Full-text publication of abstracts presented at European Orthodontic Society congresses

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SUMMARY

INTRODUCTION: Empirical evidence has indicated that only a subsample of studies conducted reach full-text publication and this phenomenon has become known as publication bias. A form of publication bias is the selectively delayed full publication of conference abstracts. The objective of this article was to examine the publication status of oral abstracts and poster-presentation abstracts, included in the scientific program of the 82nd and 83rd European Orthodontic Society (EOS) congresses, held in 2006 and 2007, and to identify factors associated with full-length publication.

METHODS: A systematic search of PubMed and Google Scholar databases was performed in April 2013 using author names and keywords from the abstract title to locate abstract and full-article publications. Information regarding mode of presentation, type of affiliation, geographical origin, statistical results, and publication details were collected and analyzed using univariable and multivariable logistic regression.

RESULTS: Approximately 51 per cent of the EOS 2006 and 55 per cent of the EOS 2007 abstracts appeared in print more than 5 years post congress. A mean period of 1.32 years elapsed between conference and publication date. Mode of presentation (oral or poster), use of statistical analysis, and research subject area were significant predictors for publication success.

LIMITATIONS: Inherent discrepancies of abstract reporting, mainly related to presentation of preliminary results and incomplete description of methods, may be considered in analogous studies.

CONCLUSIONS: On average 52.2 per cent of the abstracts presented at the two EOS conferences reached full publication. Abstracts presented orally, including statistical analysis, were more likely to get published.

Introduction

Dissemination of research findings *via* scientific congresses contributes to the advancement of the orthodontic knowledge. Initial presentation of abstracts in conferences is often followed by publication in proceedings and journal supplements, which, however, may not be indexed by electronic databases. Incomplete indexing can limit access to abstract contents to only conference attendees and journal subscribers (Scherer *et al.*, 2007). Publication in a peer-reviewed periodical is perceived as the gold standard for presenting scientific information to a broader audience (Schulte *et al.*, 2012a), and it can be postulated that the full publication of a congress abstract may indirectly infer the importance of the study results (Peng *et al.*, 2006).

Von Elm and colleagues concluded that 44.5 per cent of the abstracts accepted for presentation at biomedical meetings were eventually converted to complete manuscripts (von Elm *et al.*, 2003), and a Cochrane review found that only 31 per cent of the abstracts reached full-text publication (Scherer *et al.*, 2007). The full publication of dental congress abstracts ranged from 19 to 50 per

cent (Bagheri *et al.* 2005; Scholey and Harrison, 2005; Dahllöf *et al.* 2008; Collier *et al.* 2010; Galang *et al.* 2011; Lee *et al.* 2012; Rodriguez *et al.* 2012; Table 1), with a median or mean time of 8–26.4 months to full publication. Specifically on the publication rate of European Orthodontic Society (EOS) abstracts, only one previous study is available focusing on a single-congress, revealing a 44.6 percentage with a median time of 23.5 months until full publication (Scholey and Harrison, 2005). However, this study neither distinguished between oral and poster abstracts nor investigated possible predicting factors for full-article conversion.

The majority of articles in the biomedical literature, including orthodontics, tend to report a significant or beneficial treatment effect, whereas negative, null or non-significant findings are less likely to be published (von Elm *et al.*, 2003, Koletsi *et al.*, 2009). This phenomenon has become known as publication bias and has several implications associated with potentially distorted evidence as only a biased subsample towards positive effects is readily available for research synthesis (Egger *et al.*, 2001).

Table 1 Studies that investigated the publication rate of dental congress abstracts (n/c, not calculated; IADR, International Association of Dental Research; EOS, European Orthodontic Society).

Study	Congress	Area	Follow-up	Publication rate (average; oral presentations; poster presentations)	Mean duration before publication
Lee *et al.* (2012)	IADR 2002, 2003	Prosthodontics	5 years	37% (40.7–35.8%)	26.4 months
Rodriguez *et al.* (2012)	AAOMS 2006–09	Oral and maxillofacial surgery	1–4 years	27% (30.1–24.3%)	n/c
Galang *et al.* (2011)	ADEA 2002, 2003	Dental education	5 years	19% (n/c–n/c)	16 months
Collier *et al.* (2010)	BAOMS 2002–06	Oral and maxillofacial surgery	3 years	24% (n/c–n/c)	8 months (median)
Dahllöf *et al.* (2008)	IAPD 1999, 2001	Paediatric dentistry	5–7 years	27% (40–21%)	20 months
Bagheri *et al.* (2005)	AAOMS 1997–99	Oral and maxillofacial surgery	5–7 years	34.8% (37.5–25.3%)	23.4 months
Scholey and Harrison (2005)	IADR 1993*	Dental research	5 years	45/3% (n/c)	17 months (median)
	ORCA 1993	Caries research		50% (n/c)	13 months
	EOS 1993	Orthodontics		44.6% (n/c)	23.5 months

AAOMS, American Association of Oral and Maxillofacial Surgeons; ADEA, American Dental Education Association; IAPD, International Association of Paediatric Dentistry; ORCA, European Organisation for Caries Research.
*A 10% random sample of the IADR abstracts was assessed.

Full publication of abstracts may be influenced by abstract characteristics such as presentation mode, geographical and institutional origin, research subject area, or statistical significance. Therefore, the objective of this study was to investigate the publication fate of oral and poster abstracts of the 82nd (2006) and 83rd (2007) EOS congresses, examine existing associations between abstract characteristics and publication status, and identify the predicting factors for full-text publications.

Materials and methods

Abstract collection and processing

In April 2013, two of the authors conducted independently a literature search in PubMed (http://www.ncbi.nlm.nih.gov/pubmed) and Google Scholar (http://scholar.google.nl/) to identify full-length publication of the abstracts included in the scientific program of EOS 2006 and 2007 congresses. Abstract information was retrieved from congress supplements available on the official web site of European Journal of Orthodontics (http://ejo.oxfordjournals.org). The selected length of follow-up was considered sufficient to allow for publication following abstract presentation protocols (Peng *et al.* 2006; Harris *et al.* 2006; Kleweno *et al.* 2008; Donegan *et al.*, 2010).

After excluding keynote lectures, 590 podium and poster-presentation summaries were reviewed for the purposes of this study. The abstract title, authors' names, mode and date of presentation, type of affiliation, geographical origin, and subject area were entered into a Microsoft® Excel spreadsheet (Microsoft Corporation, Redmond, Washington, USA). Date of the abstract presentation was registered as the month and year that the congress took place. In international collaboration projects, the country of affiliation of the first contributor was registered as country of origin. The abstracts were classified into seven subject areas: 1. behaviour and psychology, 2. biomaterials, 3. biomechanics, 4. diagnostic procedures, 6. craniofacial growth, and 7. genetics.

Full-publication identification

PubMed search initiated using the names of first, second, and last authors, and if no matching full-text article could be traced, alternative combinations of contributors' names and keywords from the abstract title were implemented (Macdonald *et al.,* 2012). A match was considered to have occurred when the generated article had similarities in author list, title, study design, and conclusions. In case of failure, an identical search of Google Scholar database was attempted. The examiners were calibrated in advance for the search procedures and the use of keywords (Li *et al.*, 2004). A third reviewer intervened whenever a conflict or uncertainty arose as to whether there was match between an abstract and a publication. Following article identification and retrieval, additional data such as date of full-paper publication, title and type of journal, and language of publication was recorded. If both online and in-print publication dates were available, the first one was regarded as the publication time. Matching articles preceding the congress dates were also analyzed. Finally, the publication proportion was calculated as the ratio of the number of subsequently published papers to the total number of abstracts presented at the orthodontic meetings.

Statistical analysis

Variables were cross-tabulated with abstract publication status. Univariable analysis using the chi-square test and logistic regression was applied using as dependent variable abstract publication status and dependent variables

conference year, presentation mode, type of institution involved, geographical area, subject area, and use of statistical analysis. Multivariable logistic regression included variables that were significant at the alpha = 0.20. Goodness of fit was assessed using the Hosmer-Lemeshow test. All the analyses were performed with the STATA® version 13 software (Stata Corporation, College Station, Texas, USA).

Results

Publication fate

In the 2006 EOS congress 333 abstracts (70 lectures, 263 posters) were presented, and in the 2007 EOS congress 257 abstracts (91 lectures, 166 posters) with full-text publications of 50.45 and 54.47 per cent were presented, respectively (Table 2). The mean period until full publication from congress presentation was 1.32 years. Most abstracts (75 per cent) were published as complete reports within the first 3 years post congress, whereas 5 per cent of congress presentations took at least 5 years for publication (Table 3).

Table 2 Publication status of abstracts by congress, presentation mode, institution, continent of origin, subject, and statistical results/testing (EOS, European Orthodontic Society).

Congress	Publication status		P value (chi-square)
	Yes	Total	
	n (%)	n (%)	
EOS 2006	168 (50.45)	333(100.00)	0.33
EOS 2007	140 (54.47)	257 (100.00)	
Presentation mode			
Oral	115 (70.99)	162 (100.00)	<0.001
Poster	193 (45.09)	428 (100.00)	<0.001
Type of institution			
University	286 (52.48)	545 (100.00)	0.08
Public health service	5 (62.50)	8 (100.00)	
Other governmental	8 (61.54)	13 (100.00)	
Private practice	6 (28.57)	21 (100.00)	
Private company	3 (100)	3 (100.00)	
Continent of origin			
Europe	203 (52.05)	390 (100.00)	0.64
Asia	88 (51.16)	172 (100.00)	
Other	17 (60.71)	28 (100.00)	
Subject			
Behavioural/Psychology	17 (68.00)	25 (100.00)	0.06
Biomaterials	48 (52.75)	91 (100.00)	
Biomechanics	12 (50.00)	24 (100.000	
Diagnosis	64 (50.39)	127 (100.00)	
Treatment	77 (44.25)	174 (100.00)	
Growth	77 (58.78)	131 (100.00)	
Genetics			
Statistical results/testing			
Not significant	81 (55.86)	145 (100.00)	<0.001
Significant	201 (59.12)	340 (100.00)	
No statistical testing	26 (24.76)	105 (100.00)	
Total	308 (52.20)	590 (100.00)	

Publication characteristics

Orthodontic journals accommodated 63 per cent of the published congress abstracts, and English alone or in combination with German was the predominant publication language (97 per cent). Three of the nine remaining articles appeared in Chinese, two in French and Iranian, whereas there was a single publication in Japanese and Spanish (Table 4). Over 55 per cent (55.5 per cent) of the publications appeared in four orthodontic periodicals, namely 'American Journal of Orthodontics and Dentofacial Orthopedics', 'The Angle Orthodontist', 'European Journal of Orthodontics', and 'Journal of Orofacial Orthopedics' (Table 4).

The top 10 countries in abstract and article production are listed in Table 5. From the broader perspective of origin, approximately 6 out of 10 abstracts originated from European affiliations. University departments contributed the most to the scientific sessions with 545/590 (92.4 per cent) abstracts, followed by private practices (21), other governmental institutions, i.e. national research centres and military academies (13), public health services (8), and private companies (3; Table 2). Treatment, growth, and diagnosis were the most prevalent research topics accounting for 73 per cent of abstract reports.

Factors associated with full-length publication

The univariable analysis, as illustrated in Table 6, indicated that mode of presentation, type of institution, subject area, and statistical testing (or absence of analysis) were significant predictors for an abstract to be subsequently published. In the adjusted model, mode of presentation, subject area, and presence of statistical testing remained significant outcome predictors. For mode of publication, the odds for an oral presentation to be published was nearly three times that of a poster presentation [odds ratio (OR) = 3.02, 95 per

Table 3 Publication time in years (and months) related to each congress and divided into time periods (EOS, European Orthodontic Society).

Congress	Publication time in years (months)
EOS 2006	1.43 (17.16)
EOS 2007	1.22 (14.64)
Overall	1.32 (15.84)
Publication time	Publications
	n (%)
>1 year pre-congress	10 (3.25)
Within 1 year pre-congress	33 (10.71)
Within 1 year post-congress	89 (28.89)
Within 2 years post-congress	80 (25.97)
Within 3 years post-congress	63 (20.45)
Within 4 years post-congress	16 (5.19)
Within 5 years post-congress	12 (3.89)
>5 years post-congress	5 (1.65)
Total	308 (100.00)

cent confidence interval (CI): 2.00, 4.57 $P < 0.001$] after adjusting for institution, subject, and statistical result. The odds of publication of a congress abstract with a statistical analysis was 4.24 times (OR = 4.24, 95 per cent CI: 2.51, 7.15, $P < 0.001$; positive findings), and 3.75 times higher (OR = 3.75, 95 per cent CI: 2.10, 6.71, $P < 0.001$; negative findings) compared with abstracts without statistical analysis. There was no significant difference in the odds of publication between abstracts with significant and non-significant results. Apparently, the odds of an EOS abstract dealing with genetics to be published was 3.84 times higher (OR = 3.84, 95 per cent CI: 1.18, 12.48 $P < 0.05$) than an abstract on treatment procedures.

Table 4 Distribution of articles by journal type and language of publication and journals containing ≥6 abstract related studies.

Journal type	Publication status	
	n (%)	n (%)
Orthodontic		194 (62.98)
American Journal of Orthodontics and Dentofacial Orthopedics	60 (19.48)	
European Journal of Orthodontics	54 (17.53)	
The Angle Orthodontist	43 (13.96)	
Journal of Orofacial Orthopedics	14 (4.54)	
Non-orthodontic		114 (37.02)
Archives of Oral Biology Clinical Oral Implants Research Frontiers in Bioscience	18 (5.84)	
Other journals	51 (38.65)	
Language		
English		285 (92.54)
Bilingual		14 (4.54)
Other		9 (2.92)
Total	308 (100)	308 (100.00)

Discussion

This is the first investigation to analyze the contents of research abstracts presented at a series of EOS congress aiming to identify factors that may predict full-article publication. The present study explored two databases (PubMed, Google Scholar) that enabled a more comprehensive search and identification of studies in non-PubMed indexed and non-English language journals. It is noteworthy that 60 per cent of the authors who carried out relevant studies searched only one database (Scherer *et al.*, 2007). Moreover, the follow-up period, extending beyond the established 5 year span for investigating publication rates (Schulte *et al.*, 2012b) may render our study design advantageous in minimizing potential underestimation of the results due to late publications.

The results indicate that on average 52.2 per cent of the abstracts originally presented at the 82nd and 83rd EOS congresses were published as full-length articles in peer-reviewed journals. Our findings are higher than the ones reported by other authors in the dental (Bagheri *et al.*, 2005; Scholey and Harrison, 2005; Dahllöf *et al.*, 2008; Collier *et al.*, 2010; Galang *et al.*, 2011; Lee *et al.*, 2012; Rodriguez *et al.*, 2012) and orthodontic literatures (Scholey and Harrison, 2005). The higher percentage of the full-text publication of EOS 2006 and 2007 abstracts compared with previous EOS and other congresses may be associated with better-quality acceptance criteria of the congress committee, the relatively higher general level of research contributed by the participants or other parameters such as authorship, editorial and peer-reviewing processes, and specialty characteristics. In the past, failure of publication has been attributed to lack of time required for manuscript preparation, low priority in pursuing publication, and disagreement regarding co-authorship (Balasubramanian *et al.*, 2006; Peng *et al.*, 2006). Additional reasons for not proceeding with full publication may include a larger scale

Table 5 List of 10 most productive countries in full-article publication of European Orthodontic Society congress abstracts.

Countries	Abstracts	Countries	Publications
	n (%)		n (%)
Germany	105 (17.79)	Germany	46 (14.93)
Turkey	63 (10.67)	The Netherlands	30 (9.74)
The Netherlands	41 (6.94)	China	29 (9.41)
UK	35 (5.93)	Turkey	26 (8.44)
China	34 (5.76)	Denmark	17 (5.51)
Italy	26 (4.74)	UK	16 (5.19)
Japan	25 (4.23)	Belgium	13 (4.22)
Denmark	21 (3.55)	Italy	11 (3.57)
Iran	17 (2.88)	Switzerland	11 (3.57)
South Korea	17 (2.88)	Japan	9 (2.92)
Others (≤16 abstracts)	204 (34.63)	Others (8≤ publications)	100 (32.5)
Total	590 (100.00)	Total	308 (100.00)

Table 6 Univariable and multivariable logistic regression derived odds ratios (OR) and 95% confidence intervals (CI) for publication status and congress abstract characteristics (EOS, European Orthodontic Society).

	Univariable			Multivariable		
	OR	95% CI	*P* value (Wald test)	OR	95% CI	*P* value (Wald test)
Congress						
EOS 2006	referent	—				
EOS 2007	1.17	0.85, 1.63	0.33			
Presentation mode						
Oral	2.98	2.02, 4.40	<0.001	3.02	2.00, 4.57	<0.001
Poster	referent			referent		
Type of institution						
University	referent	—	—	—	—	—
Public health service	1.51	0.36, 6.38	0.58	1.87	0.39, 9.07	0.44
Other governmental	1.45	0.47, 4.49	0.52	1.85	0.54, 6.34	0.33
Private practice	0.36	0.14, 0.95	0.04	0.59	0.21, 1.67	0.33
Private company	Omitted*					
Continent of origin						
Asia	referent					
Europe	1.04	0.72, 1.48	0.85			
Other	1.48	0.65, 3.33	0.35			
Subject						
Behaviour/Psychology	2.67	1.10, 6.53	0.03	2.58	1.00, 6.65	0.50
Biomaterials	1.41	0.85, 2.34	0.19	1.41	0.81, 2.44	0.22
Biomechanics	1.26	0.54, 2.96	0.60	1.01	0.40, 2.51	0.99
Diagnosis	1.28	0.81, 2.02	0.29	1.35	0.82, 2.23	0.23
Treatment	referent		—	—	—	—
Growth	1.80	1.14, 2.84	0.01	1.51	0.92, 2.48	0.10
Genetics	3.28	1.12, 9.57	0.03	3.84	1.18, 12.48	0.03
Statistical results/testing						
Not significant	3.85	2.22, 6.67	<0.001	3.75	2.10, 6.71	<0.001
Significant	4.39	2.68, 1.79	<0.001	4.24	2.51, 7.15	<0.001
No statistical testing	referent	—	—	—	—	—

*Not possible to calculate due to zero values.

ongoing study that succeeded the initial project, publication of similar findings, lack of novelty in results, flaws in statistical analysis, and low expected interest among readers (Balasubramanian *et al.*, 2006; Peng *et al.*, 2006). In this study, the mean time to full publication was around 16 months, which is comparable to previously published studies (Scholey and Harrison, 2005; Dahllöf *et al.*, 2008; Galang *et al.*, 2011). The peak of full publication occurred within the first 36 months following congress presentation. A substantial percentage of abstracts appeared in print beforehand and usually within 1 year before the congress. This finding may be due to the early online publication option, which has been increasingly embraced by journals as well as to the conscious choice of researchers to protect their own work from plagiarism (Schulte *et al.*, 2012).

Four orthodontic journals with impact factor hosted more than 50 per cent of the publications. The preponderance of English language publications may be interpreted by the intention of authors to ensure accessibility to a wider audience (Hopewell *et al.*, 2006). In addition, articles in English are cited more frequently in the literature, irrespective of journal impact factor, research subject, and number of authors (Poomkottayil *et al.*, 2011). Eight out of the top 10 countries in abstract submission were also listed in the top ten publication countries. A closer examination shows that countries with the highest publication rates were China (29/34 publications or 85.29 per cent) and the Netherlands (30/41 publications or 73.17 per cent). Claims that origin of research work may influence subsequent publication (Miguel-Dasit *et al.*, 2006) could not be substantiated.

According to our results, the type of abstract presentation was a significant predictor of full publication; this is consistent with some of the previous findings (Scholey and Harrison, 2005; Peng *et al.*, 2006; Dahllöf *et al.*, 2008; Lee *et al.,* 2012; Chung *et al.,* 2012), and may indicate that the congress organizers allocated higher quality and more rigorously conducted studies to oral sessions. However, other authors found no differences in publication percentages between oral and poster forms of presentations (Balasubramanian *et al.* 2006; Rodriguez and Laskin, 2012; Winnik *et al.*, 2012). Presence of statistical analysis was also significantly associated with a favourable publication outcome. Such a link has been also demonstrated by the analysis of the research announcements of the American Dental Education Association Annual Session & Exhibition interest (Galang *et al.*, 2011). Regardless of the statistical significance of results, abstracts

containing statistical analysis had about four times higher odds to be published in a journal compared with abstracts without statistical analysis. On the other hand, subject area was a weak predictor for full articles.

A shortcoming of studies of this kind may be related to the consistency between the abstracts and their respective full publications. That is to say that evaluation of study results from abstracts may be contrived due to either the preliminary nature of the results and/or shortcomings in abstract reporting (Rodriguez and Laskin, 2012). A summary of initial results may not be consistent with the final results (Peng *et al.*, 2006; Rodriguez and Laskin, 2012); in fact, Yoon and Knobloch (Yoon and Knobloch, 2012) encountered major inconsistencies in 65 per cent of abstract and full paper publication results. The abstract may appear devoid of statistics in the proceedings book and as a consequence may have been erroneously classified. Another possible limitation may be the association of multiple abstracts with a single publication (Yoon and Knobloch, 2012). Although overlap of abstracts between conferences might have occurred, it is not expected that it would have a significant effect on our results. Finally, communication with the authors of the studies deemed as unpublished in order to ascertain publication status of the abstract would have been ideal. Nevertheless, given the poor response rates described by follow-up surveys (Chand *et al.*, 2008), such an approach had not been not implemented.

It would have been desirable to include abstracts from other orthodontic congresses, such as the annual meetings by the American Association of Orthodontists (AAO) and the orthodontic symposia by the International Association of Dental Research (IADR). However, either due to the large participation of invited speakers and lack of oral presentations based on abstract selection (the AAO conferences) or due to the relatively small and variable volume of orthodontic and/or craniofacial abstracts (the IADR general sessions), the inclusion of the aforementioned congresses was not considered to avoid non-representative or even misleading data comparison. On the contrary, the selection criteria and the number of oral lectures and poster presentations accepted by the EOS scientific committee each year are consistent and met our study requirements. Hence, in the present study, we aimed to investigate the proportion of full-text publication of oral and poster abstracts of two consecutive EOS congresses followed up to approximately 7 years and to examine potential associations between study characteristics and publication status. To this end, data of publication outcome from previous studies on other dental congresses were used as references (Table 1) for a more meaningful interpretation of our findings.

Suggestions for additional improvement of publication rate of EOS abstracts may be addressed to the congress scientific committees and academic departments. Application of standardized acceptance criteria for oral and poster presentations and inclusion of more complete studies with statistical analysis, education of researchers, editors and peer-reviewers on the perils of publication bias may further increase the odds of publication of the abstracts presented in EOS meetings. Periodical examination of the publication outcome of EOS congress presentations based on common methods may be also proved beneficial in assessing publication bias. Given the necessity of disseminating all research findings, mandatory manuscript submission for publication before conference presentation (de Andrade *et al.*, 2011) and post-graduate qualification (Scholey and Harrison, 2005) may be considered. Orthodontic residents and researchers should be provided with necessary time and means, and encouraged by home institutions, to attempt publication of completed research projects.

Conclusions

Our analysis showed that presentation of abstracts at EOS 2006 and 2007 was followed by conversion to full-length articles in 52.2 per cent of the cases. A mean period of 1.32 years elapsed between conference and publication date. Oral presentations, presence of statistical analysis, and subject area, were found to be important predictors for full-text publication.

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