Practitioner and Patient Perceptions of Orthodontic Treatment: Is the Patient Always Right?

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ABSTRACT

Purpose: As dentists embrace evidence-based clinical practice, we place increased emphasis on patient values. Standards like Angle Classification are not related to patient perceptions of the tangible benefits of treatment. This study quantifies the differences dentists and patients perceive in orthodontic treatment outcome.

Materials and Methods: A survey is used to quantify a patient's perception of orthodontic treatment. It was completed by 30 patients who completed treatment at the University of Pittsburgh School of Dental Medicine. Their responses were compared with the perceptions of five orthodontists, three general dentists, and two prosthodontists.

Results: Multivariate analysis of variance found the differences between and within the subjects to be significant at $p < 0.004$. Univariate analysis of variance of the initial scores showed the data to be significant at $p < 0.002$ and pairwise comparisons showed significant mean differences. Final score analysis of variance was significant at $p < 0.001$ and pairwise comparison showed significant mean differences.

Conclusions: Patients and general dentists have a significantly less favorable initial perception of their dental esthetics and function when compared with orthodontists. Final scores of esthetic and functional perceptions between the patients and all three dentist groups showed significant differences, with patients perceiving the results of their treatment more favorably than practitioners.

CLINICAL SIGNIFICANCE

The data herein elucidates differences in the value systems of professionals and patients. It is meant to encourage dentists to consider whether these differences justify the persistence of traditional orthodontic treatment goals or if treatment planning should incorporate consideration of each individual patient's preferences to maximize utility.

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BACKGROUND

As in the past, the winds of orthodontic change have shifted. It seems as if the era of the paternalistic orthodontist-patient relationship is waning and we are at the beginning of a new era of patient autonomy. This is, at least partially, a result of direct-to-consumer marketing by orthodontic manufacturers and the wealth of information on the Internet. The aforementioned factors enable potential orthodontic patients (and, sometimes more importantly, their parents) to become increasingly well informed consumers of health care. This begs the question: when clinicians seek to develop outcome measures that integrate patient values, is the patient always right?

In the new paradigm of evidence-based clinical practice (EBCP)[1–4] a greater emphasis is being placed on

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utilizing treatment modalities supported by the best available evidence,[5] informed consent, patient autonomy,[6,7] and patient-centered health care.[8,9] The shift from paternalistic treatment and practitioner-derived measures of treatment outcome to patient-centered measures opens a Pandora's box of questions for the clinical orthodontist. Do we possess a sound understanding of our patients' values and expectations related to orthodontic treatment? Should we devote more time to understanding the patient's wants and needs? How can we reconcile the patient's desires and priorities with our own goals and traditional measures of outcome? Perhaps most importantly, is treatment "success" now more related to patient satisfaction than time-honored, clinician-centered goals?[8,10]

Answering these questions would begin the journey towards developing outcome measures that reflect both practitioner and patient values. One first step may be to quantify some objective measurement of patient values and compare it with an objective measurement of the values of orthodontists. A broad quantitative comparison that could easily be made is to analyze how patients' perception of the overall esthetic and functional outcome of their own orthodontic treatment compares with the perceptions of orthodontists. To the best of the authors' knowledge, no studies have been conducted that quantify this change.

For further insight, it might be interesting to compare the values of both patients and orthodontists with general dentists and prosthodontists. Since general dentists are often the only professionally trained critics to review our finished cases (and also targets for new patient referrals), it would be interesting to see how their assessments compare with orthodontists and patients. Prosthodontists are trained to rehabilitate the occlusion and they, like orthodontists, must focus on both esthetics and function as paramount treatment goals.

Until now, assessments of dental and osseous tissue such as Angle's Classification, overbite and overjet, cephalometric analysis, Peer Assessment Rating (PAR)—a standard system for quantitatively measuring orthodontic cases, and American Board of Orthodontics Phase III measurements have been used to assess the effects of orthodontic treatment and provide some measure of clinical "success." These methods have the advantages of being easily conducted and proven reliable when performed by trained orthodontists.[11,12] Unfortunately, among the disadvantages of these rating schemes is that they measure variables that are continuous within a population and cannot be compared with a true "gold standard." Most importantly, these traditional measurements have not been designed to consider the patient's values.[13] Our professional values would be applicable to patients if only it were true that patients appreciated a "Mother Angle" Class I static occlusion or a fifteen point PAR improvement as much as we do!

To elaborate on the shortcomings of traditional measures of treatment outcome, despite the fact that an "ideal" occlusal scheme serves as an arbitrary point of reference and clinical goal, it has not been demonstrated that it is related to improved oral or general health or function.[14] Respected colleagues have argued that we are not intervening on a biologically abnormal state, or even one with any proven health consequences.[13] Some experimental data has been brought forth that challenges our core beliefs and suggests that inter- and intra-arch tooth alignment is not related to dental health,[15] periodontal health,[16] or temporomandibular joint function.[17] It is now understood that malocclusion is not a "disease" that can be "treated" according to the conventional disease model and has been suggested that applying such a model and utilizing rigorous criteria for outcomes is inappropriate for our profession.[13]

One treatment outcome that patients seem to universally value is improvement of the appearance of teeth and the face as a whole. Others have discussed the topics of smile and soft tissue esthetics more comprehensively and eloquently than is possible here. Suffice to say that there are certain aspects of a smile that render it more or less esthetic. It has been shown that orthodontists are much more sensitive to esthetic disharmony than laypeople and general dentists.[18,19] Based on these observations, it is assumed that patients have a higher opinion of the outcome of their

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orthodontic treatment than orthodontists. Despite the wealth of information on perceptions of esthetics by orthodontists, general dentists, and laypeople, there is very little research as to how a patient's appraisal of his or her own treatment directly compares with that of clinicians.

Even though dental professionals have baseline esthetic guides, one factor confounding the development of patient-centered treatment goals is that there is a lack of understanding of what patients perceive as esthetically valuable treatment outcomes for themselves.[10] In other words, clinicians know what a patient perceives as esthetic or unaesthetic on another person, but how do they feel about their own teeth and smile? Further complicating clear esthetic goals, it has been shown that perceptions of what constitutes an esthetic smile have been shown to vary by culture, race, and age, among other factors.[20,21] From this, we can conceive of the idea that a treatment outcome one patient views as esthetic for themselves might be considered unaesthetic for another.

The goal of this study is to elucidate the differences in perceptions of treatment outcomes between orthodontists, general dentists, prosthodontists, and patients. This is accomplished through a survey, modeled after Krug and Green,[22] which will quantitatively measure aspects of craniofacial hard and soft tissue esthetics and function. It will be provided to both patients and practitioners. On a case-by-case basis, the data from the patient surveys will be compared with data from dentists (for the sake of brevity, hereafter the word "dentists" refers to the group of all orthodontists, general dentists, and prosthodontists) who complete a similar survey after reviewing each patient's records.

After analysis, specific focus will be placed on understanding significant differences between the perceptions of dentists and patients. It is hoped that this knowledge will improve understanding of how much an individual patient feels that he or she benefits from orthodontic treatment. Further, it will quantify differences in professional and patient perceptions of treatment results. This effort will hopefully provide a true comparison of patient and doctor satisfaction and provide a first step on the journey toward the patient-centered aspects required of EBCP.

MATERIALS AND METHODS

The seven-item survey used by Krug and Green[22] was modified for this study. The first change was substitution of a five-point Likert-type scale for the visual analog scale employed by the previous study. In addition, a separate version of the form was made for dentists. In each item prompt, it changed the word "your" to "the patient's." Both surveys and necessary consents were approved by the University of Pittsburgh Institutional Review Board. **Figure 1** shows the survey as given to the patients and **Figure 2** is the survey as given to the dentists. After the modifications were made and data collected, reliability analysis was conducted to ensure that the new survey was still a reliable tool. Items two through seven were analyzed for each group. For the patients, Cronbach's coefficient alpha was 0.732; for orthodontists, Alpha was 0.969; for prosthodontists, it was 0.956; for general dentists 0.853.

Thirty consecutive patients, aged 12 to 40 years, who completed comprehensive treatment with orthodontic residents from the University of Pittsburgh School of Dental Medicine's class of 2010 were selected for analysis. All had complete digital records (photographs, radiographs, and digital models). Patients were only excluded from the study if they had been diagnosed with a craniofacial anomaly or underwent orthognathic surgery as part of their treatment. As a result of the selection criteria, the final results of all 30 treatments varied in subjective and objective measures of outcome—they were not 30 "perfect" finishes. The pool of five orthodontists, three general dentists, and two prosthodontists were all members of the University faculty. They represent a wide range of experience, professional, and demographic backgrounds.

Immediately after orthodontic appliance removal, the patients were presented with images from their initial records, a copy of the survey, and the required consents. This design was meant to mimic the post-treatment conference sometimes conducted in

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Congratulations on completing your orthodontic treatment! Please rate your impression of your treatment by circling the whole number that best corresponds to your satisfaction with each of the categories below. All answers are anonymous and will help improve our treatment of future patients. Thank you for your time.

The position of your teeth before orthodontic treatment:

1	2	3	4	5
Least satisfactory		neutral		Most satisfactory

The position of your teeth now:

1	2	3	4	5
Least satisfactory		neutral		Most satisfactory

Your bite:

1	2	3	4	5
Least satisfactory		neutral		Most satisfactory

Your smile:

1	2	3	4	5
Least satisfactory		neutral		Most satisfactory

How straight your teeth are:

1	2	3	4	5
Least satisfactory		neutral		Most satisfactory

Your profile:

1	2	3	4	5
Least satisfactory		neutral		Most satisfactory

The results of your overall orthodontic treatment:

1	2	3	4	5
Least satisfactory		neutral		Most satisfactory

Patient ID:_____

Date:_____

FIGURE 1. Patient survey designed in the manner of Krug and Green[22] and modified with a five-point Likert-type scale.

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Please rate your impression of the patient's treatment by circling the whole number that best corresponds to your satisfaction with each of the categories below. All answers are anonymous and will help improve our treatment of future patients. Thank you for your time.

The position of the patient's teeth before orthodontic treatment:

1	2	3	4	5
Least satisfactory		neutral		Most satisfactory

The position of the patient's teeth now:

1	2	3	4	5
Least satisfactory		neutral		Most satisfactory

The patient's bite:

1	2	3	4	5
Least satisfactory		neutral		Most satisfactory

The patient's smile:

1	2	3	4	5
Least satisfactory		neutral		Most satisfactory

How straight the patient's teeth are:

1	2	3	4	5
Least satisfactory		neutral		Most satisfactory

The patient's profile:

1	2	3	4	5
Least satisfactory		neutral		Most satisfactory

The results of the patient's overall orthodontic treatment:

1	2	3	4	5
Least satisfactory		neutral		Most satisfactory

Dentist ID:_____

Date:_____

FIGURE 2. Dentist survey designed in the manner of Krug and Green[22] and modified with a five-point Likert-type scale and change of "your" to "the patient's" in the individual item prompts.

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private practice.[23] Once patient data collection was complete, the pre- and post-treatment records for all 30 patients were presented at one time to the pool of five orthodontists, three general dentists, and two prosthodontists. A Microsoft PowerPoint slide show was created that displayed each patient's initial and final photographs (full facial with and without smile, facial profile, frontal, left, right, maxillary, and mandibular intraoral), initial and final panoramic and lateral cephalometric radiographs, and "gallery view" images of their digital models. The show was timed at ten seconds per slide so that the duration of review of each case was kept consistent.

The data from the surveys were analyzed through a spreadsheet that compiled all patient and dentist responses. Patient data was considered independently for each case. Professionals were pooled into groups of orthodontists, general dentists, and prosthodontists and scores were averaged within the groups. For statistical analysis, the data for all 30 cases was combined. From the combination, a mean score for each item in the survey as answered by all patients, all orthodontists, all general dentists, and all prosthodontists was obtained. The average response to item one was considered to be an "initial score" of the patient's orthodontic perception. The mean numerical responses for survey items two through seven were again averaged and considered as a composite "final score." Since the reliability analysis for each set of "final" data was high, this was considered statistically appropriate. The "final score" was compared with the numerical response for item one, which was considered to be an "initial score." The initial and final scores were compared within and between the groups.

RESULTS

When the data was combined as described earlier, eight mean values with complementary standard deviations were calculated. The descriptive statistics for each measurement are contained in Table 1. For patients, the initial score (the mean response to item one) was 1.900 with a standard deviation of 0.803. The initial orthodontist group score was 2.393 with a standard deviation of 0.534. Prosthodontists averaged an initial score of 2.200 with a standard deviation of 0.772. The three general dentists averaged out to an initial score of 1.844 with a standard deviation of 0.485. This data is represented graphically in Figure 3.

TABLE 1. Descriptive statitstics (mean, standard error of the mean, and standard deviation) for initial and final survey scores

	Mean	Standard error of mean	Standard deviation	*N*
Patient initial	1.900	0.147	0.803	30
Orthodontist initial	2.393	0.098	0.534	30
Prosthodontist initial	2.200	0.141	0.772	30
General dentist initial	1.844	0.089	0.485	30
Patient final	4.783	0.078	0.429	30
Orthodontist final	4.057	0.120	0.659	30
Prosthodontist final	4.283	0.090	0.495	30
General dentist final	4.150	0.077	0.423	30

The initial score is the mean response of the group to item one, the final is the mean response of items two through seven.

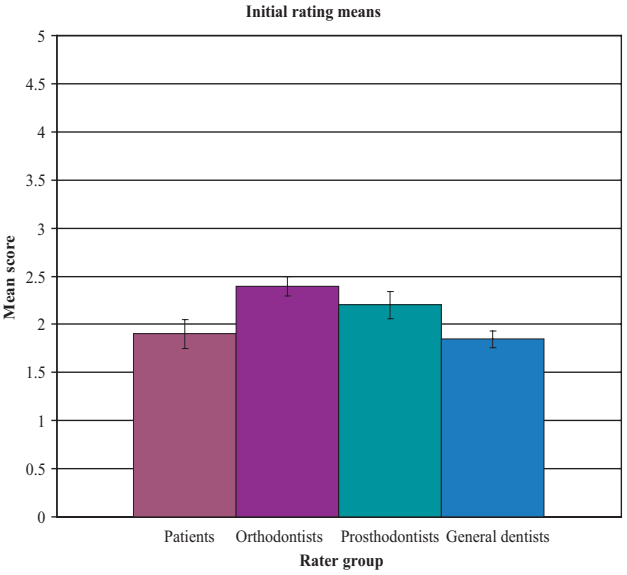

FIGURE 3. Graphical representation of initial rating means. The vertical axis is the mean item response score. Each rater group is represented by a bar. Error bars correspond to standard error.

The mean response to items two through seven was again averaged to give a "final score." In the patient

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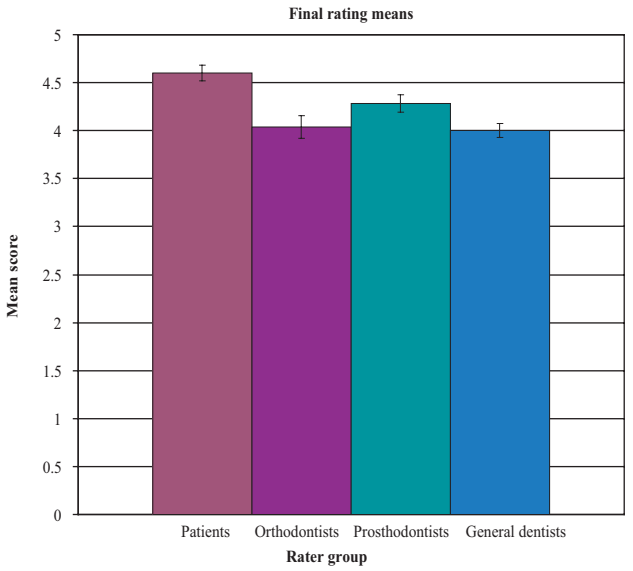

FIGURE 4. Graphical representation of final rating means. The vertical axis is the mean item response score. Each rater group is represented by a bar. Error bars correspond to standard error.

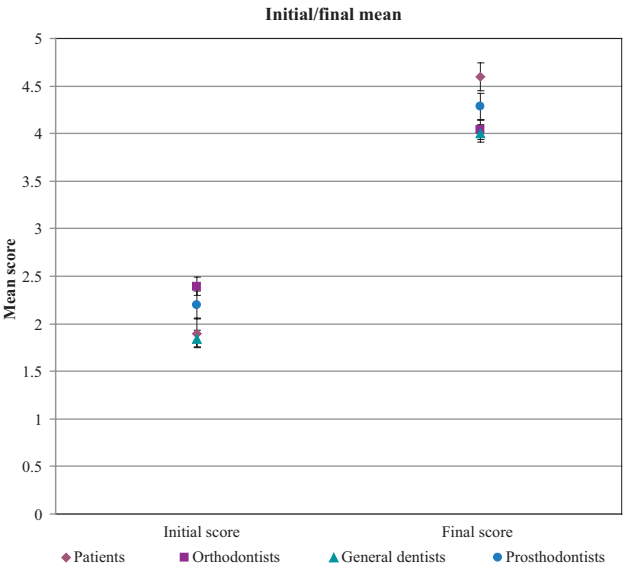

FIGURE 5. Initial and final mean scores plotted together. The vertical axis is the mean response score. The left set of data points represents the initial score and the right set represents the final score. Error bars correspond to standard error.

group, this final mean was 4.783 with a standard deviation of 0.429. The orthodontists' scores averaged to 4.057 with a standard deviation of 0.659. The final score for the prosthodontist group was 4.283 and the standard deviation was 0.495. Finally, the general dentist group combined for a mean final score of 4.150 with a standard deviation of 0.423. The final score data is represented graphically in Figure 4 and a comparison of initial and final scores on the same chart can be seen in Figure 5.

The initial tests for statistical significance of the data was a multivariate analysis of variance (MANOVA) using Wilks' Lambda. This found the differences between and within the subjects to be significant at $p \leq 0.004$. The observed power was >0.999. Analysis of the data using Mauchly's test of sphericity showed that the sphericity assumption was violated, and the Greenhouse–Geisser correction was used for the following univariate tests.

Since the MANOVA found the data to be significant, several post hoc tests were run. The first was a univariate analysis of variance (ANOVA) to test for significant mean differences. For the initial score, the Greenhouse-Geisser correction showed the data to be significant at $p \leq 0.002$ with an observed power of 0.920. Pairwise comparisons using the Tukey's honestly significant difference (HSD) procedure at an alpha <0.050 showed significant mean differences between the initial scores for orthodontists and patients and orthodontists and general dentists. The final score ANOVA was significant at $p \leq 0.001$ with a power >0.999. Pairwise Tukey's HSD procedure comparison at an alpha <0.050 showed significant mean differences between the patients and all three dentist groups.

The final comparison of interest was the mean difference between initial and final scores. This data, along with standard deviations, is contained in Table 2 and represented in Figure 6. The mean difference between initial and final scores in the patient group was 2.883 with a standard deviation of 0.858. The change scored by orthodontists was 1.663 with a standard deviation of 0.649. Prosthodontists initial and final scores differed by 2.083 points with a standard deviation of 0.957. General dentist scores revealed a "change" of 2.306 with a standard deviation of 0.642.

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TABLE 2. Descriptive statitstics (mean, standard error of the mean, and standard deviation) for the difference between initial and final survey scores

	Mean	Standard error of mean	Standard deviation	*N*
Patient difference	2.883	0.157	0.858	30
Orthodontist difference	1.663	0.118	0.649	30
Prosthodontist difference	2.083	0.175	0.957	30
General dentist difference	2.306	0.117	0.642	30

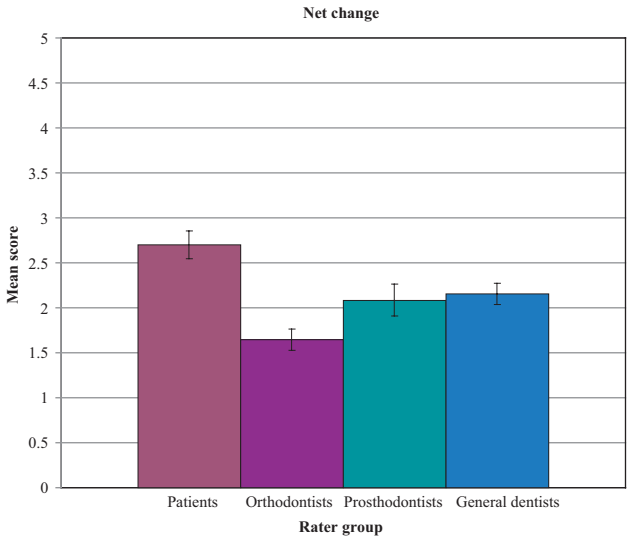

FIGURE 6. Graphical representation of the net difference between initial and final rating means. The vertical axis is the mean item response score. Each rater group is represented by a bar. Error bars correspond to standard error.

DISCUSSION

In his 1963 John Danz Lecture Series, the eminent physicist Richard Feynman espoused that it is not interesting, or even scientific, to retrospectively analyze the probability of the outcome of an experiment after it has been done and then make assertions based on the case observed.[24] In this spirit, it should be stated that this study was initiated with the idea that patients would have a significantly different perception of their final treatment outcome when compared with dentists. Data was collected and used to validate that assertion. In the interest of good science, the study was subsequently designed to remove bias for a particular outcome, so the data still stands on its own.

Often, qualitatively important data can be overlooked due to lack of quantitative statistical significance. This is not the case with the results of this investigation. Through analysis, patients and orthodontists were found to have a statistically significant quantitative difference in their survey responses. It can be said with a high degree (greater than 99.8%!) of certainty that patients in this study were shown to have both a lower initial perception of their condition and a higher opinion of the outcome than the orthodontists surveyed. In turn, the net change as a result of treatment was significantly larger for patients than orthodontists.

Conjectures may be drawn as to the meaning of the initial and final differences between patients and orthodontists. The lower initial score may relate to the documented differences in the perception of treatment need by patients and orthodontists.[25] On the contrary, it may be a result of the clinical experience of orthodontists in treating truly difficult cases. This experience may increase the frame of reference in regard to case complexity. The difference in final scores may also be attributed to numerous factors, but the major implication remains that patients do have more favorable opinions of the outcome of their orthodontic treatment.

Confirmation of the initial conjecture was not surprising, since qualitative review shows that patients almost universally scored themselves higher than orthodontists on every item of the survey (save for item one, the initial impression). Review of the data on an individual case basis revealed that every patient was generally satisfied with their treatment—responses to items two through seven almost universally varied between four and five, independent of objective measurements. Orthodontists did rate some treatment outcomes highly, but others were scored much lower. This inter-case variability could be attributed to both differences from established norms and a more sensitive eye for esthetics.

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At the outset, this study posed a few questions. Despite clear evidence of differences between orthodontist and patient, the answers to these questions are left open for debate. Each orthodontist must decide what it means for their practice. Perhaps a clinician feels that they are skilled at understanding what the patient wants and delivering treatment tailored to their needs. In this case, this data only validates their approach. If an introspective orthodontist realizes that they place more emphasis on their own goals than the patient's, other conclusions could be drawn. Some orthodontists may decide that patients are generally happy with orthodontic treatment results, and so they might as well finish to their own satisfaction. Others may reevaluate their treatments in order to maximize their patients' satisfaction.

Under no circumstances should this information be used to justify practicing in a way that provides negligible benefit or harms the patient.[26] Orthodontists are dental specialists who are trained to maximize the esthetic and functional harmony of their patient's teeth. Rejection of that mandate because it has been shown that the patient is less critical of outcomes is unfounded. That said, in some cases, compromises may be required and understanding that patients are generally more pleased with a less than perfect final result than orthodontists is helpful.

Reconciliation of sometimes differing treatment goals is a situation in which compromises may be made and in which we require a greater understanding of what patients perceive as valuable treatment results. A key concept in EBCP is recognition of the "utility" a patient derives from treatment.[27,28] By way of explanation, utilities are cardinal values assigned to particular health states and based on a decision maker's degree of preference for various possible outcomes. Utility analysis combines all factors related to a particular treatment that influence a patient's overall well being.[29] It follows that utility of an outcome varies for each individual, but it can be roughly estimated as proportional to the product of the value and likelihood of a treatment outcome.

As a gross oversimplification, we may say that it is 100% likely that we can align the maxillary anterior six teeth. Since clear measures of patient values have not been calculated for orthodontic outcomes, even though it is not recognized as the best manner,[30] we will assign an arbitrary value of 8 to the patient. The utility in this case would be something like an 8 ($1 \times 8 = 8$). For the same patient, it is 75% likely that we correct their Class II relationship, which has a (again arbitrary) value of 5 to the patient and is much harder to accomplish. By the same calculation, the utility would be 3.75 ($0.75 \times 5 = 3.75$). For this patient, it would be of a higher utility to align the anterior six teeth than correct the Class II.

With the evolution of orthodontics into a specialty of enhancement,[31] it is crucial to quantify the value of a treatment so that utility can be better calculated. If we do not have a disease to treat, but instead a condition to improve by a variable amount, we must determine what type and how much improvement is perceived as a reasonable endpoint of treatment. Our interventions are aimed at modification of conditions that are variations of normal,[31] and our goal should be to maximize the utility of treatment.[26] In this manner, if a more easily attained treatment is perceived as equally or more valuable, utility to the patient might be enhanced with less drastic intervention. In all cases, but especially those where ideal outcomes may not be achieved, we must consider what can be labeled a successful result.[10]

As an example, the most common compromises that may occur in this way are the situations where patient and practitioner goals differ or a case is dragging along without any appreciable changes.[26] Class II correction in a noncompliant patient (who does not recognize the Class II to be a problem) comes to mind as a concrete example. In this case, it may be far more efficacious to compromise, align the teeth to make the patient happy, and finish treatment within a reasonable time frame than extend treatment past reasonable norms with the goal of correcting a largely unappreciated anteroposterior discrepancy.

Now that the major goal of this investigation has been evaluated and discussed, two minor topics bear further discussion. The first was mentioned explicitly in the

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introduction—the concept that perceptions of esthetics vary by age, sex, and race. It was determined that collection of a sample homogenous in the aforementioned three characteristics would be extremely time intensive and the decision to use a heterogeneous group of patients for the final pool was made with some reservations because of these documented differences. These reservations proved unfounded when the tests of reliability for both the patients and the dentists rating the patients was found to be very high. This was fortunate not only for internal purposes, but because utilization of a diverse patient population increases the external validity of the results. Still, further studies may seek to rectify this disparity by utilizing a larger sample and/or a different population.

The remaining latent point of dialogue is the data from prosthodontists and general dentists. The rationale for inclusion of both groups was twofold: first to compare orthodontists with other dentists with esthetic goals; and second, to compare orthodontists and patients with those who will be tasked with long-term care of their patients after appliances are removed. The first point of interest is the significant difference between orthodontists and general dentists in their initial case perception. This could be due to the far greater experience of orthodontists in seeing cases that are daunting in appearance and difficult to treat. It may be that these cases raise the tolerance of orthodontists in respect to initial case complexity.

This brings us to the lack of difference in final perception between orthodontists and the other two groups, general dentists and prosthodontists. From this similarity, it can be assumed that our colleagues (and referral base!) are just as strict as orthodontists when evaluating treatment outcomes. It follows that in cases where esthetic or functional compromise must be made, good communication with other dentists is crucial to explain the nature and reasons behind the marginal treatment result. If dialogue is not in place, decisions made with the patient's consent and with their best interest in mind may be perceived as inferior orthodontics. To this same end, it may be appropriate to document in the patient's records not only what compromise was made, but more significantly why it was made and that autonomy and due process of consent was involved in the compromise.

CONCLUSIONS

This investigation used a simple survey to elucidate the differences in patient and practitioner opinions of changes in soft and hard tissue esthetics and function when looking at each patient's own case. In doing so, it showed that patients have a significantly higher opinion of their treatment outcome than orthodontists, general dentists, and prosthodontists. Concrete conclusions that can be drawn from this information are left to the individual orthodontist.

Independent of these conclusions, the charge of EBCP is to integrate the best available evidence with the patient's desires. To that end, the proven difference between the clinician's desires and the patient's is important because it shows that the orthodontist should recognize that their goals are likely different from their patient's. Logically, we should seek to abandon paternalistic approaches based on traditional treatment goals and attempt to put ourselves in our patient's place when making treatment decisions.

A spectrum of behaviors may result from this data. At one end, orthodontists may adhere to their own paternalistic treatment goals at the expense of patient desires. On the other hand, they may use more favorable perceptions of treatment outcome by patients to justify less than excellent treatment outcomes. In this case, the judicious answer seems to be a middle ground—the patient isn't necessarily always right, but making them happy should be a concern when developing treatment plans.

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