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SCIENTIFIC SECTION

Clinical trials in orthodontics II: assessment of the quality of reporting of clinical trials published in three orthodontic journals between 1989 and 1998

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Abstract

Aims: To test the hypothesis that the quality of reporting of orthodontic clinical trials is insufficient to allow readers to assess the validity of the trial.

Design: A retrospective observational study.

Setting: The *American Journal of Orthodontics and Dentofacial Orthopedics* (AJODO), the *British Journal of Orthodontics* (BJO) and *European Journal of Orthodontics* (EJO).

Data source: Clinical trials published between 1989 and 1998.

Method: A hand search was performed to identify all clinical trials. The concealment of allocation, whether the trial was randomized, double blind, and whether there was a description of withdrawals and dropouts was recorded.

Results: One hundred and fifty-five trial reports were identified of which 4 (2.6%) were adequately concealed, 85 (54.8%) were described as being randomized, 10 (6.5%) as double-blind, and 44 (28.4%) gave a description of withdrawals and drop-outs from the trial. The type of randomization was considered appropriate in 78 (50.3%) reports and in 57 (36.8%) reports the level of blinding was considered appropriate. When assessed for the risk of bias in the reported trials,[1] one trial (0.6%) had a low risk of bias, 17 (11%) a moderate risk, and 137 (88.4%) a high risk.

Conclusions: In general the quality of reporting orthodontic clinical trials was insufficient to allow readers to assess the validity of the trials. Reporting of clinical trials could be improved by orthodontic journals adopting the CONSORT statement[2,3] to ensure that all relevant information is provided.

Index words:
Clinical orthodontic research, clinical trials, quality assessment, randomized clinical trials, reporting.

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Introduction

Well-designed randomized controlled trials (RCTs), confirming the same hypothesis, have, for many years, been recognized as providing the strongest level of evidence of the treatment effect of competing therapeutic interventions. However, with the development of systematic review and meta-analytical techniques, systematic reviews of RCTs can now be seen as providing the best level of evidence.[4–8] Over recent years developments in the science of reviewing and summarizing evidence from clinical trials in systematic reviews have highlighted the need for clinical trial reports to contain all the relevant information needed to assess the internal and external validity of a clinical trial. These are the degree of control of factors that could systematically affect the results of a trial and the degree to which the results can be generalized to populations who may receive the interventions.[9]

As a result, the quality of the conduct of controlled trials has been found to systematically influence the results of the trials. Importantly, poorer quality trials tend to over estimate the treatment effects of the

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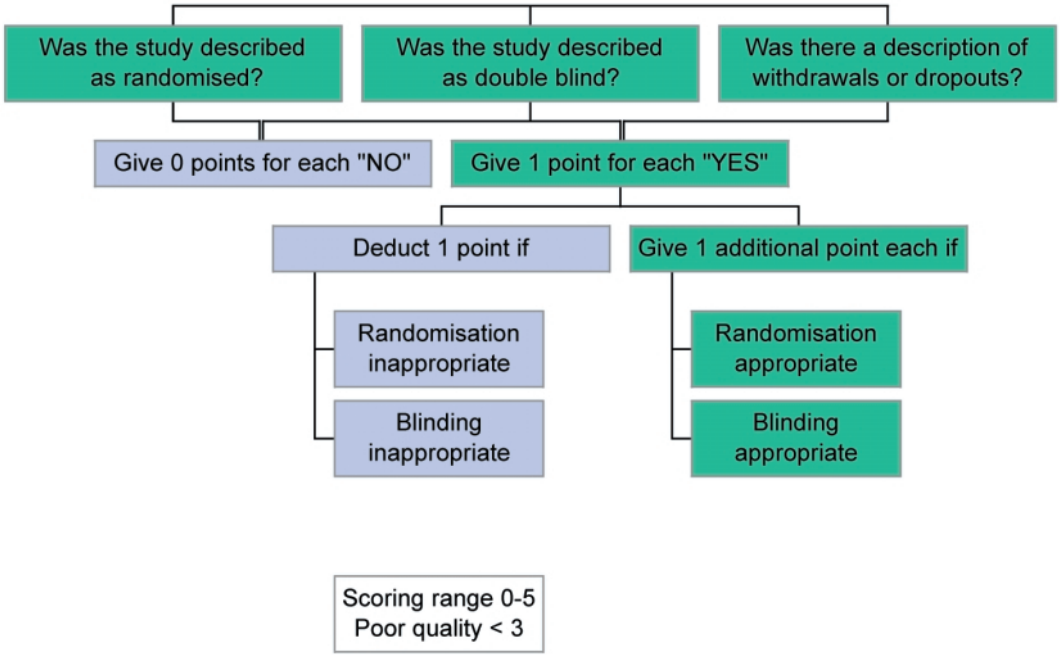

Fig. 1 The Jadad Scale for the assessment of the quality of RCTs (modified from Jadad, 1996).

interventions being assessed.[10,11] Although the quality of reporting is not a direct measure of the inherent quality of a trial, it does provide readers with a useful means of assessing its validity. Also, the published report is often the only information available on how a trial was carried out. Several scales and checklists have, therefore, been developed to help readers assess the quality of a trial report.[12]

The Jadad scale[13] was adopted for use by the Cochrane Collaboration to assess the quality of trials included in Cochrane Reviews. However, recent work assessing the quality of trials using different composite scales showed that the perception of the quality of a clinical trial varies according to which scale is used.[14,15] Consequently, the conclusions of a meta-analysis can be affected if trials are excluded/included or weighted according to the results of a summary score of a quality scale.[14] Based on empirical evidence and theoretical considerations it appears that concealment of allocation, blinding and completeness of data are the most likely indicators of trial quality.[15] For these reasons, the validity of trials being considered for inclusion in Cochrane reviews is now assessed in terms of the level of bias that is likely in each trial[1] (see Table 1).

Guidelines and checklists, aimed at improving the reporting of clinical trials, have also been published.[2,3] These have now been adopted by many journals, including the *Journal of Orthodontics*,[16] and can be used by authors, referees, and journal editors to ensure that the key pieces of information, needed to assess the internal and external validity of the trial, are reported.

The aim of this study was to test the hypothesis that the quality of reporting orthodontic clinical trials is inadequate to allow readers to assess the validity of the trial.

Table 1 Method to summarize the validity of studies

Risk of bias	Effect of bias	Criteria assessment
Low	Unlikely to seriously alter the results	All criteria met
Moderate	Some doubt raised about results	One or more criteria partially met
High	Seriously weakens the confidence in the results	One or more criteria not met

Materials and methods

Identification of clinical trials

The principal investigator successfully completed the Cochrane Collaboration Oral Health Group hand-searching test search for the identification of randomized controlled trials (RCTs) and controlled clinical trials (CCTs).[17] I hand-searched the *American Journal of*

Table 2 Reliability of the assessments used to assess clinical trials published in *AJODO*, *BJO*, and *EJO* 1989–1998

	Concealment of allocation	Randomized	Withdrawals described	Double-blind	Randomization appropriate	Blinding appropriate
% Agreement	94	100	81	100	100	94
Kappa score	0.85	1.0	0.54	1.0	1.0	0.85
Agreement	Very good	Very good	Moderate	Very good	Very good	Very good

Orthodontics and Dentofacial Orthopedics (*AJO-DO*), *British Journal of Orthodontics* (*BJO*), and *European Journal Orthodontics* (*EJO*) to identify all papers that reported randomized or controlled clinical trials published between 1989 and 1998 inclusive.

Assessments

The following information on each publication was recorded:

1. The concealment of allocation of treatment according to Cochrane Collaboration Guidelines.[1]
2. Individual domains of the Jadad scale,[13] i.e. whether
   - 2.1. the trial was randomized;
   - 2.2. the trial was double-blind;
   - 2.3. there was a description of withdrawals and drop-outs;
   - 2.4. the randomization method was appropriate;
   - 2.5. the level of blinding used was appropriate.

The studies were then assessed as having a low, moderate, or high risk of bias depending on whether they met all the quality criteria or if one or more criteria was partially met or not met suggested in the Cochrane Handbook[1] (see Table 1).

Reliability

I reclassified a random 10% sample of the trials identified in each journal, at a period no less than 3 months after the first classification, to assess the intra-examiner reliability of this classification system.

Statistical analysis

Descriptive statistics were used to assess the reporting characteristics of trials published in each journal. Any differences in categorical data were evaluated with the chi-squared (χ^2) test. Intra-examiner reliability of the assessments was evaluated with the Kappa statistic[18] and percentage agreement.

Table 3 Concealment of allocation

Concealment	Number	%
Adequate	4	2.6
Inadequate	28	18.1
Unclear	123	79.4
Total	155	100.0

Results

Between 1989 and 1998, 155 reports of clinical trials were published in the *AJODO*, *BJO*, and *EJO*, which represents 6.4% (155/2407) of all papers published in these journals over this period. Of these 85 (54.8%) were classified as randomized controlled trials (RCTs) and 70 (45.2%) as controlled clinical trials (CCTs) that used a quasi-random or haphazard control.

Reliability of the assessments

The intra-examiner reliability of the assessments ranged from 81% to 100% with Kappa statistics of 0.54–1.0 (moderate–very good agreement) for the individual domains (Table 2).

Quality assessment of the trial reports

Only four trials (2.6%) had adequately concealed allocation of treatment. The concealment was inadequate in 28 trial reports (18.1%) and unclear in over three-quarters (123/155, 79.4%) of the papers (Table 3).

Over half of the trial reports (85/155, 54.8%) were described as being randomized. However, only 10 (6.5%) were described as double blind and a quarter (44/155, 28.4%) gave a description of withdrawals or drop-outs from the trial (Table 4).

The type of randomization used was considered appropriate in half of the trial reports (78/155, 50.3%), but the level of blinding was considered to be appropriate in only a third (57/155, 36.8%) of trials (Table 5).

The assessments for the individual domains were then combined to give an assessment of the risk of bias in each

Table 4 Jadad Score domains I: method used in the reports of clinical trials published in *AJODO*, *BJO*, and *EJO* 1989–1998

	Randomized		Double-Blind		Withdrawals described	
	Number	%	Number	%	Number	%
No	70	45.2	145	93.5	111	71.6
Yes	85	54.8	10	6.5	44	28.4
Total	155	100.0	155	100.0	155	100.0

Table 5 Jadad Score domains II: appropriateness of randomization and blinding in the reports of clinical trials published in *AJODO*, *BJO*, and *EJO* 1989–1998

	Randomization		Blinding	
Appropriate	Number	%	Number	%
No	77	49.7	98	63.2
Yes	78	50.3	57	36.8
Total	155	100.0	155	100.0

Table 6 Risk of bias in the clinical trials published in the *AJODO*, *BJO* and *EJO* 1989–1998

Risk of bias	Total	%
Low risk	1	0.6
Moderate risk	17	11.0
High risk	137	88.4
Total	155	100.0

trial. Only one study (0.6%) met all the quality criteria and was assessed as having a low risk of bias. Most of the studies (137/155, 88.4%) had a high risk of bias and 17 (11.0%) a moderate risk of bias (Table 6).

Discussion

Unfortunately, the reports of orthodontic clinical trials, published in the *AJODO*, *BJO* and *EJO* from 1989 to 1998, were generally incomplete and many lacked key information thus making it difficult for readers to judge the validity of the trials. For example, the level of concealment of allocation of treatment was considered adequate in only four (2.6%) papers. Although over half of the trials (85/155, 54.8%) were described as being randomized, only 10 (6.5%) were double-blind and 44 (28.4%) gave a description of withdrawals and drop-outs from the trial. The implications of these findings on the conduct and findings of systematic reviews of orthodontic clinical trials will be discussed.

Assessing the quality of clinical trials

Unfortunately, unless researchers make a direct approach to the authors, the only information about the methodological quality of a trial that is available is what is contained within the trial report. It is important, therefore, to ask what is being assessed when trial quality is assessed from published reports, and distinguish between the methodological quality of the trial and the quality of its report.[12,19]

Inadequate concealment of treatment allocation has been identified as the factor that was most likely to affect the assessment of treatment effect.[10,11] It has been estimated that, on average, this results in an exaggerated treatment effect of about 40% and may be considered a major problem.[15]

The CONSORT statement[2,3] aims to improve the reporting of RCTs by providing a checklist for authors, so that they are prompted to include all the information that is relevant and necessary to assess the quality of trials. The quality of trial reports has started to improve since journals have adopted these guidelines and included them in their 'Instructions for Authors'.[20,21]

Orthodontic clinical trials

The main reasons for orthodontic trials failing to minimize the risk of bias was that they did not adequately conceal the allocation of interventions, the trials were not double blind, and an account of participants who withdrew or were lost to follow-up was not given.

Concealment of allocation

It was disappointing that only four trial reports contained explanations of the method of concealment of allocation that were considered to be adequate, e.g. there was central randomization by telephone or sealed, opaque, sequentially numbered envelopes were used to keep the allocation concealed until after recruitment. In some trials the concealment was clearly inadequate so that it would have been possible for clinicians to predict which intervention a patient or quadrant was to receive. Such methods include alternate patients receiving intervention A and B, or all upper right and lower left quadrants receiving intervention *X*, and the other quadrants *Y*. In the remaining trials the method of concealment was unclear and patients were simply randomized to the different interventions.

Blinding

Ideally, the participants, clinicians and assessors involved in a clinical trial do not know which intervention any participant is receiving. In the situation where the clinicians are the assessors the trial is said to be 'double-blind', but if the assessors are independent the trials may be 'triple-blind'. In orthodontics, it is often very difficult to carry out triple or even double-blind trials, because orthodontic appliances and materials often differ in appearance so that participants and/or clinicians are aware of which intervention any participant is receiving. However, it is possible to adopt double or triple blinding strategies in studies that assess different mouthwashes, toothpastes or analgesics that can be prepared and packaged to be identical. In studies in which blinding of the intervention is not possible the records that are used could have all means of identification removed. Furthermore, the data derived from these records could be recorded by an assessor who is independent of the trial and unaware of the group allocation. If guidelines on the design, conduct and reporting of orthodontic clinical trials are to be drawn up it would seem worthwhile to consider what level of blinding of patient/clinician/assessor would be considered appropriate in the situations where clinical trials are likely to be conducted. For example, in bonding trials is it possible for patients or clinicians to detect which bracket is bonded with which material—are they slightly different colours; were they cured in different ways, e.g. one light cured and the other chemical? If so, who should assess whether a bracket is off or a band lose? In this situation, it may not be possible to achieve any level of blinding, so open trials may be appropriate. For other studies, e.g. comparisons of functional appliances, it is probably not possible to blind patients or the clinicians who are treating them, but records can be assessed independently with the assessor blind to the intervention used. So, for these trials, an appropriate level of blinding would be where records are anonymous and examined by an independent assessor away from the participants. As suggested above, for trials assessing mouthwashes it would seem that a minimum of double blinding would be appropriate.

Withdrawals

For clinical trials to meet the criteria of describing withdrawals and drop-out careful records need to be kept of all trial participants and for their progress to be reported. The CONSORT[2,3] statement has gone a long way to help authors disclose this information by incorporating a flow chart of the numbers of participants at each stage of the trial.

Comparison with other specialties

Assessment of the quality of trials carried out in other specialties has been carried out. In general, the quality of reporting clinical trials is low with more than a half of all trials scoring less than half of the points available from the quality scales used.[22–30] However, these studies used a variety of scales and checklists that assessed several criteria (range 5–32 criteria), so it is not possible to make a direct comparison with this study.

Implications of poor reporting on evidence based orthodontics

Evidence-based medicine (EBM) has been defined as the process of 'systematically finding, appraising and using contemporary research as the basis for clinical practice'.[31] This definition can also be applied to dentistry and, in turn, to orthodontics. If orthodontics is to become a specialty where the clinical decisions that we make for our patients are based on sound evidence, all the relevant evidence needs to be available so that it can be found and appraised in a systematic way. Unfortunately, this study has shown that the amount of information provided in reports of clinical trials, in three of the leading orthodontic journals is, in general, inadequate. This will inevitably hamper efforts to bring together the best evidence that is available.

The quality of a trial report has implications for the interpretation of an individual trial, but the effects are compounded in systematic reviews where data from several trials are combined in a meta-analysis.[32] Unless steps are taken to reduce the influence of poor quality trials on the meta-analysis, the overall estimate of treatment effect could be severely biased and over estimated. Due to the problems associated with the validity of poor quality trials,[10,11] it is important that details of the methods of the clinical trial in trial reports are comprehensive. This information allows reviewers to assess the quality and make valid judgements as to whether to include trial results in a meta-analysis. If the appropriate details are omitted from the reports of orthodontic clinical trials it is likely that systematic reviews of them may be biased and any estimation of treatment effect would be inaccurate.

Conclusions

In general, the quality of reporting orthodontic clinical trials was insufficient to allow readers to assess the internal validity of the trials. This was related to the allocation of treatment not being adequately concealed in many trials, and/or trials not being double or adequately blinded, or lacking a full description of trial participants, withdrawals and dropouts.

Orthodontic journals should adopt or continue to use the CONSORT guidelines[3] for the reporting of randomized controlled trials with the aim of improving the quality of orthodontic trial reports and, in turn, systematic reviews of trials and the design and conduct of new trials.

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