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Evaluation of exaggerated claims in the abstracts of systematic reviews reporting accelerated orthodontic tooth movement: a meta research analysis

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Background: The latest trend in scientific literature review is to scrutinise the practices of false or biased reporting of findings, which is rightly termed as 'spin'. In recent years, accelerated tooth movement has gained attention from the orthodontic community, but the findings still remain unclear and controversial.

Objectives: To estimate the frequency of distorted claims and over-interpretation of abstracts of systematic reviews related to accelerated orthodontic tooth movement. The objective was to differentiate the type of claim and to determine its prevalence.

Methods: A literature search was performed using the Cochrane library and the top five most prominent orthodontic journals for systematic reviews on accelerated orthodontics were identified by applying appropriate key words. According to pre-set selection criteria, only systematic reviews published between January 2010 and September 2021 were included. The selected articles were scrutinised for the assigned exclusion criteria. The articles were finally scanned for false claims by two independent reviewers. The identified claims fell into either the categories of misleading interpretation, misleading reporting or misleading extrapolation. The obtained data were tabulated and analysed using the one-way ANOVA statistical test to indicate the difference between the different types of reported claims.

Results: There were 98 systematic reviews identified in total, of which 59 articles met the selection criteria and 39 articles were excluded. Of the 59 included articles, 38 systematic reviews had exaggerated claims. Twenty-two of the reported claims came under the misleading reporting category, 10 fell under the misleading interpretation category and 6 came under the misleading extrapolation category. The difference noted between the reporting prevalence of different types of claim was statistically significant ($P < 0.001$). In misleading reporting, it was noted that most of the systematic reviews refrained from reporting the adverse effects of treatment.

Conclusion: The prevalence of exaggerated claims is high in the abstracts of systematic reviews related to accelerated orthodontic tooth movement. It is recommended that a clinician critically assess the claims presented in systematic reviews which are considered to be the hallmark articles of evidence-based practice. Orthodontists should be careful when applying the findings in clinical practice.
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Introduction

Clinical diagnosis and treatment decision-making should be based on the best scientific evidence. Systematic reviews and meta-analyses are the foundation of therapeutic opinion, as they consolidate all available evidence.[1] Clinicians, decision-makers, and researchers frequently use systematic reviews to stay current on the medical literature, formulate clinical practice guidelines and plan future research.[2] Patients may utilise systematic reviews to better understand

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their therapy options. An accurate presentation and interpretation of a systematic review are therefore essential for the reliable dissemination and application of investigative results. Authors, however, usually have significant leeway when writing scientific reports,[3] with the possibility of introducing extravagant claims.

Horton initially used the term 'spin' in the medical literature in reference to research expression. Spin was defined as "the conscious and unconscious tricks of authorial rhetoric".[4] Spin, which is often connected with propaganda, public relations, and the media, is a skewed presentation meant to persuade the public to see things in a positive light. It is also found in published biomedical research, frequently referred to as 'science hype', in which scientific findings are exaggerated.[5] Spin refers to certain reporting tactics involving exaggerated claims described in the scientific literature that alter the interpretation of data and mislead readers so that the results are perceived favourably.[6]

The readers of the biomedical journals frequently skim the title and abstract of an article without reading the entire publication, because analysing the entire research is typically determined by paywalls, a lack of time or language challenges.[7] As a result, abstracts should accurately describe the aims, methods, findings and the interpretation of research.

The presence of exaggerated claims in scientific publications was first systematically investigated in reports of randomised controlled trials (RCT) following which, the clinical perception of research findings was shown to be influenced by the presence of exaggeration in approximately 60% of abstract conclusions.[8]

However, to date, there have been no investigations nor studies to uncover the occurrence of exaggeration in systematic reviews related to accelerated orthodontic tooth movement. As the accelerated orthodontic technique has become popular for adult orthodontic patients and is a topic of interest to most clinicians,[9] the current study was undertaken with the aim of estimating the frequency of distorted presentations and over-interpretation of results in abstracts related to systematic reviews on accelerated orthodontic tooth movement between the years 2010 and 2021.

Materials and method

A meta-research analysis was conducted on identified systematic reviews related to accelerated tooth movement over a period of 30 days. A thorough literature search was performed within the Cochrane library and the top five most prominent orthodontic journals (Table I) for systematic reviews on accelerated orthodontics using appropriate key words. The search was limited to articles published within the time frame of January 2010 to September 2021. The selection of the articles was based on the following pre-set criteria.

Inclusion criteria

- Systematic reviews related to different methods of accelerated orthodontic tooth movement
- Between the dates of January 2010 to September 2021

Exclusion criteria

- Systematic reviews of animal or laboratory studies
- Scoping or literature reviews
- Between dates other than the inclusion criteria dates
- Non-English articles

The search was conducted using various terms, key words and phrases related to accelerated orthodontics (Table II). A total of 98 systematic review articles were identified and, of these, 39 articles were excluded and so a total of 59 systematic review articles were included for further assessment (Figure 1). Two researchers (AR and TRS) read all of the articles and searched for distorted presentations and over-interpretation of the abstracts and classified them according to three categories of exaggeration involving misleading reporting, misleading interpretation and misleading extrapolation.

Incomplete or inadequate reporting of any key information in the context of the research that could

Table I. Orthodontic Journals selected along with their impact factor based on Metrics based on Scopus® data as of April 2021.

Sl.No	Journal Name	Impact Factor
1.	European Journal of Orthodontics (EJO)	1.252
2.	American Journal of Orthodontics and Dentofacial Orthopedics (AJODO)	1.183
3.	Angle Orthodontist	1.116
4.	The Korean Journal of Orthodontics	0.715
5.	Orthodontics and Craniofacial Research	0.664

Table II. Search terminologies and phrases.

Cochrane Database of Systematic Reviews searched via The Cochrane Library and five impactful journals on orthodontics
"accelerated orthodontic tooth movement AND systematic review"
"interventions for accelerated orthodontic tooth movement AND systematic review"
"low-level laser therapy assisted accelerated orthodontic tooth movement AND systematic review"
"corticotomy assisted accelerated orthodontic tooth movement AND systematic review"
"electrical current assisted accelerated orthodontic tooth movement AND systematic review"
"pulsed electromagnetic fields assisted accelerated orthodontic tooth movement AND systematic review"
"piezocision assisted accelerated orthodontic tooth movement AND systematic review"
"low-intensity pulsed ultrasound assisted accelerated orthodontic tooth movement AND systematic review"
"dentoalveolar or periodontal distraction assisted accelerated orthodontic tooth movement AND systematic review"
"microsteoperforation assisted accelerated orthodontic tooth movement AND systematic review"
"vibration assisted accelerated orthodontic tooth movement AND systematic review".

be misleading to a reader was characterised as misleading reporting. This category included: (1) a false reporting of study design; (2) selective reporting of outcomes favouring the treatment's beneficial effect; (3) not reporting adverse events; (4) linguistic misrepresentation (i.e., any word or expression emphasising the treatment's beneficial effect); (5) not reporting study limitations.[10,11] Misleading interpretation was described as the interpretation of study data that was inconsistent with the results presented in the scientific journal and over-estimated the treatment's beneficial effect. This category included claims related to (1) a beneficial effect of the treatment despite statistically non-significant results; (2) that the treatment was safe for statistically non-significant results despite a lack of power; (3) treatment safety despite adverse events reported in scientific articles; (4) a causal effect (i.e., implied a cause-and-effect relationship between the intervention being assessed and the outcome of interest; and (5) any other type of misleading interpretation not otherwise classified.[12]

Misleading extrapolation was defined as over-generalisation of results that were not assessed in the study. Extrapolating (1) animal study results to human application; (2) preliminary study results to clinical application; (3) inappropriate implications for clinical or daily use (i.e., an improper recommendation or

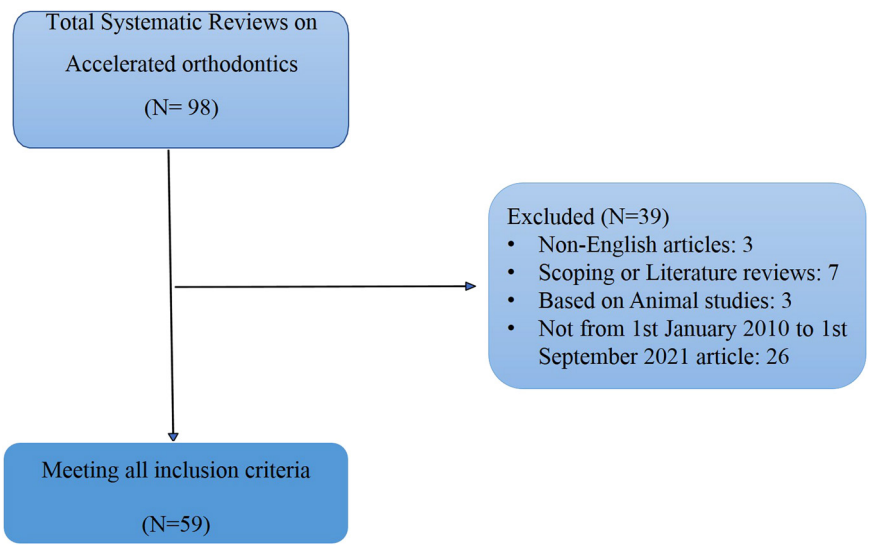


Figure 1. Flowchart for the selection and inclusion of articles assessing spin in accelerated orthodontic tooth movement related systematic review articles and reasons for exclusion.

advice to use the intervention in clinical practice or daily use not supported by the study results), and (4) any other type of extrapolation not otherwise classified are included in this category.[12]

After the assessment of the articles for the different types of exaggerated claim, the acquired data were tabulated and classified according to the type of claim (Table III). To determine the difference in the prevalence of different types of claim in the abstracts of the systematic reviews, a one-way ANOVA statistical analysis was applied.

Results

Table IV depicts the prevalence of different types of claim in the abstracts related to systematic reviews on accelerated orthodontics. In total, 38 (64.4%) reports had at least one type of misleading claim in their abstracts. Twenty-two (57.89%) systematic review abstracts had a misleading reporting type of claim. Ten (26.3%) systematic review abstracts had a misleading interpretation type of claim. Six (15.7%) systematic review abstracts had a misleading extrapolation type of claim.

Misleading reporting like "The results are significant but the clinical significance of these changes is still questionable",[13] misleading Interpretation like "There is limited available evidence…… Although the current study indicates that this method can hasten the treatment duration by 2.2–3 fold",[14] misleading extrapolation like "According to the low certainty of evidence about the topic, providing a definite conclusion is not possible, however, applying I-PRF seems to be efficient in accelerating the orthodontic tooth movement (OTM)",[15] were most often seen in the related literature.

Misleading reporting (57.89%) was the most frequently seen type of claim in accelerated tooth movement systematic review abstracts. Not reporting adverse effects was the most common type of misleading reporting followed by linguistic exaggeration. The difference noted in the prevalence of different types of claim was statistically significant.

Discussion

According to recent studies, there is a significant prevalence of exaggerated claims in published research findings. More than half of the abstract conclusions of RCT with statistically non-significant results for the major outcome featured a level of over-interpretation. In addition, one-third of published study reports of diagnostic accuracy contained a level of over-interpretation.[6] The focus was primarily on statistically significant results (within-group comparison, secondary outcomes, subgroup analyses, and modified population of analyses); or statistically interpreting non-significant results for primary outcomes as demonstrating treatment equivalence or comparable effectiveness.[16]

Boutron et al. discovered exaggerated claims in 50% (36/72) of the main text conclusions in parallel-group RCTs and 58.3% (42/72) in the abstract conclusions.[6] In a series of 525 peer-reviewed papers on obesity and nutrition, Cofield et al.[12] reported that approximately 31% of the articles used casual language in reporting. In a complementary study, Brown et al.[50] discovered that 26% to 50% of published studies attributed greater inferential strength than warranted by the study design. This is an alarming trend as an earlier study based on a RCT in the medical field reported that exaggerated claims in abstracts can influence how a reader interprets the study outcomes.[6]

Guo et al.[51] addressed the presence and characteristics of 'spin' in the orthodontic abstracts of RCT. Of the 111 abstracts, 62.2% had exaggerated claims. Forty-seven abstracts focused mainly on the significance of within-group comparison for primary outcomes, which is considered to be the most frequent claim strategy. In the conclusion section, the most common claim strategy was maintaining equivalence or non-inferiority for statistically non-significant results, with 51.4% of abstracts presenting exaggerated claims. Orthodontic RCT abstracts have a high prevalence of exaggeration. Clinicians must be mindful of the definition of exaggerated claims as well as their presence in all types of articles, as this knowledge will assist in analysing the seriousness of misleading reports relevant to evidence-based practice.[51] In addition, incomplete and inadequate reporting, interpretation, or extrapolation of findings on adverse effects reported in abstracts of systematic reviews can misdirect readers. The articles related to exaggerated claims raise awareness among readers about the different types of reporting errors seen in RCT's, abstracts and systematic reviews. Simultaneously, it also makes researchers improve reporting quality which will, in turn, increase the likelihood of including adverse effects in the results.[52]

The results of the current study indicated that 64.4% of systematic review articles reporting accelerated

Table III. Studies having different types of spin.

Type of Spin	Study		Year	
Misleading Reporting	Fau V et al.[13]	Orthod Fr.	2017	Adverse Effect not mentioned
	Darwiche F et al.[14]	J Contemp Dent Pract.	2020	There is limited available evidence about effectiveness of corticotomy assisted accelerated orthodontics. Although the current review indicates that the corticotomy assisted accelerated orthodontic treatment method can fasten the treatment duration by 2.2–3 folds compared to conventional orthodontic treatment.
	Elmotaleb M et al.[15]	J Int Soc Prev Community Dent.	2019	Adverse Effect not mentioned
	Figueiredo D et al.[16]	J Clin Exp Dent.	2019	Study limitations not mentioned
	Li Z et al.[17]	Angle Orthod.	2021	Study limitations not mentioned
	Camacho A et al.[18]	Photobiomodul Photomed Laser Surg.	2020	Adverse Effect not mentioned
	Bakdach W et al. [19]	Dent Med Probl.	2020	Low level laser therapy can speed up the rate of tooth movement. However, the overall quality of evidence ranged from low to very low and the clinical significance of the obtained statistically significant differences is questionable.
	Imani M et al.[20]	Acta Inform Med.	2018	Adverse Effect not mentioned
	Jedlinski M et al.[21]	Photobiomodul Photomed Laser Surg.	2020	Adverse Effect not mentioned
	Keerthana P et al.[22]	J Oral Biol Craniofac Res.	2020	Study limitations not mentioned
	Kalemaj Z et al.[23]	Eur J Oral Implantol.	2015	There is some evidence that LLLT can slightly accelerate OTM but this result is not significant and the effect estimated is not clinically relevant.
	Sousa M et al.[24]	Photomed Laser Surg.	2014	LLL seems to have a demonstrated efficacy, but further studies are warranted to determine the best protocols with regard to energy and frequency.
	Mohaghegh S et al.[25]	Int Orthod.	2021	Adverse Effect not mentioned
	Li J et al.[26]	Photobiomodul Photomed Laser Surg.	2021	Adverse Effect not mentioned
	Ge M et al.[27]	Lasers Med Sci.	2015	Adverse Effect not mentioned
	Mheissen S.[28]	PLOS ONE	2020	Low quality evidence suggests that piezocision is an effective surgical procedure in accelerating the rate of canine retraction in the first two months and reducing the treatment duration. However, this effect appears to be clinically insignificant.

	Alfawal A et al.[29]	Progress in Orthodontics	2016	There is limited available evidence about the effectiveness of minimally invasive surgically accelerated orthodontics (MISAO). Although the current review indicated that MISAO can help in accelerating canine retraction.
	Al- Shahrani I et al.[30]	Complementary Therapies in Medicine	2019	Findings of the current systematic review suggest a possible benefit with photobiomodulation therapy and tooth movement in orthodontia. However these findings need to be further validated in larger trails using specific standardized characteristics of laser settings to uniform the methodological design that can be used in routine clinical practice.
	Gil A et al.[31]	J Craniomaxillofac Surg.	2018	Corticotomy facilitated orthodontics resulted in decreased treatment time. Few complications and low morbitidy were found. More solid evidence based research is required to support these results.
	Kamal A et al.[32]	International Orthodontics	2019	Adverse Effect not mentioned
	Gkantidis N et al.[33]	Journal of Dentistry	2014	Adverse Effect not mentioned
	Iglesias-Linares A et al.[34]	Orthod Craniofac Res	2011	Adverse Effect not mentioned
Misleading Interpretation	Jing D et al.[35]	BMC Oral Health.	2017	Aim of study was to systematically evaluate the available evidences on the efficacy of vibrational stimulus to accelerate OTM, to which they concluded :Within the limitations of this review, weak evidence indicates that vibrational stimulus is effective for accelerating canine retraction but not for alignment. The effects of vibration on pain intensity and root resorption during orthodontic treatment are inconclusive
	Aljabaa A et al.[36]	Am J Orthod Dentofacial Orthop.	2018	Treatment is beneficial despite lack of evidence.
	Dab S et al.[37]	Orthod Craniofac Res.	2019	Current evidence suggests a very low to low level of certainty (GRADE assessment) in regard to quantified effects after CAOOT. Although CAOOT procedures show insignificant increase in the density following the use of bone graft and anchorage loss, they appear to accelerate the tooth movement during the first few months, to increase the buccal bone thickness and to show good tolerance by the patients; the clinical significance of these changes may be considered questionable.
	Viwattanatipa N et al.[38]	Korean J Orthod.	2018	Treatment is beneficial despite lack of evidence.
	Farshidfar N et al.[39]	Int Orthod.	2021	According to the low certainty of evidence about this topic, providing a definite conclusion is not possible. However, applying l-PRF seems to be efficient in accelerating the OTM of the canines.
	Apalimova A et al.[40]	Heliyon	2020	High heterogeneity among studies made it difficult to draw clear conclusions. However, within the limitations of this review, the corticotomy procedures were able to statistically and clinically produce significant temporary decrease in orthodontic tooth movement rate.

	Gkantidis N et al.[33]	J Dent.	2014	Treatment is beneficial despite lack of evidence.
	Almeida V et al.[41]	J Photochem Photobiol B.	2016	Three articles detected statistically significant differences in induced movement by comparing the orthodontic movement between the experimental and control groups. For the maxilla, there was a statistically significant influence of the laser in three months and, for the mandible, in one month. It may be concluded that there is no evidence that laser therapy can accelerate the induced tooth movement.
	Fleming P et al.[42]	Cochrane Database Syst rev.	2015	The available evidence is of low quality, which indicates that further research is likely to change the estimate of the effect. Based on measured outcomes in the short-term, these procedures do appear to show promise as a means of accelerating tooth movement.
	Yi J et al.[43]	Angle Orthod.	2017	Treatment is beneficial despite lack of evidence.
Misleading Extrapolation	Cronshaw M et al.[44]	Photobiomodul Photomed Laser Surg.	2019	Overgeneralisation of result for clinical logistics associated with frequent applications supports the concept of patient home delivery use of LED devices.
	Hassan A et al.[45]	Saudi Med J.	2015	Results of study said CAOT was found to accelerate tooth movement by 2–2.5 folds when compared with conventional orthodontic tooth movement. Conclusion- CAOT should be considered with caution.
	Eltimamy A et al.[46]	Open Access Maced J Med Sci.	2019	Prostaglandin showed a marked increase in rate of OTM; while inconclusive evidence was found regarding Prostaglandin in the acceleration of OTM
	Parcianello R et al.[47]	Orthod Craniofac Res.	2021	Twenty-four studies were included in the systematic review. On a specific dose level, epidermal growth factor + liposomes, fibroblast growth factor and prostaglandin E_2 + Ca were supported by a moderate level of evidence and rated as highly effective in increasing tooth movement in animal models. Hormones and growth factors may have a relevant impact upon orthodontic tooth movement rate. In specific formulations, prostaglandin E_2, fibroblast growth factor and epidermal growth factor showed promising results.
	Long Hu et al.[48]	Angle Orthod.	2013	Among the five interventions, corticotomy is effective and safe to accelerate orthodontic tooth movement, low-level laser therapy was unable to accelerate orthodontic tooth movement, current evidence does not reveal whether electrical current and pulsed electromagnetic fields are effective in accelerating orthodontic tooth movement, and dentoalveolar or periodontal distraction is promising in accelerating orthodontic tooth movement but lacks convincing evidence.
	Yi J et al.[49]	Journal of Oral Rehabilitation	2017	The quality of evidence ranged from very low to low. The short-term (1–3 months) effects of low-level laser therapy (LLLT, 5 and 8 J cm^2) and corticotomy were supported by low-quality evidence.We conclude that low quality evidence indicates that LLLT (5 and 8 J cm^2) and corticotomy are effective to promote OTM in the short term.

Table IV. Prevalence of different types of spin.

Spin Type	*N*	ΣX	Mean	Std.Dev.	Mean ± Std. Dev.	*F*	*p*-value
Misleading Reporting	38	22 (57.89%)	0.5789	0.5004	0.5789 ± 0.5004		
Misleading Interpretation	38	10 (26.3%)	0.2632	0.4463	0.2632 ± 0.4463	9.339	0.0001*
Misleading Extrapolation	38	6 (15.7%)	0.1579	0.3695	0.1579 ± 03695		

Note: *N*-Total number articles having spin. ΣX-Total number of individual type of spin. $Mean - \frac{Total\ number\ of\ individual\ spin}{Total\ number\ of\ spin\ articles\ reported}$. *Significant at $p < 0.05$.

tooth movement contained exaggerated claims, of which 59.8% had misleading reporting, 26.3% had misleading interpretation and 15.7% had misleading extrapolation. In a recent meta-analysis on accelerated orthodontics, the conclusion quoted "this intervention does not seem to cause an increase in root resorption…." and continuing in the same line, the authors quote "A low certainty of evidence supports that MOPs performed…..seem to have no significant effect on the rate of tooth movement".[53] The word 'seems to' is a misleading term to conclude the findings. In the current study, it was noted that the misleading reporting type of exaggerated claim was the most frequently encountered misinformation in the systematic reviews on the topic of accelerated tooth movement.

The present findings support those of earlier research. RCTs related to different methods of accelerated tooth movement also showed similar results, in identifying that a low-level laser therapy RCT contributed no significant increase in the rate of orthodontic tooth movement.[54]

The tactics involved in exaggerated claims are widespread, varied and may lead to the erroneous interpretation of study findings. This needs immediate attention by the researchers as false claims in the abstract conclusions of a systematic review article can influence the clinician's understanding of the facts.[55]

A recent article concerning exaggerated claims in an orthodontic-related meta-analysis, found that meta-analysis studies had a 1.66 times greater risk of reporting exaggeration in comparison with interventional studies. The report also showed that studies which had a large number of authors had a 1.76 times greater likelihood of presenting false claims.[56]

Interestingly, suboptimal reporting of the results in the abstract of randomised and non-randomised studies raised the chances of exaggeration. As a corollary, readers will mainly explore the title and the abstract of an article,[52] and so it becomes imperative that the scientific community pays more importance to an optimal and unbiased reporting style.

The current study was the first to investigate the impact of exaggerated claims in orthodontic-related literature and therefore, it was not possible to compare the current results with earlier studies. Including only systematic reviews published in the last 11 years may be a limitation; however, the chosen period focused on the best of current research. Including only accelerated orthodontic tooth movement systematic reviews published in the five leading orthodontic journals and stored in the Cochrane Database of Systematic Reviews may also be a limitation. In a final consideration, as the publishing landscape changes, additional future studies of a similar nature should be conducted to verify the present findings.

Conclusion

The presence of exaggerated claims in the abstracts of systematic reviews about accelerated orthodontics is a common finding. Approximately 64.4% of abstracts contained exaggeration, of which misleading interpretation was the most common type. It is imperative that readers and clinicians are aware of the terms associated with false claims and consider the recommendations carefully.

Conflict of Interest

The authors declare that there is no conflict of interest.

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