

Treatment Outcome Assessment by Orthodontists: Attitude and Practice

Seyed Mohammadreza Safavi¹, Ladan Eslamian², Soodeh Tahmasbi³, Arezoo Mahdian⁴,
Saeed Reza Motamedian⁵✉

¹ Professor, Dental Research Center, Research Institute of Dental Sciences, School of Dentistry, Shahid Beheshti University of Medical Sciences, Tehran, Iran

² Professor, Dentofacial Deformities Research Center, Research Institute of Dental Sciences, School of Dentistry, Shahid Beheshti University of Medical Sciences, Tehran, Iran

³ Associate Professor, Department of Orthodontics, School of Dentistry, Shahid Beheshti University of Medical Sciences, Tehran, Iran

⁴ Postgraduate Student, Department of Orthodontics, School of Dentistry, Shahid Beheshti University of Medical Sciences, Tehran, Iran

⁵ Assistant Professor, Department of Orthodontics, School of Dentistry, Shahid Beheshti University of Medical Sciences, Tehran, Iran

Abstract

Background and Aim: Evaluation of the treatment outcome is an important stage in every healthcare system, including orthodontics. This study aimed to assess the attitude and practice regarding treatment outcome assessment (TOA) among Iranian orthodontists.

Materials and Methods: In this cross-sectional survey, a questionnaire was developed, which consisted of demographic, attitude, and practice sections. Content validity was evaluated using content validity index (CVI), and reliability of the answers was evaluated using test-retest method and Kappa statistics. The online questionnaire was sent to a Telegram group including 315 Iranian orthodontists and orthodontic residents. Only graduated orthodontists with more than two years of experience were included.

Results: The average CVI was 0.95, and Kappa value was greater than 0.6. Totally, 66 orthodontists participated in the survey. Almost all orthodontists acknowledged the importance and positive effects of TOA. Seventy seven percent and 87.9% of the participants stated that treatment duration and stability, respectively, should be considered while evaluating treatment outcome. The most important disadvantage of TOA was its time-consuming nature (56.1%). The best criterion for the evaluation of treatment outcome was "treatment objectives" (89.4%). Photographs (84.8%) were the most common post-treatment document followed by panoramic radiographs (72.7%). Also, 23% and 65.2% of the participants "always" or "usually" performed TOA, respectively. TOA was mostly performed subjectively (84.8%) and during the debonding session (48.5%).

Conclusion: The results indicated that almost all orthodontists participating in this survey were aware of the importance of assessment of treatment outcome. Most of them usually performed such an assessment using subjective methods.

Key Words: Orthodontics, Outcome Assessment, Surveys and Questionnaires, Treatment Outcome

✉ Corresponding author:
Saeed Reza Motamedian,
Assistant Professor,
Department of Orthodontics,
School of Dentistry, Shahid
Beheshti University of Medical
Sciences, Tehran, Iran

dr.motamedian@gmail.com

Received: 16 Jan 2019

Accepted: 18 March 2019

➤ **Cite this article as:** Safavi SM, Eslamian L, Tahmasbi S, Mahdian A, Motamedian SR. Treatment Outcome Assessment by Orthodontists: Attitude and Practice. J Islam Dent Assoc Iran. 2019; 31(2):117-125. DOI: 10.30699/jidai.31.2.117

Introduction

The ultimate goal of every orthodontist is to achieve the maximally possible excellent treatment results. Assessment of orthodontic treatment outcome could not only help to establish standards but also would help clinicians to learn from their previous treatments [1,2].

Monitoring the treatment outcome is an essential step in every field of medicine, including orthodontics [3,4]. Without outcome evaluation, the clinician would not be able to assess treatment shortcomings and might underestimate negative outcomes [5]. In orthodontics, several factors, including aesthetics, function, and stability, should be considered at the time of outcome assessment.

Various indices, including American Board of Orthodontics Objective Grading System (ABO-OGS) [6], Peer Assessment Rating (PAR) index [7], and Index of Complexity, Outcome and Need (ICON) [8], have been developed to evaluate the orthodontic treatment outcome. These indices are targeted for both insurance companies and board candidates, as well as daily orthodontic practice [9], comparing treatment outcomes between clinics [2] and assessing the effectiveness of the provided orthodontic care [10]. They could also be used to evaluate combined orthognathic surgery and orthodontic treatment results [11].

Evaluation of the practitioners' attitude toward outcome assessment methods has been performed in other fields of medicine [12-14] but to the best of our knowledge not in orthodontics. Due to the importance of evaluation of orthodontic treatment outcomes, this study aimed to assess the attitude and practice regarding the assessment of the treatment outcome among Iranian orthodontists.

Materials and Methods

Questionnaire design:

Following a literature review, a preliminary questionnaire, consisting of 25 items in three sections, was designed. In the first section, demographic data, including age, gender, experience, and type of practice (private practice, private sector, and public sector), were

gathered. The second and third sections included 11 attitude-related and 10 practice-related items, respectively. The items of the ' preliminary questionnaire were modified through discussion among the authors, and then assessment of content validity and reliability was performed for the second and third sections.

Assessment of validity:

Content validity index (CVI) was used for evaluating the questionnaire validity. Six experienced university professors assessed the validity of the items in the second and third sections of the preliminary questionnaire. To calculate CVI, experts were asked to rate the relevance of each item on a 3-point scale (1=not relevant, 2=relevant but not necessary, and 3=necessary). CVI was calculated for each item as the number of experts that rated 3 divided by the total number of experts (n=6). In the guideline provided by Lynn, [15] in the presence of six experts, CVI should be at least 0.83, showing only one disagreement. Accordingly, four items in the practice section regarding the type of documents gathered at the end of treatment were excluded as the CVI was less than 0.83.

Assessment of reliability:

In order to assess the reliability of the answers, a test-retest method was used. The validated questionnaire was distributed among 10 orthodontists twice with a one-month interval. The reliability of the answers for each item was measured using Kappa statistics. Items with a Kappa value greater than 0.6 were kept in the final questionnaire [16]. Three statements in the attitude section assessing the frequency of the times the orthodontist could compare their results with "ideal", "treatment objectives", and "patient's expectations", were excluded as their reliability in the test-retest was less than 0.6. The final questionnaire included 18 items in Persian, out of which, four items were about demographic data, 8 items assessed the orthodontists' attitude, and 6 items evaluated their practice regarding the assessment of treatment outcome. All attitude-related items had 5-scale Likert answers, except for two items regarding the best method of outcome assessment and the most important obstacle

against this way, where the participants could choose between multiple choice options or add their own choice. In the third section, most items were about the method of assessment and had multiple choice answers. There was no correct answer, and the participants could add their own answer. One question evaluating how often the orthodontist evaluates treatment results had a 4-scale Likert answer. There was one question about post-treatment documents for which the participants could choose more than one answer.

Main study:

The study protocol of this cross-sectional online survey was approved by the ethics committee of the School of Dentistry, Shahid Beheshti University of Medical Sciences (Code: IR.SBMU.RIDS.REC.1395.345). All participants completed the survey following informed consent, and their information was kept confidential and anonymous. The final questionnaire was converted to an online electronic form (Google forms, Google Corp., USA). The invitation link to the form was sent to an online group of orthodontists, who were members of the Iranian Association of Orthodontists (IAO), and orthodontic residents in Telegram messenger in February 2018. Only graduated orthodontists with more than two years of experience were invited to the survey. In order to evaluate the response rate, the number of times that the invitation link was seen by group members was calculated using Telegram application features. However, it was not possible to distinguish whether the viewer was a resident or a graduated orthodontist. One month after the initial invitation, the process was repeated. One month after the second invitation, the survey was closed, and the data were gathered for statistical analysis.

Statistical analysis:

The frequency of the answers for each item was calculated. To measure the effect of confounding factors (age, gender, experience, and treatment location) on key questions, an ordinal regression model was applied. Statistical analysis was performed using SPSS 18 software (SPSS Inc., Chicago, IL, USA) with a significance level of 0.05.

Results

Validity and Reliability:

Kappa value and CVI for each item in the final questionnaire are presented in Table 1. The average CVI was 0.95.

Participants:

Overall, 66 qualified orthodontists participated in this survey. The total number of members in the IAO telegram group was 315, and the invitation link was seen by 241 group members. This gives a response rate of 29.05%. However, it was not possible to determine how many of those who visited the invitation were qualified to participate in the study.

Among the 66 participants, 42 orthodontists (63.6%) were males and 24 ones (36.4%) were females. Their mean age was 42.08 ± 9.34 years (range: 28-60 years), and their mean orthodontic treatment experience was 12.36 ± 8.01 years (range: 2-30 years). Most of the participants (75.8%) had a private practice, while 18.2% worked in private sectors. Four orthodontists (6.1%) worked in public sectors.

Attitude:

Most orthodontists strongly agreed (77.3%) or agreed (19.7%) that assessment of treatment outcome is necessary. Also, 98.5% (65 individuals) of the participants claimed that they had knowledge about methods for assessment of treatment outcome. All orthodontists stated that such an assessment would have a positive effect on the clinician's ability and would improve future treatments.

With regard to the treatment duration at the time of assessment of treatment outcome, 22 participants (33.3%) strongly agreed, 29 (43.9%) agreed, while 7 (10.6%) were neutral, and 8 (12.1%) disagreed. In terms of the stability at the time of assessing the treatment outcome, 39 (59.1%) strongly agreed, 19 (28.8%) agreed, while 4 (6.1%) were neutral, and 4 (6.1%) disagreed.

As demonstrated in Figure 1, the most important obstacle against treatment outcome assessment was the time-consuming nature of the procedure followed by patient-related factors such as treatment discontinuation and lack of provision of post-treatment documents. The best criterion for evaluation of treatment

Table 1. Reliability and validity of the items in the final questionnaire

Statements/Questions	Answers	Kappa		CVI
		Value	Sig.	
1. It is necessary to evaluate the orthodontic treatment outcome.	5-point Likert	.769	.018	1
2. I am familiar with indices for evaluation of orthodontic treatment outcome.	5-point Likert	.609	.023	.83
3. Evaluation of treatment outcome could influence clinician's ability and experience.	5-point Likert	1	.003	1
4. Evaluation of treatment outcome could influence the success of future treatments.	5-point Likert	.727	.023	1
5. "Treatment duration" should be considered while evaluating treatment outcome.	5-point Likert	.609	.023	.83
6. "Treatment stability" should be considered while evaluating treatment outcome.	5-point Likert	.813	.001	.83
7. What is the most important obstacle in the way of evaluating treatment outcome?	Time-consuming nature, Not aware of the best method, No comprehensive method exists, Patient-related factors, Other	.625	.008	1
8. What are the best criteria for evaluating treatment outcome?	Ideal treatment, Treatment objectives, Patient expectations, Other	1	.003	1
9. What post-treatment documents do you usually provide?	Photography, Panoramic radiography, Lateral cephalogram, Dental cast, No document	1	.003	1
10. Do you assess the treatment outcome of your patients?	4-point Likert	.769	.018	1
11. What is your usual approach for evaluating treatment outcome?	Subjective, Objective, Other	.727	.023	1
12. If you use a subjective approach, what criteria do you usually consider while assessing treatment outcome?	Ideal treatment, Smile and facial aesthetics, Treatment objectives, Other	.750	.002	1
13. If you use an objective approach, what criteria do you usually consider while assessing treatment outcome?	ABO-OGS, PAR index, ICON, Other	1	.157	.83
14. When do you usually evaluate treatment outcome?	At debonding session, Regularly, Irregularly, Other	.795	.002	1

CVI=Content Validity Index, ABO-OGS=American Board of Orthodontics Objective Grading System, PAR=Peer Assessment Rating, ICON=Index of Complexity, Outcome and Need

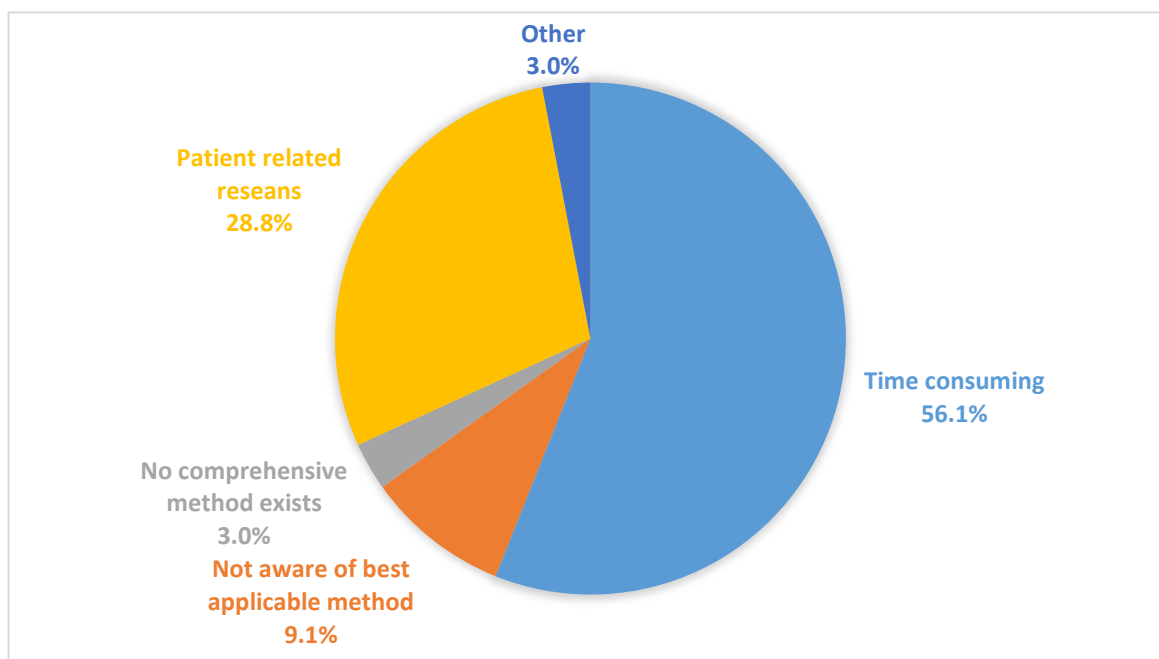


Figure 1. Distribution of orthodontists' opinion of the most important hindrance in the way of assessment of treatment outcome (sample size=66)

outcome was "treatment objectives" based on the opinion of 59 participants (89.4%). Five orthodontists (7.6%) stated that comparison with "ideal treatment" would be the best criterion, while 2 (3%) considered "patients' expectations" as the best criterion.

The regression model showed no significant effect of confounding variables (age, gender, experience, and type of practice) on attitude-related items ($P>0.05$).

Practice:

Diagram 1 displays that photography was the most common post-treatment documenting method followed by panoramic radiography. Six (9.1%) orthodontists provided no post-treatment document.

Regarding the frequency of assessing treatment outcomes, 15 orthodontists (22.7%) claimed that they always did it. On the other hand, 43 participants (65.2%) assessed the treatment outcome usually, while 6 (9.1%) only did it occasionally, and 2 orthodontists (3%) never evaluated their treatment results.

According to Figure 2, most of the treatment

outcome evaluations had been performed subjectively (84.8%). Among the subjective methods, evaluation of smile and facial aesthetics was the most common approach (39.3%) followed by comparison with treatment objectives (28.6%) and ideal treatment (19.6%). On the other hand, 10 orthodontists (15.2%) stated that they measure the treatment outcome objectively. ABO-OGS was employed by six, PAR index was used by two, ICON was used by one, while one orthodontist did not mention the utilized index. Evaluation of treatment outcome had been performed during debonding session for each patient by 32 orthodontists (48.5%), while 12 (19.7%) evaluated treatment results even before debonding and at the finishing stage of treatment. Other orthodontists assessed their treatment outcome regularly (17, 25.8%) or irregularly (4, 6.1%).

Again, the regression model indicated no significant effect of confounding variables (age, gender, experience, and type of practice) on practice-related items ($P>0.05$).

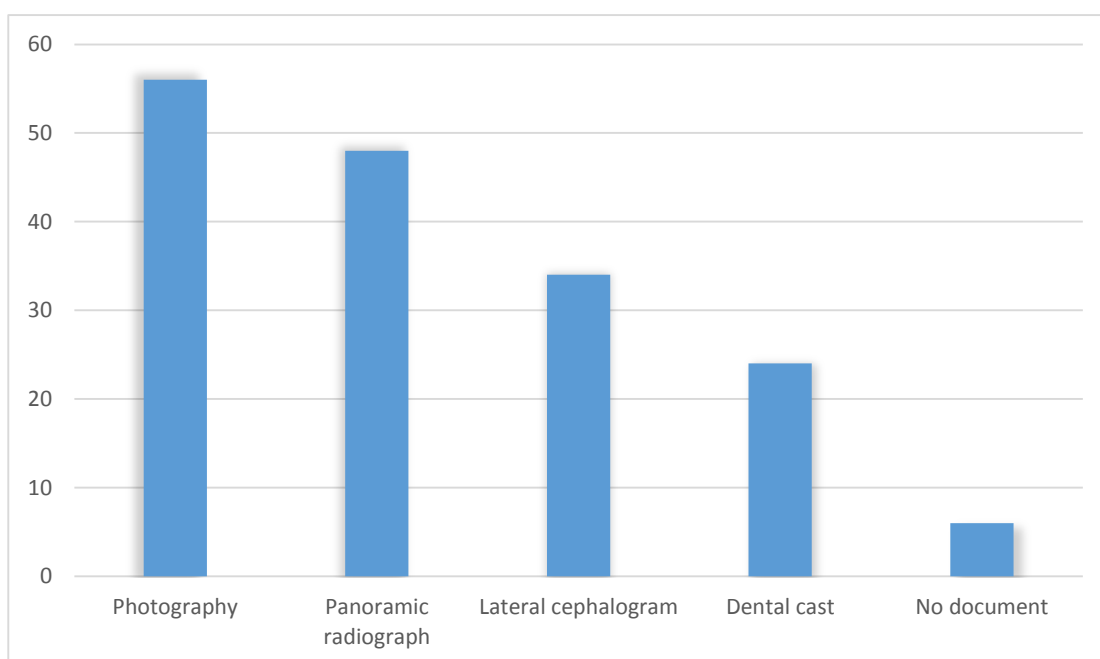


Diagram 1. Distribution of post-treatment documents provided by the orthodontists (each participant could choose more than one document; sample size=66)

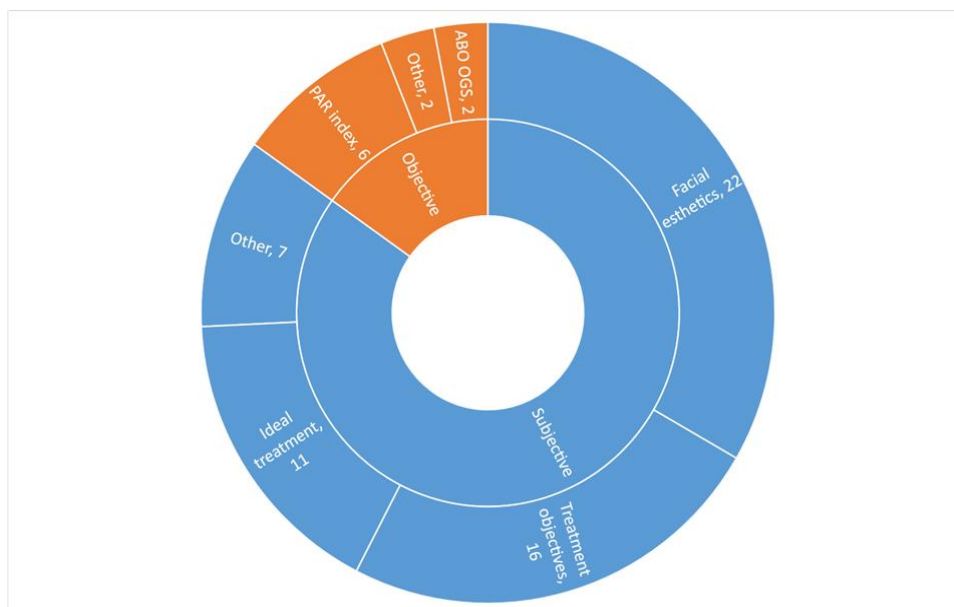


Figure 2. Distribution of participants based on methods of orthodontic treatment outcome assessment (sample size=66)

Discussion

In 1975, Hickham [17] stated that the evaluation of treatment outcome is important for every orthodontist and is necessary for those with less than 10 years of experience. To the best of our knowledge, no previous study has evaluated the orthodontists' attitude and performance in this field. Therefore, the current study was performed to first design a valid and reliable questionnaire for evaluation of attitude and practice of orthodontic treatment outcome assessment, and second, to use it in a group of orthodontists. The results suggested that almost all orthodontists acknowledged the importance of treatment outcome assessment, and most of them performed it using subjective methods. The orthodontists believed that evaluation of treatment results could affect their experience and ability, and could also improve the results of their future treatments.

In this survey, 77.2% agreed that treatment duration is an important factor and should be considered in the evaluation of outcome. Deguchi et al [2] advocated the importance of treatment duration in the quality of the outcome. A systematic review of 41 articles suggested that various factors, such as extraction treatment plan, early Class II treatment, and canine impaction, could influence the treatment duration [18]. Also, the treatment method chosen by the clinician and the biomechanics could lengthen the treatment period, while lengthened treatments reported to be related to more orthodontic treatment failure [18].

Although several factors could influence orthodontic treatment stability [19], 87.9% of the participants stated that treatment stability should be considered while evaluating the treatment outcome. It has been demonstrated that although the perfect alignment of the teeth is an important criterion in the outcome assessment indices, it might deteriorate and does not guarantee stability [20]. Therefore, most orthodontists preferred to include stability in the definition of treatment success.

A noteworthy finding was that more than half of the participants stated that the most important difficulty in evaluation of treatment results is

that this process is time-consuming. As mentioned in the World Health Organization (WHO) criteria [21], an index should be objective, reliable, reproducible, simple, fast, and accurate. Most of the current objective indices for the assessment of treatment outcome need several measurements. It could be suggested to define an index which can be used as a part of routine treatment procedure by orthodontists or a trained assistant to save the clinician's time.

Another noteworthy finding was that almost 90% of the participants preferred "treatment objectives" as more valuable criteria for evaluation of treatment outcome. Nevertheless, the most famous outcome assessment indices such as ABO-OGS [6], PAR index [7], and ICON [8], compare treatment results with ideal treatment. In daily practice, although optimal and ideal results are the ultimate goal of every orthodontist, ideal results might not be achievable or they might not be in the best interest of the patient [22,23]. When the patient does not accept orthognathic surgery or extraction treatment plan, or when there is a little or doubtful benefit in trying to reach the ideal, clinicians may accept suboptimal alternatives [22]. These alternatives could be defined in the treatment objectives. Orthodontists try to find the best possible treatment objectives. In some cases, treatment objectives are not different from ideal treatment. However, in those with compromised treatments, comparing the treatment outcome with ideals would reduce the treatment score for some reasons that are out of the orthodontist's control. This seems to be the reason that most participants of the current study stated that they prefer treatment objectives as the criteria rather than treatment ideals.

Surprisingly, two orthodontists stated that they prefer patients' expectations as the outcome assessment criterion. However, generally, patients have a poor understanding of orthodontic treatment as well as the expected results, and they mostly value the alignment of the anterior teeth [23,24].

Although dental casts are valuable documents both for legal purposes and performing

measurements, they need extra space for storage and are costly. Therefore, the most preferred post-treatment documenting method by the participants was photography as it provides a great deal of information, and photographs could be easily stored. However, a study by Song et al [25] showed that study casts are an inevitable part of outcome assessment and they should be combined with either lateral cephalograms or photographs.

Although 98.5% of the participants claimed that they have knowledge about the methods for assessing treatment outcome, only 15.2% used these methods for objectively evaluating the results. Other orthodontists performed their evaluations subjectively, and the most common method was to evaluate the final aesthetics. Subjective methods are not measurement-based and have lower reliability [26]. On the other hand, indices, such as the commonly used PAR index, lack aesthetic sensitivity [27], and important aspects of malocclusion, such as facial profile, are not included in occlusal indices [24]. As some of the participants reported, the combination of occlusal indices, such as ABO-OGS, with aesthetic appraisal could be more useful for assessment of orthodontic treatment outcome. Also, such combined indices could be used by national associations to standardize orthodontic treatments throughout the country.

One limitation of this study was the relatively low response rate (29%). A previous review indicated that the average response rate in online surveys is 33% (20%-47%) [28]. Another limitation is that participants might overvalue their performance in the surveys. Confidentiality and anonymity of the forms were mentioned at the time of invitation to reduce such overestimations.

Conclusion

Considering the limitations of the current survey, the results revealed that almost all participants acknowledged the importance of treatment outcome assessment and its beneficial effects on clinician's practice; however, more than half of the orthodontists stated that it is a time-consuming procedure,

and about one-eighth of the orthodontists never assessed treatment outcome or at best performed it occasionally. The most frequent method was subjective evaluation of smile and facial aesthetics at the time of debonding.

Treatment duration and stability are two important factors while evaluating treatment outcome, and about 90% of the orthodontists preferred "treatment objectives" instead of "ideal treatment" or "patient expectations".

References

1. Gottlieb EL. Grading your orthodontic treatment results. *J Clin Orthod.* 1975 Mar; 9 (3):155-61.
2. Deguchi T, Honjo T, Fukunaga T, Miyawaki S, Roberts WE, Takano-Yamamoto T. Clinical assessment of orthodontic outcomes with the peer assessment rating, discrepancy index, objective grading system, and comprehensive clinical assessment. *Am J Orthod Dentofacial Orthop.* 2005 Apr;127(4):434-43.
3. de Beurs E, den Hollander-Gijsman ME, van Rood YR, van der Wee NJ, Giltay EJ, van Noorden MS, et al. Routine outcome monitoring in the Netherlands: practical experiences with a web-based strategy for the assessment of treatment outcome in clinical practice. *Clin Psychol Psychother.* 2011 Jan-Feb;18(1):1-12.
4. Veen J, Raviglione M, Rieder HL, Migliori GB, Graf P, Grzemska M, et al. Standardized tuberculosis treatment outcome monitoring in Europe. Recommendations of a Working Group of the World Health Organization (WHO) and the European Region of the International Union Against Tuberculosis and Lung Disease (IUATLD) for uniform reporting by cohort analysis of treatment outcome in tuberculosis patients. *Eur Respir J.* 1998 Aug;12(2):505-10.
5. Lambert, M. J., Whipple, J. L., Hawkins, E. J., Vermeersch, D. A., Nielsen, S. L., & Smart, D. W. (2003). Is It Time for Clinicians to Routinely Track Patient Outcome? A Meta-Analysis. *Clinical Psychology: Science and Practice*, 10(3), 288-301.
6. Casco JS, Vaden JL, Kokich VG, Damone J, James RD, Cangialosi TJ, et al. Objective grading system for dental casts and panoramic radiographs. American Board of Orthodontics.

- Am J Orthod Dentofacial Orthop. 1998 Nov; 114(5):589-99.
7. Richmond S, Shaw WC, O'Brien KD, Buchanan IB, Jones R, Stephens CD, et al. The development of the PAR Index (Peer Assessment Rating): reliability and validity. *Eur J Orthod*. 1992 Apr; 14(2):125-39.
 8. Daniels C, Richmond S. The development of the index of complexity, outcome and need (ICON). *J Orthod*. 2000 Jun;27(2):149-62.
 9. Cordua T, Ursini R, Giuliani L, Deli R. The excellence challenge in orthodontics: clinical use of an objective grading system for orthodontic cases. *Prog Orthod* 2009;10(2):4-15.
 10. Richmond S, Phillips CJ, Dunstan F, Daniels C, Durning P, Leahy F. Evaluating the cost-effectiveness of orthodontic provision. *Dent Update*. 2004 Apr;31(3):146-52.
 11. Templeton KM, Powell R, Moore MB, Williams AC, Sandy JR. Are the Peer Assessment Rating Index and the Index of Treatment Complexity, Outcome, and Need suitable measures for orthognathic outcomes? *Eur J Orthod*. 2006 Oct;28(5):462-6.
 12. Abrams D, Davidson M, Harrick J, Harcourt P, Zylinski M, Clancy J. Monitoring the change: current trends in outcome measure usage in physiotherapy. *Man Ther*. 2006 Feb;11(1):46-53.
 13. Beezhold J. Influence of Feedback and Attitude of Patient and Clinician Toward Outcome Measurement. *Eur Psychiatry*. 2015 Mar;30(Suppl 1):137.
 14. Jensen-Doss A, Hawley KM. Understanding barriers to evidence-based assessment: clinician attitudes toward standardized assessment tools. *J Clin Child Adolesc Psychol*. 2010; 39(6):885-96.
 15. Lynn MR. Determination and quantification of content validity. *Nurs Res*. 1986 Nov-Dec; 35(6):382-5.
 16. McHugh ML. Interrater reliability: the kappa statistic. *Biochem Med (Zagreb)*. 2012; 22(3): 276-82.
 17. Hickham JH. Directional edgewise orthodontic approach. 5. *J Clin Orthod*. 1975 Mar; 9(3):143-9,152-4.
 18. Klaus K, Stark P, Serbesis TSP, Pancherz H, Ruf S. Excellent versus unacceptable orthodontic results: influencing factors. *Eur J Orthod*. 2017 Nov 30;39(6):615-621.
 19. Al Yami EA, Kuijpers-Jagtman AM, van 't Hof MA. Stability of orthodontic treatment outcome: follow-up until 10 years postretention. *Am J Orthod Dentofacial Orthop*. 1999 Mar; 115(3): 300-4.
 20. Nett BC, Huang GJ. Long-term posttreatment changes measured by the American Board of Orthodontics objective grading system. *Am J Orthod Dentofacial Orthop*. 2005 Apr; 127(4): 444-50; quiz 516.
 21. Burt BA, Albino JE, Carlos JP, Cohen LK, Dubner R, Gershen JA, et al. Advances in the epidemiological study of oral-facial diseases. *Adv Dent Res*. 1989 May;3(1):30-41.
 22. Bergström K, Halling A, Huggare J, Johansson L. Treatment difficulty and treatment outcome in orthodontic care. *Eur J Orthod*. 1998 Apr;20(2):145-57.
 23. Riolo ML, Vaden JL. Standard of care: why it is necessary. *Am J Orthod Dentofacial Orthop*. 2009 Oct;136(4):494-6.
 24. Vig KW, Weyant R, O'Brien K, Bennett E. Developing outcome measures in orthodontics that reflect patient and provider values. *Semin Orthod*. 1999 Jun;5(2):85-95.
 25. Song GY, Zhao ZH, Ding Y, Bai YX, Wang L, He H, et al. Reliability assessment and correlation analysis of evaluating orthodontic treatment outcome in Chinese patients. *Int J Oral Sci*. 2014 Mar;6(1):50-55.
 26. Turbill EA, Richmond S, Andrews M. A preliminary comparison of the DPB's grading of completed orthodontic cases with the PAR Index. *Br J Orthod*. 1994 Aug;21(3):279-85.
 27. Angermann R, Berg R. Evaluation of orthodontic treatment success in patients with pronounced Angle Class III. [Article in English, German]. *J Orofac Orthop*. 1999;60(4):246-58.
 28. Nulty DD. The adequacy of response rates to online and paper surveys: what can be done? *Assess Eval High Educ*. 2008 Apr;33(3):301-14.