

**Characteristics and Fate of Orthodontic Articles
Submitted for Publication:**

An exploratory study of the *American Journal of Orthodontics and
Dentofacial Orthopedics*

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ABSTRACT

Purpose:

The orthodontic literature lacks any study that investigates the characteristics and fate of manuscripts submitted to a top journal, such as the *American Journal of Orthodontics and Dentofacial Orthopedics* (AJO-DO). Having such information could be valuable to authors and editors alike in understanding critical aspects of the review process.

Methods:

This exploratory study looked at original articles submitted to the AJO-DO in 2008 and gathered the following information: (1) For rejected articles: main reason for rejection, publication elsewhere, and journal of subsequent publication where applicable; (2) For accepted articles: number/type of revisions and time elapsed to publication; (3) For all articles: study topic, study design, area of origin, and presence of statistically significant findings. Descriptive statistics were used to describe the manuscripts in terms of the above characteristics. Interactions between the above characteristics and rejection/acceptance/publication elsewhere were explored and reported using the Chi-squared test for equality of proportions, with Fisher's exact test used for samples of five and below. Post-hoc pairwise tests were checked against the Bonferroni correction to account for multiple testing.

Results:

Of the 440 original articles submitted to the AJO-DO in 2008, 113 (25.9%) were accepted for publication while 323 (74.1%) were rejected. All accepted articles underwent either major or minor revision before acceptance and were published in an average of 20.9 months (sd=4.9) after acceptance. Of the rejected articles, 137 were subsequently published in 58 different journals with an average time to publication of 22.2 months (sd=10.9) after rejection from AJO-DO. Among articles not accepted by AJO-DO, the top three reasons for rejection were: (1) Poor study design/small sample size (59% of rejected papers); (2) Outdated/Unoriginal topic (41.5%); and (3) Inappropriate for AJO-DO audience (27.2%). Manuscripts rejected for poor study design had the least success in subsequent publication, while those rejected as inappropriate for the AJO-DO had the highest rate of publication elsewhere. Neither study topic nor study design were significantly associated with acceptance to AJO-DO or publication elsewhere except among rejected observational studies, where it was found that cross-sectional studies were most likely to be published elsewhere, and case series had the least success ($p=0.002$). Area of origin was found to be significantly associated with acceptance to AJO-DO, with articles from USA and Canada most likely to be accepted ($p<5\times 10^{-9}$). An inverse relationship was seen for publication of rejected articles in other journals, where countries with the least publishing success with AJO-DO had the highest rate of publication elsewhere. The presence of statistically significant findings was shown to be significantly associated with acceptance to AJO-DO ($p=0.013$) but not with publication elsewhere ($p=0.77$).

Conclusions:

Rejection by AJO-DO does not preclude publication elsewhere. Geographic origin is a predictor of acceptance to AJO-DO as well as subsequent journals. Authors aiming to maximize their chance of article acceptance should submit to an appropriate journal, use a well-designed and described study with adequate sample sizes, and emphasize the novelty and relevance of their work.

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INTRODUCTION

The medical and scientific communities depend on peer-reviewed journals to publish high quality studies, which often influence future research and clinical decisions. Both authors and reviewers expend considerable effort and resources to ensure that published research meets stringent criteria. While there exists a general consensus regarding proper study design and scientific reporting, even the most seasoned authors see their work rejected periodically. Understanding the reasons for a manuscript's rejection may help authors identify areas needing improvement, while editors may use this information to more clearly communicate their expectations to authors and reviewers. For orthodontic literature in particular, an investigation of rejected manuscripts may help to bolster the continuing improvement of research in this specialty.

The medical literature offers many studies examining main reasons for manuscript rejection, mostly in editorial form. In the dental literature, there are considerably fewer studies on this topic, though both medical and dental articles emphasize many of the same reasons for rejection. These reasons include the absence of novel findings, irrelevance to a journal's scope, flawed study design, and poor English and grammar. Few investigations in either medical or dental literature have endeavored to compare specific characteristics between accepted and rejected articles, such as country of origin, institutional affiliation, presence of statistically significant results, and study topic, which could potentially reveal sources of bias in the peer-review process.

Another area of interest regarding rejected articles is their ultimate fate after initial rejection. Several studies in medical journals have tackled such questions as, “What percentage of rejected articles are subsequently published elsewhere?” and “How much time elapses between rejection and publication in a different journal?” But, once again, the dental literature – and especially the orthodontic literature—is lacking in information on this topic. An investigation of rejected orthodontic manuscripts would fill a gap in the orthodontic literature as well as provide useful insights to editors, reviewers, and authors.

This study looked at original manuscripts submitted to the *American Journal of Orthodontics and Dentofacial Orthopedics* in 2008 and gathered the following information (1) For rejected articles: main reason for rejection, publication elsewhere, and journal of subsequent publication where applicable; (2) For accepted articles: number of revisions and time elapsed to publication; (3) For all articles: study topic, study design, area of origin, and presence of statistically significant findings. The purpose of this study is to report descriptive findings and examine the interactions between manuscript characteristics and acceptance/rejection/subsequent publication.

BACKGROUND

Studies abound in medical journals investigating reasons for manuscript rejection and the fate of manuscripts after initial rejection. Meanwhile, the dental literature has a relatively limited number of articles addressing these topics. Some of the studies on rejected articles are data-based, while the majority draw from the

authors' opinions or experiences to identify common pitfalls. Across the various studies on this topic, there is a common emphasis that not one, but multiple factors usually contribute to a manuscript's ultimate rejection.

A paper published in *Clinical and Experimental Ophthalmology* provides a good example of a study of reasons for rejection in a medical specialty journal. This study reported the top reasons for rejection for articles submitted in 2008. Of the 662 manuscripts submitted that year, 76.3 percent were rejected, with "does not add to current literature" as the most commonly cited reason for rejection, at 31 percent of articles. Twenty-six percent of the overall reasons for rejection were "poor methodology/questionable results", followed by "small sample size/problematic control groups", at 12 percent. The remainder of the reasons each comprised less than 10% of the overall reasons and included "poor English and grammar/poorly organized", "needs further work/clarification", and "no reason given" [Wyness 2009]. The results of Wyness' analysis overlap with several editorials from other medical specialty journals about common reasons for rejection. These editorials also mention that manuscripts are often rejected for not bearing relevance to a journal's scope or audience, not disclosing major conflicts of interest, not presenting a hypothesis, and/or not following the required format of a particular journal [Pierson 2004; Chernick 2008; Dogra 2011; Robinson et. al. 2010].

The existing dental literature echoes the information given in the above-mentioned medical literature, though far fewer studies exist to examine reasons for manuscript rejection [Hupp 2008]. An article in the *British Dental Journal* presented the results of a questionnaire sent to editors from fifty dental journals, which asked

them to share the main factors that influenced their decision to reject a manuscript. Of the 42 editors who responded, 49 percent cited “poor construction of the paper”, 46 percent said “poor use of English and careless preparation of the manuscript”, and 37 percent mentioned “poor research design”. Twenty-nine percent of the respondents assigned a high value to manuscripts that presented “scientific novelty and timeliness of the topic”, suggesting that articles deemed not to have this quality are more likely to be rejected [Radford et. al. 1999].

With regard to comparing characteristics of accepted versus rejected manuscripts, little precedent exists in either medical or dental literature. Characteristics that can be compared include the following: institutional affiliation, country of origin, reporting of statistically significant findings, and study topic. A study from a Dutch medical journal reported that manuscripts of non-institutional origin were more likely to be rejected than those of institutional origin [Kan 1990]. In consideration of country of origin, Liesegang et. al investigated the relationship between that variable and rejection by *The American Journal of Ophthalmology* and found that the countries submitting the most articles had the most rejections as well as the most acceptances, due solely to numbers [Liesegang et. al. 2007]. Regarding the effects of statistically significant findings, many have explored publication bias, which is an editor’s tendency to publish articles with positive findings or an author’s preference to submit articles with positive findings. Koletsi et. al. examined the contents of five top orthodontic journals and found that 75 to 90 percent of published studies contained statistically significant results [Koletsi 2009]. Meanwhile, a study by Lee et. al. in *Clinical Experimental Ophthalmology* asserted

that the presence of statistically significant results does not affect publication [Lee et. al. 2009]. An article in JAMA raised the question of whether an article without significant results is more likely to be rejected, or if the majority of submitted articles present statistically significant results [Dickersin et. al. 1992]. Regarding the relationship between study topic and manuscript rejection, this topic has not been explored to great depth in medical or dental literature.

With respect to ultimate fate of rejected articles, it is well known that most articles rejected after initial submission are subsequently published in another journal. Studies in the medical literature report that rejected articles are usually published in journals of lower impact factor (IF) than the journal to which they were initially submitted [Koene et. al. 1994; Liesegang et. al. 2007]. The IF of a journal for a particular year is defined as the number of citations from that journal from the previous two years divided by the total number of articles published in those two years. To give an example, the IF of a journal for the year 2008 can be calculated by dividing the total number of citations in 2008 of articles from 2006 and 2007 by the total articles published in that journal in 2006 and 2007. The equation would be set up as follows:

$$2008 \text{ Impact Factor} = \frac{\text{All citations in 2008 of articles from 2006-2007}}{\text{Number of articles published 2006-2007}}$$

Journals are assigned IFs in Journal Citation Reports®, published by Thompson Reuters. Journals with high IFs are usually judged as higher in quality, though using IF as a measure of journal quality has its limitations [Kurmis 2003; Mathur et. al. 2009]. A journal's article rejection rate (RR) may also be used to measure journal quality, assuming that a higher quality journal will have a higher article RR. It bears

noting that neither IF nor RR is a definitive measure of journal quality, and one does not necessarily influence the other [Kurmish and Kurmish, 2006]. The time to subsequent publication varies greatly among articles, but most medical studies showed that articles were published within three years of initial rejection [Koene et al. 1994; Ray et al. 2000; Liesegang et al. 2009]. The dental literature is lacking in information on the fate of rejected articles.

Though the existing medical and dental literature give some ideas about the answers to this study's research questions, the characteristics and ultimate fate of rejected articles in orthodontic literature have yet to be explored. The AJO-DO is an appropriate journal to analyze, as American orthodontists regard it as the premier purveyor of clinical advances in orthodontics. It receives a wide variety of submissions from around the world and is appreciated by an international audience. Its IF is the highest among orthodontic journals, with a five-year IF of 1.924.

METHODS

Study sample and data collection

This study was carried out with the approval of the University of Washington Human Subjects Division, application #42908.

A search of the electronic archives of the AJO-DO for original articles submitted between January 1, 2008 and December 31, 2008 yielded 461 articles for use in this study. The database included the abstracts of the submitted articles but not the full articles. For each manuscript included in the study, the following information was recorded where applicable:

- AJO-DO manuscript number
- Corresponding author's name
- Date submitted
- Date of final AJO-DO decision
- Days elapsed to AJO-DO decision
- Study topic classification (According to AJO-DO submission form)
- Number of revisions
- Type of revisions
- AJO-DO publication month and year
- Days elapsed to publication in AJO-DO
- Reason for rejection
- Country of origin
- Institutional affiliation
- Presence of statistically significant findings
- Study design
- Final fate (Published in AJO-DO, published elsewhere, or not published)
- Title of journal of subsequent publication
- Month and year of subsequent publication

Two investigators carried out the data collection, with Investigator #1 collecting data for one half of the articles and Investigator #2 collecting data for the other half. For study design and reason for rejection, both investigator determined these data independently for all articles, then intra- and inter-rater reliability was determined by re-categorizing 100 articles. For study design, the intra-rater reliability was 0.97 for Investigator #1 and 0.96 for Investigator #2. The inter-rater reliability for study design was 0.97. For reasons leading to rejection, the intra-rater reliability was 0.95 for Investigator #1 and 0.95 for Investigator #2. Their inter-rater reliability for reason for rejection was 0.92. Where the two investigators differed, a consensus was reached through review and discussion. In the particular case of determining study design for articles appearing to be controlled trials, the final determination was made after discussion with a third investigator with many years' experience as an associate editor for the AJO-DO.

The main topic of each article was determined from the topic classifications indicated by the authors during the AJO-DO submission process (Table 1). Each topic includes a number of subtopics that could also be indicated by the author. If more than one main topic was chosen for a particular manuscript, the main topic was determined using the context given in the article’s abstract.

Table 1: Study topic classifications	
AJO-DO classification number	Topic
10	Appliances-design and use
20	Biostatistics
30	Bonding
40	Business
47	Dental anomalies
50	Diagnosis and treatment planning
52	Digital technology
55	Evidence based orthodontics
60	Growth and development
70	Histologic studies
80	Imaging
90	Indexes/public health
95	Lasers
100	Materials
103	Molecular biology
110	Periodontics
120	Psych/soc
130	Sleep apnea
140	Surgery
150	TMD/function
160	Treatment/biomechanics

When an article is submitted to the AJO-DO, it can receive one of several review decisions, as listed below:

- Accept without revision
 - o Article can be published after copyediting.
- Return for minor revision

- Some changes needed in text; justify technique or method used; re-treat data; add a figure or table.
- Return for major revision
 - Reanalyze data; repeat part of the experiment using alternate method; replace or eliminate inappropriate elements, including figures; reorganize tables; follow journal submission guidelines for references, figures, submission elements, etc.
- Reject but submit to another journal
 - Article has merit but topic would be of limited interest to AJO-DO readers or has been recently covered in journal
- Reject after review
 - Team of reviewers determines that there is a fundamental error in design or sample; inappropriate methods; confounding variables that have not been detected.
- Reject after unsatisfactory revision
 - Team of reviewers determines that revisions do not meet the requirements for publication in the AJO-DO, and paper is rejected.
- Reject without review
 - Editor determines that article is fundamentally flawed or inappropriate for AJO-DO audience, and the article is rejected without being sent to a team of reviewers.

For this study, an accepted article was defined as having received a decision of “Accept without revision” or was accepted after resubmitting with revisions. A rejected article was defined as having received a decision of “Reject but submit to another journal,” “Reject after review,” or “Reject without review.” Articles that were returned to authors for revisions but not resubmitted to AJO-DO were excluded from the study.

The main reason for rejection was determined by reading the editor’s notes in the database as well as reading the reviews submitted by the reviewers. Given that more than one reason was usually given for rejection of an article, the investigators recorded one or two main reasons based on what was most commonly emphasized

among the reviewers and editor. As noted above, there was a very high intra- and inter-rater reliability in determination of reason for rejection.

Institutional affiliation could fall into one of four categories: (1) University; (2) Research center; (3) Hospital; (4) Private clinic. It was determined based on the affiliation noted for the corresponding author only.

The presence of statistically significant findings was determined using the article abstracts, with each article placed in one of three categories: (1) Statistically significant findings (i.e. abstract includes statements and numbers indicating statistically significant results); (2) Null findings (i.e. abstract includes statements and numbers indicating that the statistical analysis did not produce a significant result); (3) No statistical analysis (i.e. abstract does not indicate that any statistical analysis was included in the study).

The article abstract was also used to determine study design. Figure 1 shows a schematic for how articles were grouped among different study design types. Table 2 gives the definitions used to guide determination of study design.

Table 2: Definitions of study designs		
<p>Basic: Systematic study directed toward fuller knowledge of the fundamental aspects of phenomena without specific applications toward processes or products in mind (NSF definition)</p>	<p>Materials: Study to test properties of wires or adhesives, not tested in a living organism. Includes in-vitro studies.</p>	
	<p>Cell: Bench study involving cell samples.</p>	
<p>Translational: Research that helps to make findings from basic science useful for practical applications (<i>Center for Clinical and Translational Sciences</i>)</p>	<p>Human: Involves human extracted teeth</p>	
	<p>Animal: Involves animal subjects or animal extracted teeth</p>	
	<p>Theoretical: Includes studies on computer modeling, assessing and comparing imaging modalities, assessing opinions on esthetics from experts and lay people</p>	
<p>Clinical: Research involving human volunteers that is intended to add to medical knowledge</p>	<p>Controlled trial: participants receive specific interventions according to the research plan or protocol established by the investigators</p>	<p>Randomized controlled trial: study subjects are randomly allocated to the alternative treatments under study</p>
		<p>Non-Randomized controlled trial: study subjects are not randomly allocated to the alternative treatments under study</p>
	<p>Observational: Investigators assess the effects of an intervention on subjects, where assignment of the intervention is outside the investigator's control</p>	<p>Cohort: Subjects in treatment groups are followed over time to assess health outcomes</p>
		<p>Case-Control: Compares subjects with/without a given outcome and determine exposure that led to outcome</p>
		<p>Case Series: Reports on treatment course/outcomes for a group of subjects given the same exposure</p>
		<p>Cross-sectional: observation of a population, or a representative subset, at one specific point in time. Includes surveys.</p>

To determine whether a rejected article was eventually published elsewhere, the title of the article and corresponding author's name were used to search PubMed, Scirus, Scopus, and Google Scholar. If the article was not found by via any of these search tools, it was categorized as "Not published." If an article was found to be published elsewhere, the name of the journal of eventual publication as well as the month and year of publication were recorded.

A list of all the journals of subsequent publication was made and the 2010 impact factor was recorded (if available) for the journals that appeared most frequently on the list. The IF for the year 2010 was chosen for comparing journals, because it was observed that the overwhelming majority of journals submitted in 2008 were published in AJO-DO or elsewhere in the year 2010.

Data Analysis and Statistical Model

Descriptive statistics were used to report the characteristics of accepted and rejected articles according to the data collected for each article as outlined in the previous section. Interactions between the article characteristics and rejection/acceptance/publication elsewhere were explored and reported using the chi-squared test for equality of proportions in situations involving large sample sizes and Fisher's exact test where samples of five and below were involved. Where the sample size fell between 5 and 10, both chi-squared and Fisher's exact tests were used and were found to be equal in every such case. Significance was assigned at the $p < 0.05$ level. Where statistical significance at the 0.05 level was observed, post-hoc pairwise tests were performed and then checked against the Bonferroni correction to account for potential type 1 error due to multiple testing. The

Bonferroni correction is $\alpha_{\{per\ comparison\}} = \frac{\bar{\alpha}}{n}$, where $\bar{\alpha}$ is the experiment-wide significance level of 0.05 and n is the number of comparisons. In cases of multiple testing, the p-value was compared to the Bonferroni correction in order to assess statistical significance.

RESULTS

Of the 461 original articles submitted to the AJO-DO in 2008, twenty-one were excluded from the study:

- 2 case reports submitted as original articles;
- 15 articles not returned after revision requests
- 4 articles that were rejected then resubmitted to AJO-DO after 2008 and accepted for publication

This yielded a final sample size of 440 original articles, whose disposition is presented in Table 3. Accepted papers were published in the AJO-DO an average of 20.9 months (sd=4.9) after the final decision of acceptance. Of the rejected articles, 137 were eventually published in a journal other than AJO-DO an average of 22.2 months (sd=10.9) after the final decision of rejection.

Table 3: Disposition of 440 original manuscripts submitted in 2008			
324 Rejected (74.1%)		116 Accepted (26.4%)	
137 Published elsewhere (42.4%)	187 Not published (57.6%)	40 Major revision (34.5%)	76 Minor revision (65.5%)

Listed below are the percentages of articles given each final review decision:

- 21% Reject without review;

- 27% Reject after review;
- 25% Reject but submit elsewhere;
- 17% Accept after major revision,
- 9% Accept after minor revision, and
- 1% Rejected after unsatisfactory revision.

From submission, the time to final decision ranged from zero to 740 days (average=63 days) for all papers. Among rejected papers, the time to final decision ranged from zero to 288 days (average=41 days), with four papers rejected without review on the same day they were submitted. Meanwhile, final decisions for accepted papers were made within a range of 34 to 740 days (average=126 days).

Study topic

Table 4 shows the distribution and fate of all submitted articles among main study topics.

Table 4: Disposition of articles according to study topic				
Study Topic	All # (%) 440 total	Accepted # 116 total	Rejected # (%) 324 total	
			Published elsewhere 137 total	Not published 187 total
Appliances	54 (12.4%)	10	17	27
Biostatistics	3 (6.88%)	1	0	2
Bonding	56 (12.8%)	14	22	20
Business	8 (1.83%)	1	4	3
Dental Anomalies	12 (2.75%)	4	2	6
Diagnosis and Treatment planning	70 (16.1%)	15	27	28
Digital Tech	4 (9.17%)	1	1	2
Evidence-based	3 (6.88%)	1	1	1
Growth and Development	32 (7.34%)	7	13	12
Histology	13 (3.98%)	0	7	6
Imaging	41 (9.40%)	17	4	20
Indices/PH	11 (2.52%)	3	4	4
Lasers	1 (0.23%)	0	1	0
Materials	23 (5.28%)	6	7	10
Periodontal	1 (0.23%)	0	1	0
Pysch/Soc	18 (4.09%)	8	4	5
Surgery	5 (1.15%)	1	1	3
TMD/function	5 (1.15%)	1	2	2
Treatment/biomechanics	80 (18.2%)	26	18	36

The top six most common study topics and their acceptance probabilities are as follows:

- (1) Treatment/Biomechanics (32.5%)
- (2) Diagnosis and treatment planning (33.3%)
- (3) Appliances (18.5%);
- (4) Bonding (25.0%);
- (5) Imaging (41.5%);
- (6) Growth and development (21.9%).

While articles with the topic of “Imaging” had the highest acceptance rate, a chi-squared test of equality of proportions found that, among the top six, study topic was not significantly associated with acceptance by the AJO-DO ($p=0.18$). Statistical tests for rejected articles found study topic to be marginally associated with publication elsewhere ($p=0.057$).

Statistical significance

The great majority of original articles submitted to the AJO-DO in 2008 reported significant findings (329 out of 440), and those articles with significant findings had a higher rate of acceptance than articles without significant findings and those without statistical analysis. To test whether the presence of statistically significant findings was associated with acceptance to AJO-DO, Fisher’s exact test was used to compare articles with statistically significant findings to those that did not have statistically significant findings. It was found that having statistically significant findings was significantly associated with acceptance ($p=0.013$). Among rejected articles, the probability of publication elsewhere was similar across the categories. A chi-squared test comparing articles with positive findings and those without found that the presence of statistically significant results was not associated with publication elsewhere ($p=0.77$).

Area of Origin

The 440 original articles included in this study came from a total of 43 countries. Articles were grouped into seven areas of origin according to their country of origin. These areas of origin, along with the disposition of articles from each region, are shown in Table 5.

Area of origin	All # (%) 440 total	Accepted # 116 total	Rejected # (%) 324 total	
			Published elsewhere 137 total	Not published 187 total
Asia	97 (22.3%)	29	31	37
Australia	2 (0.5%)	1	0	1
Eastern Europe	7 (1.6%)	8	3	1
Western Europe	66 (14.9%)	19	25	21
Latin America	92 (20.6%)	10	26	54
Middle East/Africa	92 (21.1%)	10	41	41
U.S./Canada	84 (19.1%)	41	10	32

Area of origin was found to be significantly associated with acceptance ($p < 5 \times 10^{-9}$). Post-hoc pairwise tests indicated statistically significant differences in the rate of acceptance between the following pairs:

- Asia and Latin America ($p = 0.0029$)
- Asia and Middle East/Africa ($p = 0.0023$)
- Eastern Europe and US/Canada ($p < 1 \times 10^{-5}$)
- Latin America and US/Canada ($p < 1 \times 10^{-7}$)
- Middle East/Africa and US/Canada ($p < 1 \times 10^{-9}$)

According to the Bonferroni correction, p-values had to be below $0.05/15 = 0.0033$ in order to be considered significant.

Statistical tests found that area of origin was significantly associated with publication elsewhere ($p = 0.007$). This statistical analysis was performed excluding Australia and Eastern Europe, which were judged to have too few submissions for meaningful comparison. Post-hoc pairwise tests failed to reveal a significant

difference among any pairs, using a Bonferroni-corrected p-value of $0.05/10=0.005$. In general, rejected papers from Western Europe were most frequently published elsewhere, whereas those from U.S./Canada were least frequently published elsewhere.

Study design

Figure 2 shows the number of articles in each category of study design. Statistical tests did not find any aspect of study design to be significantly associated with acceptance. Among rejected articles, study design was not found to be a significant predictor of publication elsewhere, with the exception of rejected observational studies. Among these observational studies, the following percentages of publication elsewhere were noted:

- Cohort: 36%
- Case-Control: 35%
- Case Series: 21%
- Cross-sectional: 66%

A chi-squared test for equality of proportions showed a significant difference among these percentages ($p=0.002$). Post-hoc pairwise tests indicated a statistically significant difference between one pair: Cross-sectional and Case series ($p<0.005$). According to the Bonferroni correction to account for multiple testing, p-values had to be below $0.05/6=0.0083$ to be considered significant.

Institutional affiliation

Of the 440 original articles submitted, 415 had corresponding authors who were affiliated with a university. Figure 3 shows the distribution and final fate of

submitted articles according to institutional affiliation. Institutional affiliation was not found to be a significant predictor of acceptance or publication elsewhere, though the disparity among groups precludes any meaningful comparison.

Reason for rejection

Table 6 shows the disposition of rejected articles divided by reasons for rejection.

Reason for Rejection	All rejected papers	Not published elsewhere	Published elsewhere
Outdated, not interesting	135 (41.5%)	73 (39.0%)	62 (45.9%)
Poor design, small sample size	191 (59%)	123 (65.8%)	68 (50%)
Poor graph quality, wrong format	15 (4.64%)	8 (4.28%)	7 (5.15%)
Poor grammar, writing	36 (11.1%)	19 (10.2%)	17 (12.5%)
Conclusion unwarranted, statistics error	46 (14.2%)	26 (13.9%)	20 (14.7%)
Inappropriate for AJODO readership	88 (27.2%)	41 (21.9%)	47 (34.6%)

As mentioned in the Methods section, one or two reasons for rejection were recorded for each article. Of 324 rejected papers, 36.8% had one reason recorded and 63.2% had two reasons. The top three most commonly recorded reasons were as follows:

- (1) Poor study design/small sample size (Cited in 59% of rejected papers);
- (2) Outdated/Uninteresting topic (41.5%); and
- (3) Inappropriate for AJO-DO readership (27.2%).

Articles with “Inappropriate for AJO-DO readership” given as a reason for rejection had the highest frequency of publication in a different journal (53.4%). Meanwhile,

articles given “Poor study design/small sample size” as a reason for rejection had the lowest frequency of publication elsewhere (35.6%). Because many articles had more than one reason for rejection, separate logistic regression models were fit for the outcome “Published elsewhere” regressed against each possible reason for rejection. The results are shown in Table 7.

Table 7: Results of logistic regression for each reason for rejection	
Reason for rejection	p-value
Outdated, not interesting	0.30
Poor design, small sample size	0.0046 *
Poor graph quality, wrong format	0.71
Poor grammar, writing	0.51
Conclusion unwarranted, statistics error	0.84
Inappropriate for AJODO	0.012 *

**Indicates significance at $p < 0.05$*

Reason for rejection compared to Area of origin and Study design

The frequencies of each reason for rejection were investigated according to area of origin and primary study design. Table 8 shows the frequency of each reason for rejection among each area of origin.

	Asia	Eastern Europe	Western Europe	Latin America	Middle East/Africa	U.S./Canada
Outdated, not interesting	26	1	16	28	45	19
Poor design, small sample size	43	2	27	42	48	29
Poor graph quality, wrong format	5	0	3	3	4	0
Poor grammar, writing	9	0	5	11	10	1
Conclusion unwarranted, statistics error	9	1	8	13	11	5
Inappropriate for AJODO	18	1	12	29	21	6

Because more than one reason was given for many articles, there was no clear statistical test to perform. The following trends were observed:

- 97% of articles rejected for poor grammar/writing were not from U.S. or Canada, with articles from South and Southeast Asia most likely to be given this reason if rejected.
- Articles from U.S. or Canada were most likely to be rejected for “Poor study design/ small sample size” (69% of rejected articles) compared to the other areas of origin.

Table 9 shows the frequency of each reason for rejection for each primary study design.

Table 9: Reason for rejection and primary study design				
	Basic	Translational	Clinical	Total
Outdated, not interesting	39	45	51	134
Poor design, small sample size	36	62	93	191
Poor graph quality, wrong format	4	7	4	15
Poor grammar, writing	7	16	13	36
Conclusion unwarranted, statistics error	10	13	24	46
Inappropriate for AJODO	27	34	27	88

The following trends were observed:

- Clinical studies were most likely to receive a reason for rejection of “Poor study design/small sample size.”
- Basic studies were most likely to be rejected as “Outdated/Uninteresting” compared to Translational and Clinical studies.

Journals of subsequent publication

Of the 324 rejected articles, 137 were eventually published elsewhere in 58 journals. These journals ranged from well-regarded journals with higher IFs than AJO-DO (for example, the *Journal of the American Dental Association* with 2010 IF of 2.195), to lesser-known or more local journals (such as *Australian Orthodontic Journal* with 2010 IF of 0.444). The top five journals of eventual publication and the number of articles from this study published in each are listed in Table 3, along with the 2010 IFs for these journals. These IFs can be compared to the AJO-DO 2010 IF of 1.354.

Table 10: Top five journals of eventual publication

Journal title	Number of papers	Impact factor (2010)
Angle Orthodontist	17	1
European Journal of Orthodontics	23	0.932
World Journal of Orthodontics	4	Not indexed
Orthodontics & Craniofacial Research	4	1.809
Brazilian Oral Research	4	0.4225

DISCUSSION

Limitations

There were several limitations to this study. First, the data collection and analysis reflects only articles submitted in 2008, which may not be an accurate representation of the types of articles currently submitted to AJO-DO. It was decided to study articles from 2008 in order to give an adequate timeframe for rejected articles to be published elsewhere, given that previous medical studies have found that rejected articles are usually published within three to five years of initial rejection. [Koene et. al. 1994; Ray et. al. 2000; Liesegang et. al. 2009; Okike et. al. 2012].

Second, the results of this study may not be broadly applicable to all orthodontic manuscripts, given that each orthodontic journal tends to have a unique publication profile [Kanavakis et. al. 2006; Gibson et. al. 2011]. The fact that one of the most common reasons for rejection was “Inappropriate for AJO-DO readership” speaks to

this limitation. The AJO-DO readership comprises mainly clinicians, meaning that articles without clear clinical applications are more likely to be rejected as inappropriate for AJO-DO. Such manuscripts had the highest probability of being published elsewhere, most likely in a journal with a more appropriate publication profile. This observation highlights the importance of considering a journal's publication profile and audience in order to maximize the chance of acceptance to that journal.

Third, the amount of data that could be gathered to compare the original articles was limited by the information available in the AJO-DO electronic archive, which does not retain full manuscripts beyond one year after submission. Not having access to the full manuscript presented difficulty when making determinations about an article's study design, which was not always clear from the abstract. If the full manuscripts had been available, further investigation could have been done on rejected articles, such as comparing the AJO-DO manuscript to the eventually published article to see if the authors used the AJO-DO review to make changes to the manuscript before submitting elsewhere. In a 2012 study of rejected manuscripts from the *Journal of Bone and Joint Surgery* (JBJS), authors of rejected articles were surveyed and asked whether they had revised their manuscripts after rejection by JBJS. A higher rate of publication elsewhere was seen for articles whose authors reported revising their manuscripts based on the JBJS review [Okike et al. 2012].

A fourth limitation is the possibility that a search of PubMed, Google Scholar, Scopus, and Scirus may have missed articles that were published in unlisted

journals, potentially skewing the data regarding the fate of rejected articles. It bears mentioning that these sources cover such a vast portion of the literature that the likelihood of missing an article was kept to a minimum. PubMed, which is often a researcher's first choice for scholarly searching, boasts "more than 23 million citations for biomedical literature from MEDLINE, life science journals, and online books" [pubmed.gov]. Meanwhile, Scopus reports having access to 50 million records and 21,000 titles, making it "The largest abstract and citation database of peer-reviewed literature" [Elsevier.com]. Not to be outdone, Scirus has 200 million science-specific pages listed. Even Google Scholar has been shown to find unique items not indexed by PubMed [Schultz 2007]. The search for rejected articles in this study was extensive compared to the search methods of other studies on rejected articles, which were mainly limited to PubMed [Silberzweig and Khorsandi 2008, Okike 2012].

Fifth, the bias of the investigators may have affected the categorization of reasons for article rejection and study design. Efforts were made to minimize this source of bias by testing the intra- and inter-rater reliability for both of these variables, which were all above 0.90 and deemed acceptable. In the case of study design, clear definitions of each study design type were agreed upon between the investigators (as detailed in Table 2), and any points of disagreement were discussed until a consensus could be reached. Classification of controlled trials presented a particular challenge, which is why a third expert also examined the abstracts of the manuscripts in question and facilitated agreement about the assigned study design.

Sixth is the temporal limitation of this study, which reflects the review and publication trends of 2008. Even in the short time between 2013 and 2008, changes have taken place within the AJO-DO as well as other journals in terms of guidelines for review of randomized controlled trials and other types of study designs. Time to publication is much shorter (six months compared to two years), and even publication profiles can shift over time.

Fate of articles

The overall acceptance rate of original articles submitted to the AJO-DO in 2008 was 26.4%, which is similar to the acceptance rates reported for some medical specialty journals, though acceptance rates vary widely across different journals. For the example, *Epidemiology* was reported to have accepted 28% of articles submitted in 2002, while a study of submissions to the *BMJ*, *Lancet*, and the *Annals of Internal Medicine* found a collective acceptance rate of six percent for these medical journals [Lee et al. 2009, Hall and Wilcox 2007].

Statistical significance

Interestingly, the presence of statistically significant findings was associated with acceptance to AJO-DO but not with eventual publication of rejected articles. For articles accepted to the AJO-DO, the global test showed a difference among the three categories of (1) articles with statistically significant findings, (2) without significant findings, and (3) without statistical analysis. Using Fisher's exact test to compare just the first two groups showed that articles with statistically significant results were more likely to be accepted to AJO-DO than those with results that were not statistically significant. The findings of this study support a 2009 study of five

orthodontic journals (AJO-DO, *Angle Orthodontist*, *European Journal of Orthodontics*, *Journal of Orthodontics*, and *Orthodontics and Craniofacial Research*), which showed that all five journals published significantly more studies with significant results [Koletsi et al. 2009]. Yet this publication bias did not bear out when analyzing publication rates among the rejected articles. As mentioned in the Background section, the literature is conflicting as to whether statistically significant findings influence publication. While a difference may exist in acceptance rate between articles with significant results and those without, the very low sample size in this study of articles without statistical significance may have lacked the power to detect this difference.

Area of origin

Area of origin was found to be significantly associated with acceptance by AJO-DO as well as with publication elsewhere for rejected articles. Articles from the U.S. and Canada had the greatest success with acceptance to AJO-DO, but the least success for rejected articles being published elsewhere. At the same time, it was observed that articles from U.S. and Canada were most likely to be rejected due to problems with study design or small sample sizes and were least likely to be rejected due to grammar or writing problems. This may help explain the trends seen in AJO-DO acceptance among the different areas of origin. If the articles from U.S. and Canada were more often rejected due to problems with study design or small sample sizes, it may be less likely that these articles could be revised adequately to warrant publication when submitted elsewhere. Meanwhile, a non-U.S./Canada manuscript with grammar or writing problems may be more readily revised in

order to qualify for publication when resubmitted to a different journal. Alternately, an article rejected for problems with English might be more likely published in a local journal that prints in the author's native language.

Reason for rejection

The most commonly given reasons for rejection were (1) Poor study design/small sample size, (2) Similar submission already published/Topic is not novel, and (3) Article inappropriate for AJO-DO readership. These reasons echo those emphasized in a previous editorial article and an article that surveyed reviewers about their most commonly used reasons for rejection (Hupp 2008, Radford 1999). Unlike previous studies, the findings of this study present a more objective report of the most common reasons for rejection rather than relying on opinion or recollection. While the above three reasons were emphasized most often in rejected articles, it is important to note that it is not usually just one flaw that leads to a manuscript's rejection, which was the main reason to record more than one reason for rejection for most articles. While this method of data collection prevented the use of a statistical test to analyze reason for rejection among study design types or areas of origin, it is nonetheless an accurate reflection of the realities of the review process.

These data can be used to make general statements about the interaction between reason for rejection and primary study design. It was seen that clinical studies were more likely than basic and translational studies to be rejected due to poor study design/small sample size. Basic studies were more likely than the other study design types to be rejected as inappropriate for the AJO-DO readership.

Journals of subsequent publication

The 137 rejected articles that were published elsewhere appeared in 58 different journals. Of these, 9 were specifically orthodontic journals, and 9 were journals that published in a non-English language (though many published in both English and another language). The *Angle Orthodontist* and the *European Journal of Orthodontics* published the great majority of articles (40 total). After that, the number of articles published in each journal falls off sharply. This result is not surprising, as it was expected that manuscripts rejected by AJO-DO would likely be resubmitted for publication in other orthodontic journals.

CONCLUSIONS

This study sought to add to the orthodontic literature by examining the characteristics and fate of original articles submitted to the AJO-DO. The following conclusions can be taken from this study:

- Rejection by AJO-DO does not preclude publication
- Most commonly-given reasons for rejection:
 - Poor study design/small sample size
 - Similar submission already published/Topic is not novel
 - Article inappropriate for AJO-DO readership
- Articles from U.S./Canada most likely to be accepted by AJO-DO
- Rejected articles from U.S./Canada least likely to be published elsewhere
- Of articles rejected due to poor study design/small sample size, the majority were from U.S./Canada

- Of articles rejected due to grammar/writing problems, only 3% were from U.S./Canada.

Authors aiming to maximize their chance of article acceptance should submit to an appropriate journal, use a well-designed and described study with adequate sample sizes, and emphasize the novelty and relevance of their work.

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FIGURES 1-3

Primary	Basic	Material	
		Cell	
	Translational	Human	
		Animal	
		Theoretical	
	Clinical	Controlled trial	Randomized controlled trial
			Non-randomized controlled trial
		Observational	Cohort
			Case-control
			Case series
Cross-sectional			

Figure 1: Study design organization

Primary (440)	Basic (96)	Material (91)	
		Cell (5)	
	Translational (146)	Human (25)	
		Animal (28)	
		Theoretical (93)	
	Clinical (198)	Controlled trial (13)	Randomized controlled trial (10)
			Non-randomized controlled trial (3)
		Observational (185)	Cohort (62)
			Case-control (28)
			Case series (46)
	Cross-sectional (49)		

Figure 2: Number of articles for each study design

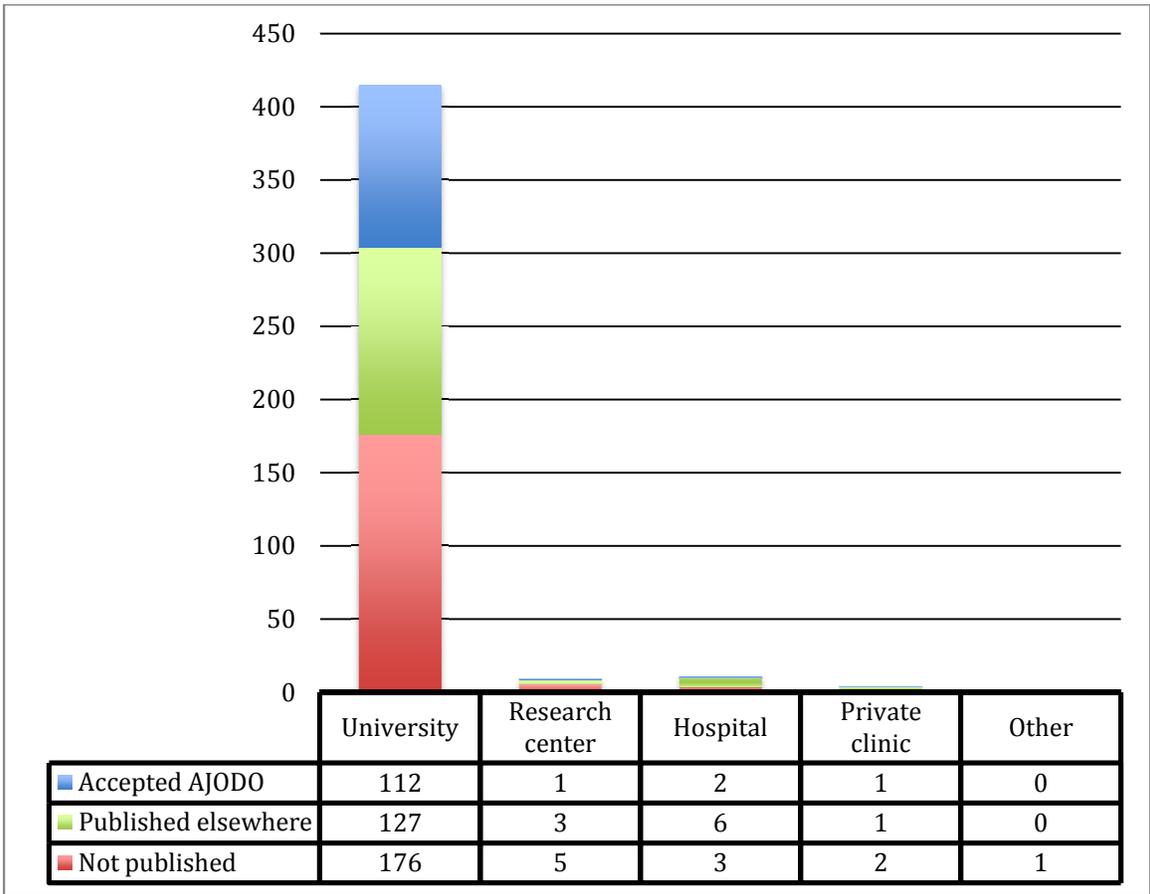


Figure 3: Disposition and institutional affiliation