations among the items. If

the individual items are somewhat reliable measures of the same concept, responses to them will be positively correlated and a scale derived by adding (or averaging) the responses will be reliable. Because the random measurement errors on different items tend to cancel each other out, scales with more items tend to be more reliable. The standard measure of reliability based on internal consistency is Cronbach's alpha. A higher alpha value indicates a more reliable scale; Cronbach¹⁶ considers .70 or higher a "fairly large coefficient of equivalence" and Carmines and Zeller¹⁷ state that "as a general rule, reliability should not be below .80 for widely used scales."

The purpose of this study was to develop a better understanding of patients' perceptions of orthognathic surgery by incorporating some of the concepts of utility measurement into the measuring of orthognathic surgery patients' perceptions of the costs, risks, and benefits of treatment. It was designed to (1) develop a survey to quantify patient perceived outcomes and (2) determine the reliability of the survey instrument.

Materials and methods

The subjects of the study were treated patients, prospective patients, or parents of prospective patients in the University of Michigan Dentofacial Deformities Program. The first part of the study used open-ended questions to ascertain qualitatively what patients who had received treatment and prospective patients felt were the risks and benefits of orthognathic surgery. The findings of this study were used to develop "closed-form" questions to quantify prospective patients' perceptions of the likelihood of the identified risks and benefits. In the second part of the study, prospective patients answered these closed-form questions to rate the likelihood of the identified risks and benefits for each of three alternative courses of treatment. Psychometric analysis then was used to evaluate the

reliability of the survey questionnaire for assessing beliefs about the benefits and risks of these alternative treatments.

Open-ended survey

To identify the specific benefits, risks, and costs that are of concern to patients rather than clinicians, a sample of patients were asked open-ended questions about the costs and potential positive and negative outcomes of orthognathic surgery as suggested by Ajzen and Fishbein.¹⁸ Both a pretreatment sample (consisting of individuals who had been evaluated by the Dentofacial Deformities team or who were scheduled to be seen by the team) and a posttreatment sample (consisting of patients who had received orthognathic surgery and had all appliances removed by the time the telephone survey was conducted) were used. Of the 45 potential pretreatment subjects, 34 (76%) responded to the survey questions. In 13 of the 34 cases, a parent rather than the patient was interviewed because the patient was under the age of 18 and the parent felt the child could not understand the questions. The pretreatment group included 24 females and 10 males. Of the 70 potential posttreatment subjects, 49 (70%) were interviewed. All patients were over the age of 18, so no parent interviews were used. The posttreatment sample included 34 females and 15 males.

The following seven questions were asked:

1. What are the advantages that someone may receive from orthognathic surgery treatment?
2. What other positive side effects could someone receive from orthognathic surgery treatment?
3. What are the possible things that might go wrong from receiving treatment?
4. Even if everything goes as planned and there are not any unforeseen problems, there still may be some expected negative consequences

and some other disadvantages. What do you see as some of these expected disadvantages?

5. What do you consider to be the monetary costs of receiving this treatment?
6. What do you consider to be the inconveniences and other nonmonetary costs of receiving this treatment?
7. Is there anything else that comes to mind when you think about receiving treatment?

These questions were asked in telephone interviews conducted by one of the authors. If a subject was unclear about the meaning of a question, the question was reread and a brief explanation was given. To avoid biasing subjects' answers, examples were never given. Interviews lasted from 15 minutes to 1 hour. All responses were recorded verbatim.

Subjects gave 1,355 responses (including repetitions) to the open-ended questions. Responses were sorted by a nondentist and an orthodontist into 64 categories of extremely similar or identical answers. The most common categories of responses in the survey were as follows:

1. Better appearance (78.3%)
2. Straight teeth (51.8%)
3. Cost of insurance (48.2%)
4. Numbness (44.6%)
5. Pain (43.4%)
6. Cost of orthodontics (43.4%)
7. Increased self confidence (42.2%)
8. Surgical or hospital costs (39.8%)
9. Improved chewing/digestion (38.6%)
10. Improved bite (37.3%)

Closed-form survey

Items in the closed-form questionnaire were developed from responses to the open-ended survey. Specifically, subjects were to report their perceptions of the chances of each benefit and

risk for each of the three treatment options: (1) no treatment, (2) orthodontics only, and (3) orthognathic surgery. At least one item was developed to assess beliefs about each of the salient benefits and risks (eg, improved appearance, numbness) identified in the open-ended questionnaire. The questionnaire items are presented in Table 1. Responses to each item were given on a scale from 1 (extremely unlikely) to 7 (extremely likely). Altogether, 47 benefit and risk items were written, and each was included in a written questionnaire in three variations (for the three treatment options) by changing the items' opening phrase. Questions about insurance and other costs also were included in the closed-form questionnaire (eg, "If I receive orthognathic surgery I expect it will cost approximately \$_____."). Costs were quantified in dollars rather than likelihood ratings, and since cost questions were not used in reliability testing they are not included in Table 1.

As a pilot test, the draft questionnaire was administered to a small sample of patients. These patients were interviewed informally about their understanding of the questions. Items identified as difficult to understand were revised. Questionnaires, along with postage-paid return envelopes, were mailed to subjects. Phone calls and a second mailing of the questionnaire were used to encourage those who did not respond promptly to complete and return their questionnaires.

Subjects in the closed-form survey were pretreatment patients or their parents. At the time of the study there were 60 eligible patients living in the Ann Arbor area. Completed questionnaires were returned by 36 (60%) of them. Parents had filled out 9 (25%) of the completed questionnaires. Though the response rate was somewhat lower than desired, it was not unusually low for a questionnaire of this length (25 pages).¹⁹ Demographic questions indicated that most respondents (67%) were female and that the largest percentages of respondents were 20 to 24 years of age (22%) or 15 to 19 years of

Table 1 Items in the closed-form questionnaire

Three variations of each item were given to correspond to the three treatment options. Items began with the phrases (1) If I receive no treatment; (2) If I receive orthodontics only; and (3) If I receive orthognathic surgery....

- B1. I will have temporary bruising and swelling in my face.
 B5. Some others will NOT recognize my face.
 C1. My bite will feel uncomfortable.
 C5. I will have some teeth removed.
 C9. I will have sensitive teeth.
 C13. I will have some teeth die or break.
 C17. I will develop gum problems or periodontal disease.
 C21. I will have difficulty cleaning my teeth for the next 2 years.
 D1. I will have difficulty eating for several months.
 D5. I will be on a liquid diet for at least 2 weeks.
 D9. I will lose some weight.
 D13. I will NOT be able to open my mouth wide enough to eat a Big Mac (large hamburger).
 D17. I will have difficulty talking for a few weeks.
 D21. I will have difficulty breathing for a few days.
 D25. My jaw will make a noise.
 D29. My jaw will NOT work correctly for a few weeks.
 D33. I will choke.
 E1. I will find my face unattractive for a few weeks.
 E5. I will find my face unattractive 5 years from now.
 E9. I will feel frustrated or stressed for a few weeks.
 E13. I will feel run down or depressed for a few weeks.
 E17. My family will be temporarily shocked by my appearance.
 F1. I will have a painful hip or trouble walking for a few weeks. (Explanation was included in the questionnaire.)
 F5. I will have long term headache pain.
 F9. I will have long term jaw pain.
 F13. I will have my mouth wired shut.
 F17. I will have my mouth rubber banded shut.
 F21. I will have parts of my face that are numb for at least several months.
 F25. I will develop an infection in my mouth.
 F29. I will have an adverse reaction to medications or general anesthesia.
 F33. I will die prematurely.
 G1. I will have a pleasing appearance.
 H1. I will have straight teeth and an attractive smile.
 H5. My teeth will be easy to clean.
 H9. My teeth will meet correctly.
 I1. I will have overall good health.
 I5. It will be easy to bite off and chew food.
 I9. I will NOT have frequent indigestion.
 I13. I will breathe easily through my nose.
 I17. I will have clear pronunciation of words and sounds.
 J1. I will be self-confident.
 J5. I will make a good first impression when I meet someone new.
 J9. I will be treated well by people who already know me.
 J13. I will have good job opportunities.
 K1. I will have NO severe headache pain.
 K5. I will have NO jaw joint (TMJ) pain.
 K9. I will have NO jaw joint (TMJ) noise.

The words NO and NOT were capitalized in descriptions of the outcomes to reduce the chance that respondents would fail to notice them.

age (19%). Though respondents sometimes were patients' parents, these demographics are similar to those in other studies of orthognathic surgery patients.

Assessment of scale reliability

The likelihood ratings from the closed-form survey could be combined, by adding or averaging, to form scales of patients' perceptions of treatment. This was performed at three different levels of aggregation, producing scales to assess broad classes of perceptions, such as all benefits, and scales to measure more detailed or specific perceptions, such as perceived functional risks.

Results

The specific scales constructed are listed in Table 2, starting with the two most global scales followed by two sets of more detailed scales. It should be noted that there were three separate scales corresponding to each of the treatment options. One item (D9, weight loss) was not included in any scale because it was not consistently seen as a risk or benefit. When 36 subjects were asked to rate the desirability of weight loss, 56% indicated it was good, 33% indicated it was bad, and 11% indicated it was neutral.

Cronbach's alpha for each of the scales is presented in Table 3. Alphas for the global scales of benefits and risks are all over 0.70 and most are over 0.80, indicating excellent reliability.

The middle panel of Table 3 presents reliability coefficients for risks and benefits in the areas of appearance, comfort, and health. Alphas for the scales of discomfort risks are consistently above 0.80, indicating excellent reliability. The alphas for health risks, appearance benefits, and health benefits average 0.77, 0.75, and 0.69, respectively, and the individual treatment versions never drop below 0.60. The two remaining appearance/comfort/health scales (appearance risks and comfort benefits) never had alphas

Table 2 Items included in the scales

Scale	Items
1. All risks	All B, C, D, E, and F items, except D9, weight loss
2. All benefits	All G, H, I, J, and K items
3. Appearance risks	B1, B5, E1, E5, E17
4. Discomfort risks	C1, C9, D1, D5, D17, D21, D33, E9, E13, F1, F5, F9, F13, F17
5. Health risks	C5, C13, C17, C21, D13, D25, D29, F21, F25, F29, F33
6. Appearance benefits	G1, H1, J1, J5, J9, J13
7. Comfort benefits	I9, K1, K5
8. Health benefits	H5, H9, I1, I5, I13, I17, K9
9. Facial risks and benefits	B1, B5, G1*
10. Dental risks	All C items
11. Functional risks	All D items except D9, weight loss
12. Psychological risks	All E items
13. General risks	All F items
14. Dental benefits	All H items
15. Functional benefits	All I items
16. Psychological benefits	All J items
17. General benefits	All K items

*G1, the facial benefit item, was reverse scored (ie, 7 = extremely unlikely) for inclusion in this scale.

as high as 0.70; the specific versions for orthognathic surgery were particularly weak and were inadequate. Of the six appearance/comfort/health scales, these two included the fewest items.

The lower panel of Table 3 displays reliability results for scales of risks and benefits in nine more narrowly defined categories. Two of these scales, functional risks and general risks, had alphas that were consistently above 0.70 when used for each of the three treatment options and were the scales with the largest number of items. Two other scales, psychological risks and psychological benefits, had average alphas over 0.70, suggesting that they might be adequate. However, the versions of these scales designed to measure perceptions of orthognathic surgery had alphas below 0.60, so they did not seem adequate for immediate application. The other detailed scales show less promise of future usefulness; the scale of facial risks and benefits had an av-

Table 3 Scales and their reliabilities

Scale	Number of items	Alpha coefficients		
		No treatment	Orthodontics only	Orthognathic surgery
1. All risks	30	0.91	0.89	0.87
2. All benefits	16	0.74	0.82	0.81
3. Appearance risks	5	0.66	0.61	0.29
4. Discomfort risks	14	0.83	0.83	0.85
5. Health risks	11	0.84	0.79	0.67
6. Appearance benefits	6	0.64	0.83	0.78
7. Comfort benefits	3	0.63	0.48	0.29
8. Health benefits	7	0.68	0.67	0.73
9. Facial risks and benefits	3	0.30	0.03	-0.60
10. Dental risks	6	0.77	0.46	0.52
11. Functional risks	8	0.78	0.80	0.83
12. Psychological risks	5	0.80	0.83	0.55
13. General risks	9	0.85	0.91	0.82
14. Dental benefits	3	0.31	0.40	0.56
15. Functional benefits	5	0.27	0.55	0.29
16. Psychological benefits	4	0.71	0.83	0.59
17. General benefits	3	0.67	0.43	0.50

Alphas of 0.7 and higher are in bold, indicating good reliability.

erage alpha below 0, indicating it was useless as currently constructed.

Discussion

Review of the reliability interpretations of previous studies reveals that most studies did not report the reliability of the measures they used. The studies that do report reliability have considered subscales with alphas below 0.43 to have inadequate reliability and subscales with reliability greater than 0.72 to have adequate reliability.¹² Outside the orthognathic surgery literature, but within the confines of the orthodontic literature, Slakter and coworkers²⁰ have considered an alpha of 0.71 as indicating adequate reliability whereas Tedesco and coworkers²¹ report alpha coefficients as low as 0.50 to be moderately reliable and acceptable. The cutoff for acceptable subscale reliability ranges from a low of 0.50 for some researchers to a high of 0.70 or 0.80 by others.

Interpretation of acceptable subscale reliability is stated by Carmines and Zeller¹⁷: "The most important thing to remember is to report the reliability of the scale and how it was calculated. Then other researchers can determine for themselves whether it is adequate for any particular purpose."

In developing a reliable measure of patients' perceptions of treatment involving orthodontics and surgery, it is important that the measure have validity. Unless the questionnaire that is developed measures what it purports to measure, the issue of reliability is irrelevant. The first part of this study involved a clinician-administered telephone questionnaire from which the second closed-form questionnaire was derived. The use of open-ended questions about patients' perceived benefits and costs increases the validity of the scales by including outcomes that might not occur to clinicians. It does not guarantee, however, that all such relevant outcomes are included. Patients may

have concerns other than those reported, which they may feel are irrational and are therefore embarrassed to discuss. Hence the total inventory of concerns or perceptions may omit some issues of psychological importance that respondents consciously or subconsciously avoid. The extent to which such omissions may underreport or bias concerns or overestimate expected benefits was not tested but should be considered in subsequent survey instrument development and validation procedures.

A long-range goal of such studies is to increase the concordance between patients and providers in terms of the risks and benefits of treatment. The limiting factors conditioning clinicians' decisions have as much to do with technical feasibility and rates of success as measured by criteria that are intrinsically different from those that influence patients' desires or acceptance of treatment. A better understanding of consumers' utility structures and ultimate application of these structures to individual patients should enable clinicians to generate greater patient satisfaction with the treatment provided.

Clinical decisions can be qualitatively improved only if these decisions result from the patient's informed consent, if clinicians systematically assess the probabilities of alternative outcomes, and if tradeoffs of alternative treatments are reconciled in the context of patient values.

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