Gender equality in orthodontic literature and leadership in the United States

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The objective of this study was to evaluate gender equality in orthodontics by reviewing the authorship in three orthodontic journals in addition to the involvement of women in leadership roles within orthodontic organizations and academia in the United States. Three journals representing orthodontics were selected to analyze the author demographics for the years 1986, 1990, 1995, 2000, 2005, and 2008. Inclusion criteria were at least one first or last author with a dental degree whose primary affiliation was in the United States. Female leadership was assessed in three orthodontic organizations as well as orthodontic program directorship. Overall, the percentage of female first authors increased significantly from 0% to 18% in the years studied (P = .004). The change of the percentage of female last authors was not statistically significant (P = .719). The participation of women in leadership roles within orthodontic organizations and in orthodontic program director positions has been limited. Within the limitations of this study, it was concluded that women are underrepresented in orthodontic authorship and leadership. ORTHODONTICS (CHIC) 2012;13:176–183.

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Gender disparity in authorship and leadership has been studied extensively in the medical literature.¹⁻⁴ Several studies have shown that 16% to 40% of authors are women, despite an increase in the prevalence of women authors and professionals over the past 30 years.¹,² Although the number of women choosing careers in medicine has grown substantially, there has not been a proportionate increase in the percentage of women in senior leadership positions.³,⁴

Professional advancement in an academic environment depends on scholarly activity, including outstanding performance in teaching, research, and service.⁵ Academic productivity may be objectively measured by the number of publications in peer-reviewed journals. In dentistry, women are more likely than males to choose academic careers⁶ and remain in education long term.⁷ However, female clinicians remain underrepresented in the academic workforce.⁸ Additionally, although grant support⁹ and time spent on research were similar by sex, female faculty members have still reported experiencing gender bias in professional advancement.¹⁰
Women constituted about 1% of students enrolled in dental schools until the late 1960s and 1970s. The percentage of women enrolled in dental schools and advanced dental education, including orthodontics programs, has increased over the years (Fig 1). While there has been an increase of women in dentistry as a whole, the participation of women in orthodontic education and literature has not been widely investigated.

Recently, an evaluation of gender authorship in dental literature was performed. A significant increase in the number of female authors was noted, especially for the last authorship, from 1986 to 2008, and a need for further research of female authors and gender disparity in dentistry was expressed. The current study explored female professionals in orthodontic literature and organizational leadership in the United States. The purposes of this study were to: (1) determine the trend of contributions from female authors in orthodontic literature over time, (2) describe the profile of published female authors, and (3) compare the gender differences in orthodontic leadership.

METHODS

The methods of analyzing the literature were based on previous studies. The journals selected were based on high circulation rate, content related to orthodontics, and publication in the United States. The selected journals were American Journal of Orthodontics and Dentofacial Orthopedics (AJODO), Angle Orthodontist (AO), and Journal of Clinical Orthodontics (JCO). The electronic archives for the three journals were searched for articles published within the years 1986, 1990, 1995, 2000, 2005, and 2008. Editorials, correspondence regarding previously published articles, commentaries, summaries, guidelines, biographies, interviews, and letters to the editors were excluded from this analysis. To be included in the study, the articles needed a first or last author with a minimum dental degree (DDS/DMD/BDS) and primary affiliation in the United States. When only one author was named, that author was considered to be the first author. If the author's sex was ambiguous, an online search was utilized to locate more specific information. If the author's sex was still unable to be determined, that author was categorized as “unidentified.” For male authors who met the inclusion criteria, the combined dental and PhD degrees were noted. Female authors who met inclusion criteria were analyzed for the following variables: degree (equivalent of DDS, DDS and MS, DDS and PhD, DDS and MS and PhD, and DDS and other), primary affiliation (private practice,
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Information regarding the percentage of female program directors was obtained and compiled from the American Dental Association (ADA) Central Office from the years 2000, 2005, and 2008. Previous years lacked gender-specific information. The history of past and present presidents in three orthodontic organizations (American Association of Orthodontists [AAO], Edward H. Angle Society of Orthodontists [EHASO], and American Board of Orthodontics [ABO]) and their respective genders were examined. Information was obtained by contacting representatives from the associations.

Data were entered into a database (Microsoft Excel 2007, Microsoft). SPSS 17.0 (IBM) was used for descriptive and analytic analyses. Descriptive statistics including the frequency and percentage of female first and last authors in the selected journals were calculated for each year. Percentages of female author degree, affiliation, academic rank, type of article, and type of funding were also computed. A comparison was made between the percentage of male and female first and last authors holding a combined dental and PhD degrees. A linear regression analysis was performed to investigate the trend of female authorship in orthodontic literature. The chi-square test was performed to evaluate the relationships between academic ranks of female first and last authors. A significance level of .05 was used for all tests.

RESULTS

Authorship
A total of 1,901 articles were reviewed from the AJODO, AO, and JCO within the years 1986, 1990, 1995, 2000, 2005, and 2008. Of these articles, 596 met the inclusion criteria with a total of 533 first authors and 336 last authors. Of those articles, 10% (n = 55) of the included first authors and 11% (n = 38) of the included last authors were women. Overall, within the years included in
this study, the percentage of female first authors increased significantly from 0% to 18% ($P = .004$) (Table 1). The change of the percentage of female last authors was not statistically significant as a linear trend ($P = .719$). With respect to each individual journal, a significant trend of linear increase in female first authorship was evident in the AO journal ($P = .007$).

The majority of female first and last authors who held only a dental degree (47% and 58%, respectively), followed by combined DDS and MS degrees (36% and 24%, respectively). There was a higher percentage of female last authors with an additional PhD degree (16%) compared with female first authors (9%). The distribution was less than their male counterparts, where 34% of last authors and 10% of first authors had an additional PhD degree.

Eighty-one percent of female first and last authors were affiliated with a university, with the remaining 19% in private practice. Within the first authors, nearly equal distribution was shown among student/resident (25%), junior faculty (24%), senior faculty (24%), and other (27%). For last authors alone and both first and last authors combined, a significant difference among the academic rank was observed ($P < .034$ and $P < .044$, respectively) (Table 2). The articles written by women were mostly original research (81%), followed by case reports (11%) and technology/techniques (8%). More than three-quarters
(77%) of articles written by women did not identify a source of funding, 9% of articles reported a university as a source of funds, 8% reported government funding, 5% reported private funds, and 1% reported university and government funding.

**Leadership**

In 2000, 13% of orthodontic program directors were female. This percentage decreased to 8% in 2005 and increased to 14% in 2008 (Table 3). The AAO and ABO have had all male presidents since their establishment. The EHASO has had only one female chairperson in its entire history (Table 4).

**DISCUSSION**

This study utilized publications in peer-reviewed journals to gauge female scholarly activity. The results indicated that female authorship in orthodontics is less prevalent than male authorship. These findings are similar to previous studies in dentistry. One possible explanation for lower female involvement in research or authorship is the responsibility of raising a family. A previous study found that female clinicians were likely to spend twice as much time with childcare and housework compared with male clinicians. They also found that female clinicians were more likely to take a leave of absence for childcare and that leave of absence was longer in duration than their male counterparts. Another study focused specifically on orthodontic residents found that female residents planned on working significantly fewer hours than their male counterparts. Participation in research requires additional time and effort, both of which may already be allocated to family priorities for the female professional.

It is commonly accepted that first authors are usually students or junior faculty and the last authors are usually senior faculty with more experience, often...
displaying a mentee-mentor relationship. One would expect that the majority of last authors are senior faculty members, with more experience in research and an advanced education, which would explain why more last authors have additional degrees as opposed to first authors. Surprisingly, both female first and last authors were most likely to have solely a dental degree. Perhaps there are so many last authors without an advanced degree because, until recently, more residents graduated with only a certificate in orthodontics as opposed to an advanced degree. The second most common degree noted among first and last authors was a combination of DDS and MS. One survey of orthodontic residents found that in 2003, of the residents pursing advanced degrees, most were in an MS program and expressed an intention to publish their research. These residents contribute to the increased percentage of authors with an MS degree. The Commission on Dental Accreditation (CODA) standard 6-1 for orthodontic programs requires all residents to complete a full research project. For the advancement of the orthodontic profession, it is recommended that programs encourage students to publish their research.

This study demonstrated a significant increase in female first authorship of orthodontic publications, but the change in female last authorship was not significant. If most last authors are senior faculty members, it may take longer to see a significant increase in female last authors, since it takes many years to achieve a senior faculty position. Almost 50% of first authors were students or private practitioners; therefore, the increase in female first authors may be attributed to the increase in female enrollment in orthodontic programs (see Fig 1). The higher contribution of private practitioners may be a result of initiating research while the author was in residency but publishing the research once the author was in private practice. Another explanation for this finding is that to become part of an elite orthodontic organization such as the EHASO, one requirement set forth in the society bylaws is a written contribution to the profession suitable for publishing. Many private practitioners who want to become members may use clinical data obtained in their practice to meet the requirement.

Most articles written by women were original research. This is a positive finding due to the potential impact original research data have on the profession. Publications in peer-reviewed journals are the foundation for evidence-based treatment. The second most common type of article was a case report. The elevated number of case reports and technique articles is similar to the findings in the prosthodontic literature.

Academic advancement may be contingent on publications in respected journals since this is an objective measure of scholarly production. Consequently, most publications come from authors in academic institutions. Most articles written by women did not report any funding, and of the ones that did, the most common source was through a university. The process of obtaining federal funding is stringent, and the task of writing a grant proposal requires skills that are acquired through advanced research education and/or collaboration with senior researchers, both of which are less common in female academics.

Traditionally, female participation in orthodontic leadership roles has been underrepresented. With the exception of one female chairperson, all three national organizations lacked female presidents in their history. Female participation as orthodontic program directors has also been limited. Wright et al found that females had the same aspirations and self-assessed ability to hold leadership positions, yet females were significantly less likely to have been asked to serve. A need for more encouragement to apply for higher positions is warranted. Mentorship of female professionals may be beneficial in instilling higher aspirations and subsequently increasing female leadership and parity in academic achievements.
In 1986, the president of the American Dental Education Association (ADEA) raised the subject of female participation in dental education. The address urged the profession of dentistry to specifically take action with policies meant to increase female involvement in leadership positions. A number of national policies have been implemented. The attention has focused on females in research and has supported efforts for the advancement of females across health careers. The Federal Glass Ceiling Commission identified barriers that blocked female advancement and prompted federal policy makers to reduce those barriers. The Commission on Graduate Medical Education emphasized the need for females in leadership positions and policymaking roles to provide a diverse approach to health. The Association of American Medical Colleges reported the progress that females have achieved in medical education and leadership but addressed the need for improvement in gender issues that affect recruitment, retention, advancement, and development of female academicians.

There has been improvement in the encouragement of female leadership in dentistry; however, lack of detailed records with respect to gender hinders any evaluation of change. The AAO could follow the initiative of the medical associations to encourage the development and advancement of female orthodontists. A database which incorporates the gender of all positions in programs allows assessment of progress.

Some limitations to this study exist. Only first and last authors were included in this study, which may have underestimated the number of females participating in research. Additionally, for this study, it was assumed that all authors with a minimum dental degree were orthodontists. The educational background of each author was not readily available; therefore, the application of the results is restricted. The age of authors could not be ascertained, so the results have not been adjusted for this variable. Further investigation is warranted for determination of a possible generational gender difference.

For analysis, only information from the three selected journals were included. Orthodontists may publish in other journals, and for this reason, generalization of the results is limited.

CONCLUSION

Within the limitations of this study, the following conclusions were drawn:

- Female first authorship in orthodontic publications has increased significantly over time; however, this increase was difficult to compare to the overall increase of females in the profession.
- Female last authorship did not show a significant increase.
- Most female authors had solely a dental degree, were affiliated with an academic environment, published original research articles, and did not identify a source of funding.
- Participation in orthodontic leadership and administration by females has been minimal since the profession’s inception.

"The participation of women in leadership roles within orthodontic organizations and in orthodontic program director positions has been limited."
REFERENCES


