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Poster Presentation, American Association of Endodontists Annual Meeting

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VAPING: ALERT, Severe Pulmonary Disease Reported, 2019, Weekly Dental Update, United States Navy

Dental Professionals Support the Fight Against COVID-19, 2020

Naval Health Clinic Annapolis Conducts Virtual Indoctrination, 2020

NHCA Pharmacy Adjusts Procedures in Response To COVID-19, 2020

Naval Health Clinic Annapolis Launches Messaging App, 2020

Naval Health Clinic Annapolis and Uniformed Services University; Partners to Reduce Sudden Cardiac Death, 2020

Navy Dentistry Confronts COVID-19, 2020

NHC Annapolis Supports USNA Flu Shot Exercise, 2020

NHC Annapolis Modernizes Pharmacy Scripts Access, 2021

Hospital Corpsman First Active Duty Sailor to Achieve Lean Six Sigma Certified Master Black Belt, 2021

Abstract

Title: Gender Equity in Endodontic Scholarship and Academia

Sarah J. Ermoshkin, Master of Science 2025

Thesis directed by Dr. Patricia A. Tordik, DMD, FICD, Clinical Professor, Department Chair of Endodontics Division, Department of Advanced Oral Sciences and Therapeutics.

IMPORTANCE: Women have been achieving gender equity in lower academic positions, such as assistant professors. However, they have been underrepresented in higher ranks of academic endodontics.

OBJECTIVES: The first specific aim was to assess women's participation as authors, reviewers, and members of the editorial boards of the highest-impact endodontic journals from 2010 through 2023. The second specific aim was to test whether there are gender disparities in faculty rank after accounting for differences due to leadership roles and scholarship in US endodontic programs.

METHODS AND MATERIALS: After a PubMed® search of publications in *Dental Traumatology* (DTR), *International Endodontic Journal* (IEJ), and the *Journal of Endodontics* (JOE), authors, reviewers, and editorial board member names were downloaded. Gender API software was used to determine gender based on first names. Fifty-four (54) universities with endodontic postgraduate departments were identified in the American Association of Endodontists (AAE) website in 2022, and faculty information and rank were verified on departmental websites. Respective h-index scores were calculated using Harzing's *Publish or Perish* software.

RESULTS: Of the 36,587 authors, 35% were women; the percentage of women authors increased by 0.5% per year (95% CI=0.3 to 0.6%). There was a similar percentage increase in women reviewers and editorial board members (0.8% and 1.0%, respectively CI=0.6 to 1.0% and 0.2 to 1.8%). In 2023, the US endodontic academic leadership was 29% women. Women comprised 23% of chairs, 21% of post-graduate directors, and 47% of pre-doctoral director positions (P=0.013).

Men published more than women, outnumbered women as reviewers, and held more positions on editorial boards. Men outnumbered women in all faculty ranks. As a cohort, men had more publications than women.

CONCLUSION: The percentage of research productivity increased for women as authors, reviewers, and editorial board members. After adjusting for differences due to leadership roles and h-index, there is no evidence for a difference in the likelihood of holding higher academic rank due to gender.

Gender Equity in Endodontic Scholarship and Academia

by

Sarah J. Ermoshkin

The thesis submitted to the faculty of the graduate school of the
University of Maryland, Baltimore, in partial fulfillment
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Acknowledgements

I am lucky to have been raised by my parents, Tom and Connie. I grew up in the eighties and nineties. At the time, I didn't realize how fortunate I was to have a working mother with career ambitions until I arrived at college. I realized how unusual it was to have two married parents, both with professional careers. This year marks their 51st wedding anniversary. They instilled a sense of *limitless possibilities*—I could take on anything I set my mind to do. Arriving at this point in my career as a divorced, mid-forties female with two teenage children would not have been possible without feeling like I could take on any challenge at any time, now or in the future.

I am lucky to have two wonderfully supportive children, Nathan and Anna. Both sacrificed time with me while growing up so that I could pursue dental school, deployment on the USS Gunston Hall, LSD-44, and endodontic residency. They've encouraged me through my years of postgraduate study, my Navy career, and writing this thesis. Arriving at this point in my endodontic residency could not have happened without their words of encouragement and reassurance that what I was doing was inspiring them in their dreams and pursuits.

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Also, I am ever so grateful to Dr. Al M. Best, who initially approached Dr. Tordik and me about evaluating gender equity in endodontic publishing and allowed me to expand on his idea and how it translates to the real-world application of women in scientific academia.

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List of Abbreviations

American Association of Endodontists (AAE)

American Dental Association (ADA)

Dental Traumatology (DTR)

International Endodontic Journal (IEJ)

Journal of Endodontics (JOE)

Carnegie Classification of Institutions of Higher Education, Doctoral Universities: Very High Research Activity (R1)

Introduction

Gender balance is a reference to human resources and equal participation of women and men in all areas of work, projects, and programs and occurs when women make up 40 to 60% of any group (West et al., 2013). As of 2021, female dental graduates and female endodontic residents fell within that range: 51.6% and 43.8% respectively (American Dental Association, 2021).

Gender disparities have trended in a positive direction, according to these numbers. However, an analysis of rank and gender at US academic institutions concerning Division Chairs, Postgraduate Program Directors, and Predoctoral Directors demonstrates continued evidence that gender inequities have persisted in higher education at the highest levels of rank and positional authority (Kim et al., 2024).

Being published in high-impact journals has been highly valued and rewarded with selection, advancement, and promotion within the scientific environment (Lundine et al., 2019). Bringing in financial dollars to research universities is considered a pathway to promotion and advancement, and as women have published fewer articles in the high-impact journals men are reasonably more likely to predominate in higher-ranked academic positions (Lundine et al., 2019; Elsevier, 2017; Filardo et al., 2016; Ioannidou and Rosania, 2015; West et al., 2103). With less publishing, women have been less likely to act as peer reviewers and as scientific advisors or referees (Hosseini and Sharifzad, 2021; Surdu et al., 2021; Lerback and Hanson, 2017; Bonomo et al., 2016; Kane and Meadows, 2016; Kjeldal et al., 2016; Yuan et al., 1986,) and have held fewer editorial board positions (Ioannidou and Rosania, 2015).

This theory that advancement is connected to scholarly productivity assumes that the progression in academic influence moved from funding to authorship to peer review to editorial board membership to more research funding driven to the university and from the university to promotion in rank.

Alternative views that explained inequity at the higher levels of academic professionals (Simon et al., 2019; Tiwari et al., 2019) proposed that women did not apply for positions if they did not meet all the recommended requirements or women thought that promotion was more likely based on experience and track record rather than potential (Barsh and Yee, 2011; Mohr, 2014; Sandberg, 2013). By extension, these views explain why women were inequitably represented in academic positions of assistant professor and underrepresented in positions of professor.

The purpose of this retrospective study was to evaluate if women are increasing their participation at all levels of research as authors, peer reviewers, and editors. Also, because publication rate is not the only measure of productivity, this research compared h-index and leadership roles to test their effects on academic rank in men versus women.

Review of the Literature

Gender Disparity in Academic Rank Within Medicine, Dentistry, Specialty Dentistry, and Endodontics

Gender Disparity in Publishing, Peer Reviewers, and Editorial Boards

Gender Disparity Based on Female Career Assumptions

Gender Disparity in Academic Rank Within Medicine, Dentistry, Specialty Dentistry, and Endodontics

Over the last two decades, women have consistently and progressively increased their numbers in the dental academic pipeline (Kim et al, 2024). Over 51.6% of dental students are women, and 43.8% of endodontic residents are women (American Dental Association, 2021). However, although women have equitably filled lower ranks (instructor and assistant professor) of the dentistry pipeline, key decision-makers have been predominately men (Kim, 2023; Bompolaki, 2022; Simon et al., 2019; Tiwari et al., 2019; Yuan et al., 1986). The central issue is not “women in dentistry” but “women in dental leadership” (Gangwani, 2024; Iaonnidou et al., 2014).

A survey of dental faculty showed that women aspire to leadership roles, wishing to take their talents to new levels, and women residents express higher rates of interest in academic careers than male residents (Tricco et al., 2021). Furthermore, women were significantly more likely than men to pursue academic careers, and the number of women who advanced to the ranks of associate and full professor was significantly lower compared to men at similar stages of their careers with similar circumstances (Nonnemaker et al., 2000). In fact, from 1994 to 2016, oral science PhD graduates with

substantial research had a greater likelihood for academic careers, and gender was not an associated factor. The problem of gender inequity in academics has not been a result of too few women with appropriate experience, training, or the desire to fulfill leadership roles (Tricco et al., 2021; Pololi et al., 2012; Nazarova et al., 2016; Gadbury et al., 2016).

Gender Disparity in Publishing, Peer Reviewers, and Editorial Boards

Traditional measures of academic productivity have been research grant support, publication rate, and publication impact. These continue to be essential components for promotion that can be consistently evaluated across institutions, remaining relevant in academia when evaluating gender disparity.

Across multiple scientific disciplines, retrospectively, women have published fewer articles, have had less access to research funding, have had fewer citations than men, received fewer invitations to review peers, received fewer editorial board appointments, and have had fewer chances to preside as editors. The gross effect of a reduced publishing presence has been a compounding effect that provided fewer opportunities for peer review and editorial board membership, perpetuating gender disparity between men's and women's research productivity. Tiwari et al. correlated fewer published articles in high-impact journals by women with a lower academic rank around the globe than men in the United States, United Kingdom, European Union, Saudi Arabia, and Japan. As women have had fewer opportunities overall, women researchers gained fewer positions in top research environments.

Ceci and Williams (2011) noted that men produced 30% more publications than women, but when tenured women were compared to tenured men, the difference between full

professors was less than 5%. They concluded that the variable was not gender but access to resources provided by differing types of institutions, such as teaching load, funding, and research assistance. Moreover, the variable critical to the net difference between men and women was not gender. Still, it correlated more with access to resources, and women were more likely to be at teaching-intensive institutions (Ceci and Williams, 2011).

Ultimately, the research impact was a product of the organizational environment. Women appeared to be strongly overrepresented in lower academic positions, with higher teaching requirements, which reduced or limited time allotted to research (Lundine et al., 2019; Kaplan et al., 1996). Compared with men, women who reported slower career progress were less likely to be tenured or at the professor level, spent more time in clinical activities, and had less time for research. This resulted in less recognition in academia, and women were less likely to receive honors or awards that came from scholarly impact (Van den Besselaar and Sandström 2017).

With less scholarly recognition, fewer women were called upon for peer review. As editors used reviewers who were recognized experts in the field, with high volumes of submissions, they relied on known networks for peer review (Clark and Horton, 2019), This may explain why women were significantly underrepresented as reviewers and filled fewer editorial positions in dental and medical journals. Having fewer women as gatekeepers resulted in less direct effects on the generation of knowledge through published literature (Lundine et al., 2019).

Gender Disparity Based on Female Career Assumptions

Alternative views that explained inequity at the higher levels of academic professionals (Simon et al., 2019; Tiwari et al., 2019) proposed that women did not apply for positions if they did not meet all the recommended requirements or they assumed that promotion was more likely based on experience and track record rather than potential (Barsh and Yee, 2011; Mohr, 2014; Sandberg, 2013). Perhaps the potential for promotion for women was tied with performance reviews that gave women a vague sense of what they needed to do to achieve promotion (Correll and Simard, 2016) or that gave inflated performance feedback (Jampol and Zayas, 2021) that underdeveloped women for leadership positions.

Traditionally, gender equity research focused on organizational barriers. However, it may be more a matter of self-limiting mindsets and negotiation skills (Arnold and McAuliffe, 2020). As a result, women were inequitably represented in academic positions of assistant professor and underrepresented in positions of professor.

Purpose

This retrospective study has two purposes: first, to document whether women have increased their scholarly productivity over time; second, to evaluate the association between faculty rank and gender after accounting for scholarly productivity and leadership roles in endodontic academia.

Hypotheses

The first specific aim was to assess women's participation as authors, reviewers, and members of the editorial boards of the highest-impact endodontic journals from 2010 through 2023.

H_0: There is no increase in the percentage of women authors, reviewers, and editorial board members.

H_1: The percentage of women authors, reviewers, and editorial board members increased.

The second specific aim was to test whether there are gender disparities in faculty rank after accounting for differences due to leadership roles and scholarship in US endodontic programs.

H_0: After adjusting for differences due to role and h-index, there is no difference in the likelihood of holding a higher academic rank due to gender.

H_1: After adjusting for differences due to role and h-index, there is a difference in the likelihood of holding a higher academic rank due to gender.

Materials and Methods

Research Design

This is a retrospective study evaluating the gender of authors, reviewers, and editorial board members in three journals related to the field of endodontics and the rank and leadership of academic US graduate programs. This study's data was obtained from publicly accessed information. Reporting follows the STrengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines (von Elm et al., 2007).

Counts of publication numbers of women serving as authors, reviewers, and editors were obtained from publicly available information from MEDLINE through PubMed. An author search was conducted by targeting three journals between 2010 and 2023 to determine whether there was an increasing proportion of women authoring, reviewing, and editing roles over time. The three journals evaluated were *Dental Traumatology* (DTR), *International Endodontic Journal* (IEJ), and *Journal of Endodontics* (JOE). Their selection depended on their relevance to endodontics, impact factors higher than 2 (Clarivate, 2023), and use of peer review. Reviewers, referees, and scientific advisory board names were taken from published spring issues, and editorial board member names were taken from each year's December issue.

Publications evaluated were individually authored, full-length papers in print. In-press articles, retracted/errata, editorials, and letters were excluded. Following the SCOPUS specification of papers included in impact factor calculations, the following document types were included: article, review, and conference paper.

The gender of an author was determined by the gender-api.com online lookup of the first name. The Gender API software was used for two reasons: high accuracy and its feature of valid reporting of gender classification (https://gender-api.com).

A three-step process was used to determine gender. The first pass through the data used first names and accepted the determination if the accuracy was at least 66% in at least 5 samples. Those that were indeterminate went through a second pass that used the first name and country code (determined from the affiliation/address AD field in PubMed). Lastly, those genders that could not be determined by these two methods were subjected to a manual online search using biographies and faculty headshots at the university websites. Names with undetermined gender were treated as missing values.

The outcome variables all measured the percentage of women authors in the three journals. As in other studies of gender disparity, the following outcome variables were analyzed: first author, last author (in articles with two or more authors), second author (in articles with three or more authors), and all authors.

An individualized search that identified the leadership of postgraduate endodontic programs in the US and associated faculty academic rank was obtained by an internet search of department websites in conjunction with the roster posted on the American Association of Endodontists (AAE) website, which was performed in June of 2022 and December of 2023. Endodontic leadership roles were grouped into the following categories:

- Chair: (chair, chair (interim), co-chair, department head, division director, division chief, chair/division director, chair/director, or department director/chair)

- Postgraduate Program Director (interim)
- Predoctoral Program Director (or co-director)

Faculty ranks were grouped into the following categories:

- Professor/Clinical Professor
- Associate Professor/Clinical Associate Professor
- Assistant Professor/Clinical Assistant Professor

The h-index scores by faculty members were determined using Harzing's *Publish or Perish* software (Harzing, 2007), which was retrieved using the faculty member's last name, the first initial, and the middle initial. The software analyzed academic citations from Google Scholar with date restrictions from 1990 to 2022. This timeframe was kept after repeating a review of endodontic faculty in 2023 to keep the same search timeframe that appeared in the previous search. Due to the commonality of specific names, each author search result was manually examined, and citations were included in the h-index calculation when subject titles were manually identified as dentistry-related, matching the initial letter of their first name and last names from program online biographies.

Statistical Analysis

Summaries are reported as counts, percentages, and means with 95% confidence intervals. Raw data was entered into a spreadsheet. All analysis was done using the SAS® system (SAS/STAT® version 14.2 and JMP® Pro version 17.2, SAS Institute Inc., Cary, NC) to process the downloaded text files and to perform all statistical analysis using the article as the unit of analysis. Poisson regression was used to analyze the relationship between the number of authors and the characteristics of the articles. Simple logistic

regression evaluated the increase in the percentage of women and inverse prediction was used to estimate the year when 50% will be reached.

The NLMIXED procedure was used to estimate the average increase per year over approximately ten years. Descriptive statistics invested the proportion of men versus women at all faculty ranks and leadership roles. The information on the leadership in endodontic programs was analyzed using a multivariable logistic regression or a multivariable zero-inflated Poisson regression. Statistical significance was declared at $P<0.05$% and 95% confidence intervals.

Results

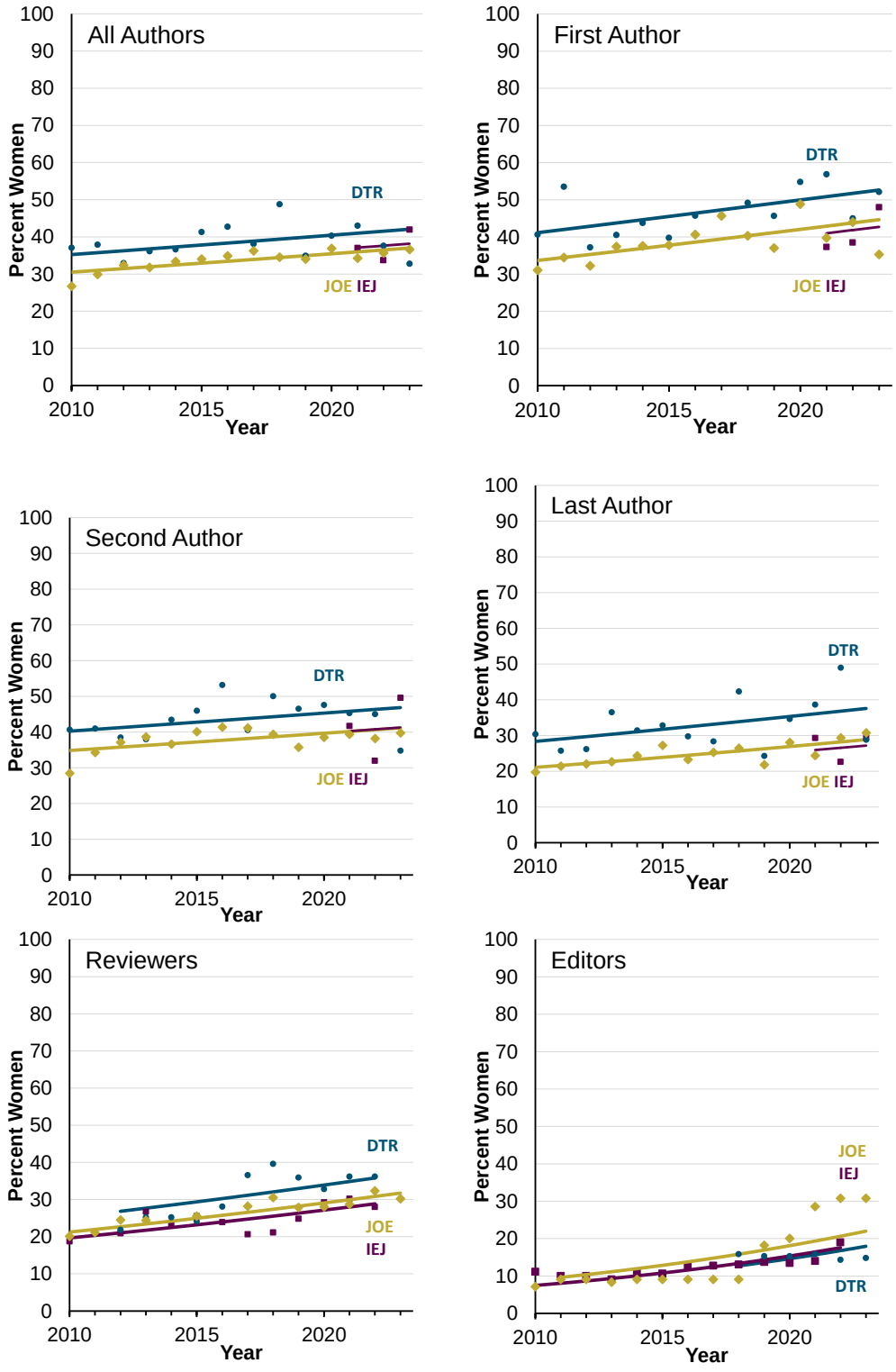
In the sample, 6,987 full-length articles were analyzed. Table 1 describes the characteristics of full-length journal articles, including publication year, document type, and number of authors. Figure 1 illustrates the increasing trends of women's percentage of participation grouped by total authors, first authors, second authors, last authors, peer-reviewers (reviewers), and editorial board members (editors) by journal and year. On average, 499 articles were published each year (SD=66, Table 1). DTR contributed 16% (n=1092), the IEJ contributed 29% (n=1994), and the JOE contributed 56% of all articles (n=3901). The IEJ published a higher percentage of reviews (13%) and the JOE published fewer reviews (5%). Overall, 91.6% were classified as document type=article. However, this percentage varied by the journal (chi-square $P<0.0001$).

Table 1: Characteristics of Full-Length Journal Articles

Characteristic	DTR No.	IEJ No.	JOE No.	Total No.	Total %
Total	1092	1994	3901	6987	100.0
Publication Year					
2010	100	133	344	577	8.3
2011	88	137	303	528	7.6
2012	79	139	297	515	7.4
2013	81	136	307	524	7.5
2014	80	129	377	586	8.4
2015	75	139	334	548	7.8
2016	82	121	288	491	7.0
2017	74	134	346	554	7.9
2018	60	162	280	502	7.2
2019	48	167	207	422	6.0
2020	86	144	254	484	6.9
2021	98	179	223	500	7.2
2022	64	135	158	357	5.1
2023	77	139	183	399	5.7
Document Type					
Article	990	1740	3671	6401	91.6
Conference paper	21	2	16	39	0.6
Review	81	252	214	547	7.8
Number of Authors					
1	22	27	62	111	1.6
2	122	119	268	509	7.3
3	174	266	497	937	13.4
4	259	329	686	1274	18.2
5	173	307	753	1233	17.6
6	156	363	684	1203	17.2
7	90	254	428	772	11.0
8	39	166	243	448	6.4
9	25	79	130	234	3.3
10+	32	84	150	266	3.8

Abbreviations
DTR = *Dental Traumatology,* IEJ = *International Endodontic Journal,* JOE = *Journal of Endodontics*

Figure 1: Percentage of Women by Journal and Year



Articles

Articles averaged 5.2 authors (SD=2.3) using a Poisson regression on the number of authors indicated variation by document type, year, and journal (all P<0.0001). Reviews had fewer authors (mean=4.7, CI=4.5 to 4.9) than articles (mean=5.3, CI=5.2 to 5.3). Conference reports had the fewest authors (mean=3.1, CI=2.6 to 3.7). In 2010, there was an average of 4.7 authors per paper (95% CI=4.5 to 4.9), which increased to 5.8 authors in 2023 (CI=5.5 to 6.0). DTR had the lowest number of authors (mean=4.8, CI=4.7 to 5.0), and the IEJ had the highest (mean=5.4, CI=5.3 to 5.5), with the JOE in the middle (mean=5.2, CI=5.2 to 5.3).

Authors

Of the 6,987 articles and 36,587 associated authors, 19,806 used full author names. Gender could not be determined if an author's name consisted only of the initials of the first (and the middle) name. As the IEJ used the "initials only" format for first names until August of 2021, only later issues were included in this analysis. The remaining 5,338 articles with 27,747 authors were included in the gender identification analysis of Table 2, and the author's gender was identified in 97% of the articles evaluated. Asian authors had the highest number of indeterminate names after using the gender API software and manual searches. We observed that 42% of unidentified names were from China, and 8% from South Korea. Overall, 9,162 women authors were identified with 95% accuracy, and men with 96% accuracy.

Articles and authors in the three journals from 2010 to 2023 are described in Table 2. In 2010, 412 authors published 100 articles in DTR, 397 of the authors could be determined, and 37% (n=412) were women authors, and the percentage of women authors decreased to 33% (128/391) in 2023. Women authors published 42% (303/723) papers in the IEJ and 37% (362/990) in the JOE in 2023. The percentage of women authors increased over time (logistic regression $P<0.0001$) by 0.5% per year (95% CI=0.3 to 0.6%, Figure 1). The three journals were significantly different ($P<0.0001$). Using the post hoc multiple comparison procedure, DTR's percentage of women authors was higher than the JOE and the IEJ ($P<0.006$). The JOE and the IEJ were not significantly different ($P=0.38$).

Table 2: Description of Female Authorship by Journal and Year

Year	Articles	Authors	All Authors			First Author			Second Author			Last Author		
	No.*	No.†	Total No.‡	Women§ No.	%	Total No.‡	Women§ No.	%	Total No.‡	Women§ No.	%	Total No.‡	Women§ No.	%
Dental Traumatology														
2010	100	412	397	147	37	96	39	41	91	37	41	79	24	30
2011	88	368	354	134	38	86	46	53	83	34	41	70	18	26
2012	79	388	383	126	33	78	29	37	78	30	38	65	17	26
2013	81	377	366	132	36	79	32	41	79	30	38	74	27	36
2014	80	376	372	136	37	80	35	44	76	33	43	70	22	31
2015	75	343	337	139	41	73	29	40	74	34	46	64	21	33
2016	82	375	370	158	43	81	37	46	79	42	53	74	22	30
2017	74	355	352	134	38	72	33	46	74	30	41	67	19	28
2018	60	320	314	153	49	59	29	49	58	29	50	52	22	42
2019	48	196	192	67	35	46	21	46	43	20	47	33	8	24
2020	86	500	489	197	40	84	46	55	82	39	48	78	27	35
2021	98	494	475	204	43	95	54	57	95	43	45	88	34	39
2022	64	374	354	133	38	60	27	45	60	27	45	49	24	49
2023	77	413	391	128	33	71	37	52	69	24	35	66	19	29
Total	1092	5291	5146	1988	39	1060	494	47	1041	452	43	929	304	33
International Endodontic Journal														
2021	71	436	376	139	37	59	22	37	60	25	42	58	17	29
2022	135	713	689	232	34	130	50	38	122	39	32	115	26	23
2023	139	819	723	303	42	125	60	48	119	59	50	119	35	29
Total	345	1968	1788	674	38	314	132	42	301	123	41	292	78	27
Journal of Endodontics														
2010	344	1697	1652	441	27	335	104	31	327	93	28	119	35	29
2011	303	1498	1472	440	30	296	102	34	295	101	34	309	61	20
2012	297	1553	1522	492	32	295	95	32	291	108	37	271	58	21
2013	307	1642	1596	507	32	297	111	37	290	112	39	263	58	22
2014	377	1904	1845	615	33	362	136	38	358	131	37	278	63	23
2015	334	1727	1693	576	34	328	124	38	322	129	40	341	83	24
2016	288	1512	1474	513	35	283	115	41	278	115	41	305	83	27

Table 2 continued

			All Authors			First Author			Second Author			Last Author		
	Articles	Authors	Total	Women§		Total	Women§		Total	Women§		Total	Women§	
Year	No.*	No.†	No.‡	No.	%	No.‡	No.	%	No.‡	No.	%	No.‡	No.	%
2017	346	1837	1772	641	36	331	151	46	328	135	41	262	61	23
2018	280	1470	1439	496	34	268	108	40	272	107	39	297	75	25
2019	207	1112	1082	368	34	200	74	37	196	70	36	257	68	26
2020	254	1336	1310	483	37	248	121	49	239	92	38	188	41	22
2021	223	1222	1196	409	34	214	85	40	216	85	39	235	66	28
2022	158	905	842	300	36	141	62	44	144	55	38	201	49	24
2023	183	1073	990	362	37	170	60	35	166	66	40	143	42	29
Total	3901	20488	19885	6643	33	3768	1448	38	3722	1399	38	3469	843	24

Table Footnotes

* The count of all the full-length articles in print in the indicated year.

† The count of all the authors listed in all the articles in the particular year. Note that 2021 for the IEJ includes only partial information on authors.

‡ The count of all authors in the category identifiable as to gender.

§ The count (No.) and percentage (%) of all the identifiable authors in the category identified as women.

Looking at first authorship, 41% (39/96*)* of first authors in DTR were women, and by 2023, women increased their first authorship to 52% (37/71). For the IEJ, 48% (60/125) of women were the first authors, and 35% (60/170) were the first authors of the JOE articles. Table 2 shows the percentage of women first authors increased over time in the "First Authors" panel (logistic regression $P<0.0001$), showing a 0.8% average increase per year (95% CI=0.5 to 1.2). The three journals were significantly different by 2023 ($P<0.0001$). The post hoc multiple comparison procedure indicated that the IEJ and the JOE were not significantly different (P=0.025), but both had a lower percentage of women who were first authors compared to DTR ($P<0.004$).

In 2010 publications, 41% (37/91) of second authors were women in DTR, which increased to 43% (22/51) by 2023. In 2022, 50% (59/119) of the second authors were women in the IEJ and 40% (60/166) in the JOE. In Table 2's "Second Authors" panel, the percentage of women second authors increased over time (P=0.0071), showing a 0.5% increase per year (95% CI=0.1 to 0.8%). By 2023, the three journals were significantly different ($P=0.189$). The post hoc multiple comparison procedure showed that the IEJ was not significantly different from DTR or the JOE ($P>0.105$), but DTR had a higher percentage of women authors compared to the JOE ($P=0.0011$).

Publications for 2010 determined that 30% (24/79) of the last authors were women publishing in DTR, and their percentage nominally decreased to 29% (19/66) by 2023. Comparing the last authors in 2023, 29% (42/143) of the JOE articles and 29% (35/119) of the IEJ were women. Table 2's "Last Author" panel shows that the last authors increased over time ($P<0.0003$), showing a 0.6% increase per year (95% CI=0.3 to 0.9%). The three journals were significantly different by 2023 ($P=0.0002$). The post hoc

multiple comparison procedure indicated that the JOE and the IEJ were not significantly different (P=0.084) but had a lower percentage of women last authors compared to DTR (P<0.003).

Reviewers

In the early months of each year, endodontic journals usually publish the list of their past year's reviewers. Before 2012, DTR did not publish a list of reviewers. In 2014 and 2016, the JOE did not publish a list of reviewers. As of December 2024, the IEJ and DTR have not published their 2023 list. Gender was identified for 99% (n=10,487) of the 10,628 names published. Men reviewers were identified with 98% accuracy (n=7675) and women with 96% accuracy (n=2812).

All journals increased their women reviewers. The "Reviewers" panel in Table 3 demonstrates that the percentage of women reviewers increased over time (P<0.0001), showing an average increase of 0.8% per year (P<0.0001). The IEJ increased reviewers from 19% in 2010 to 28% in 2022, and the JOE increased from 20% to 30% from 2010 to 2023. Women reviewers for DTR increased from 22% to 36% from 2012 to 2022. The three journals were significantly different (P<0.0001) in 2022; the post hoc multiple comparison procedure showed that the IEJ and the JOE (P<0.0004) had a lower percentage of women compared to DTR. The JOE and the IEJ were not statistically different (P=0.065).

Editorial Board Members

Gender was identified for editors-in-chief, associate editors, editorial board members, and consultant editors, except for DTR before 2018 and the IEJ for 2023 because they were unavailable. 156 names were identified with 98% accuracy for men, and 35 for women were identified with 96% accuracy. Table 3 shows in the "Editors panel" that the percentage of women reviewers increased over time (P=0.0098), showing a 1.0% increase per year (96% CI=0.2 to 1.8%), and the three journals were not significantly different (P=0.66). By 2022, the JOE had 31% women editors, followed by the IEJ with 19% and DTR with 14%. An increase in the percentage of women in editorial roles was noted after 2018. However, a non-linear trend was not supported by the lack of fit test.

Table 3: Description of Female Reviewers and Editorial Board Members

	Reviewers			Editors		
	Total*	Women†		Total	Women†	
Year	No.	No.	%	No.	No.	%
	Dental Traumatology					
2012	156	34	22			
2013	135	34	25			
2014	139	35	25			
2015	162	39	24			
2016	132	37	28			
2017	145	53	37			
2018	177	70	40	57	9	16
2019	223	80	36	59	9	15
2020	250	82	33	59	9	15
2021	166	60	36	57	9	16
2022	166	60	36	56	8	14
2023				54	8	15
	International Endodontic Journal					
2010	230	43	19	9	1	11
2011	321	67	21	10	1	10
2012	321	67	21	10	1	10
2013	236	63	27	44	4	9
2014	204	47	23	54	6	11
2015	255	65	25	47	5	11
2016	247	59	24	47	6	13
2017	267	55	21	55	7	13
2018	256	54	21	46	6	13
2019	242	60	25	51	7	14
2020	250	73	29	52	7	13
2021	252	76	30	50	7	14
2022	250	70	28	58	11	19

Table 3 continued

	Reviewers			Editors		
	Total*	Women†		Total	Women†	
Year	No.	No.	%	No.	No.	%
	Journal of Endodontics					
2010	379	76	20	14	1	7
2011	422	89	21	11	1	9
2012	388	95	24	11	1	9
2013	320	78	24	12	1	8
2014				11	1	9
2015	365	93	25	11	1	9
2016				11	1	9
2017	387	109	28	11	1	9
2018	338	103	30	11	1	9
2019	575	160	28	11	2	18
2020	579	162	28	10	2	20
2021	634	182	29	7	2	29
2022	350	113	32	13	4	31
2023	616	186	30	13	4	31

Table Footnotes

∗ The count of all the reviewers or board members in the indicated year. Note that information is not available for all years in each journal.

† The count (No.) and percentage (%) of all the identifiable individuals in the category identified as women.

Program Leadership

This section first describes gender differences in endodontic leadership roles, faculty rank, and h-index. Additionally, differences in average h-index are also described. Finally, the second specific aim was tested: Are gender disparities in faculty rank due to leadership role and scholarship differences in US endodontic programs?

In 2023, fifty-four (54) US schools were identified with an undergraduate or postgraduate endodontics program. Predoctoral program directors, postgraduate program directors, and department/division chairs (heads, chiefs, directors) were identified within those programs. Of the combined leadership programs, 29% were women (42/144), varying by role (chi-square P=0.0133).

Women represented 47% of predoctoral directors (20/43), 21% of postgraduate directors (11/53), and 23% of endodontic chairs (11/48). Of the 42 assistant professors in endodontic leadership, 45% were women (19/42), 25% of associate professors were women (11/44), and 21% of the professors were women (12/58). This was a significant difference (chi-square P=0.026).

Overall, h-index varied a great deal, from 0 to 86. Although the median h-index was 10, 13% of those in endodontic leadership had an h-index of zero (19/141), and 8.5% had an h-index of 1. Table 4 shows the h-index leadership varied by gender, faculty rank, and leadership role using a multivariable Poisson regression (all P<0.0001). Highly ranked faculty did have more publications. For example, a professor had a mean predicted h-index of 23 (95% CI=21 to 24), and an assistant professor had a lower mean h-index of 6 (95% CI=5 to 7). Table 4 shows the department chair predicted a mean of 12 (95% CI=11

to 14) was higher than a predoctoral program director's h-index of 9 (95% CI= 8 to 10). Women in endodontic leadership compared to men have published less (8.2 versus 13.6, $P<0.0001$, respectively).

Table 4: H-Index by Leadership Characteristics

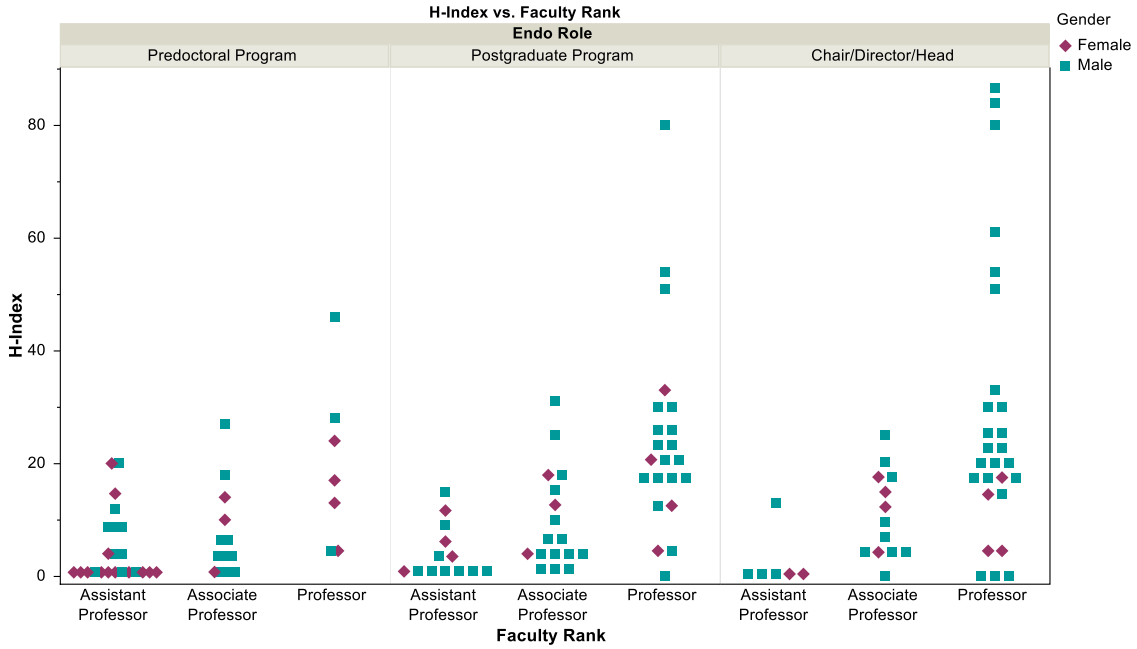
		Estimated H-Index*		
Characteristic	**N**	**Mean**	**95% CI**	
Gender				
Female	42	8.2	7.3	9.2
Male	102	13.6	12.7	14.5
Faculty Rank				
Assistant Professor	42	6.2	5.3	7.2
Associate Professor	44	8.4	7.6	9.4
Professor	58	22.5	21.0	24.2
Leadership Role				
Predoctoral Program	43	9.3	8.3	10.3
Postgraduate Program	53	10.1	9.2	11.2
Chair/Director/Head	48	12.4	11.2	13.7

Table Footnote
* Estimated from Poisson regression. All characteristics are significantly different, $P<0.0001$.

Figure 2 illustrates the variability in h-index within role, rank, and gender. That is, comparing the three panels from left to right there appears to be lower h-index scores for those in the predoctoral role and more faculty in higher h-indexes in the chair/director/ head role. But within these three panels, we also see a similar trend between assistant professors, associate professors, and professors—assistant professors have lower h-indexes and professors have higher h-indexes. However, the pattern is far from uniform. Additionally, it is unclear what the gender-related differences in h-indexes may be after the effects of role and rank are considered.

Figure 2: H-Index by Leadership Role, Faculty Rank, and Gender

The observed h-index by gender (colored symbols), program role (panels left to right) and faculty rank (within panels, from left to right). All are significantly different, $P<0.0001$.



Thus, the need to use multiple logistic regression to test whether there are gender disparities in faculty rank after accounting for differences due to leadership role and scholarship in the US endodontic programs. Ordinal logistic regression models the likelihood of each faculty rank as a function of leadership role, h-index, and gender. When all three predictors are considered, there are significant differences in faculty rank due to endodontic role (chi-square=10.1, df=2, P=0.0065), and h-index (chi-square=54, P<0.0001), but not due to gender (chi-square=0.72, P=0.3960).

This result is illustrated in Table 5. Using a logistic regression model, we can predict the likelihood of each faculty rank, depending upon leadership role and h-index. For convenience, Table 5 shows these predicted values using the medial value of h-index,

which is 10. Also, Table 5 shows that for a typical male faculty member in a predoctoral program role, approximately 40% are assistant professors, 43% are associate professors, and 17% are professors. There is not an appreciable difference between the typical female faculty member in this role where approximately 48% are assistant professors, 39% are associate professors, and 13% are professors. Similarly, for a typical faculty member in the postgraduate role the male-female difference is 22% versus 28% as assistant professors, 46% versus 46% as associate professors, and 33% versus 26% as professors. And finally, for a typical faculty member in the chair role, the male-female difference is 13% versus 18% for assistant professor, 40% versus 44% for associate professor, and 47% versus 39% for professors. That is, these apparent differences do not always favor men. But, the size of the difference does not rise to statistical significance in any event (P>0.3).

Table 5: Predicted Likelihood of Each Faculty Rank for Faculty in Each Leadership Role with an H-Index = 10 (Median Value)

		Gender		
Leadership role	**Faculty rank**	Male	Female	Average
Predoctoral Program	Assistant Professor	40.1%	48.4%	44.3%
	Associate Professor	43.1%	39.1%	41.1%
	Professor	16.7%	12.6%	14.7%
Postgraduate Program	Assistant Professor	21.8%	28.1%	25.0%
	Associate Professor	45.6%	46.3%	46.0%
	Professor	32.5%	25.6%	29.1%
Chair/Director/Head	Assistant Professor	13.3%	17.6%	15.5%
	Associate Professor	39.9%	43.7%	41.8%
	Professor	46.8%	38.7%	42.8%

From ordinal logistic regression, leadership role and h-index are significant factors (P=0.0065 and P<0.0001, respectively. There is no evidence for a significant difference due to gender (P=0.3960).

Discussion

Women held fewer leadership positions in US endodontic dental schools with predoctoral and postgraduate education programs, which is consistent with other studies in other dental specialties and medical specialties (Burke et al., 2019; Tiwari et al., 2019; Nguyen et al., 2017; Van den Besselaar and Sandström, 2017; Reed et al., 2012). At entry-level endodontic assistant professor positions, the male-to-female ratio was near parity at 47% (20/43), suggesting that women should have had an equitable chance to be promoted to higher faculty positions in US endodontic programs.

The results show that a disproportionate number of women published in endodontic academia compared to men from 2010 to 2023. However, women published more each year and increased their scholarly productivity over time by 0.5% annually.

Analysis of publishing counts by gender evaluated first, second, and last author percentages. The first and second authorships increased over time and, as of 2023, were 52%/43% (DTR), 48%/50% (IEJ), and 35%/40% (JOE), respectively. As of 2023, the last authors across all three journals were 29%, with DTR having a higher percentage of women-last authors from 2010 to 2023 and the JOE and the IEJ not significantly different (P=0.084).

Consistent with other studies, men predominated in the more prestigious last authorship positions (West et al., 2013; Haag et al., 2023; Filardo et al., 2016; Van den Besselaar and Sandström, 2017). While notable parity was reached in the first author position in this study, women published slightly more in DTR.

Next, women's participation as reviewers and editorial board members was analyzed. Historically, editors used reviewers who were subject matter experts within an established network due to the pressures of volume and timing of submissions (Clark and Horton, 2019). DTR, the IEJ, and the JOE showed an average increase of 0.8% of women reviewers per year (95% CI=0.6 to 1.0%). It is not known if women were less likely to be called upon as peer reviewers or were more likely to decline to participate as reviewers in endodontics.

According to Ioannidou and Rosania (2015), when more women were in journal editorial leadership positions, there was a higher participation of women as advisory board members. As of 2022, on average, there was a 1.0% (95% CI=0.2 to 1.8%) increase per year among this study's journal editorial board members, and the three journals were not significantly different from other study findings (Ioannidou and Rosania, 2015; Lundine et al., 2019; Gottlieb et al., 2024). From 2010 to 2023, an encouraging increase of approximately 10% or more in women reviewers was noted overall across all the journals evaluated in this study. However, editorial board members continued to be underrepresented at levels lower than 20% within the IEJ and DTR (19% and 14%, respectively).

Currently, women comprise 23% of US endodontic chairs (11/48) and 77% of professors in endodontic leadership are men. These percentages mirror other studies (Kim et al.,

2024; Hernández-Ruiz et al., 2022; Simon et al., 2019; Tricco et al., 2021; Burke et al., 2019; Bompolaki et al., 2022; Simon et al., 2019; Tiwari et al., 2019; Yuan et al., 1986). The central issue continues to be that gender inequity is not “women in dentistry” but “women in dental leadership” (Gangwani et al., 2024; Ioannidou et al., 2014).

Ceci and Williams (2011) evaluated how teaching affects the productivity of both women and men, and they concluded that it affected both genders equally. Furthermore, men produced 30% more publications than women, but when tenured women and men at R1 universities were compared, the difference fell to 8%, and full professors at R1s were less than a 5% difference.

In sum, the critical variable was not gender, but it was access to resources (Ceci and Williams, 2011), which relates to this study, which evaluated the h-index and academic rank. According to these results, rank was not dependent upon productivity, although men did produce more endodontic research from 2010 to 2023. Table 4 illustrates that lower scholarly impact was not a barrier for faculty rank or leadership roles for either gender. When considering only two variables (rank and gender), rank appeared to be related to gender. However, when adding the additional leadership variable, gender was not significant. Within the same leadership roles of predoctoral program director, postgraduate program director, and chair, differences between men's and women's productivity were negligible (P=0.259). Ultimately, rank was predicted by leadership role and not by gender.

Career-wise, women should not view their promotional status solely based on their current research productivity and citation impact. In endodontic academia, women were equally represented in the leadership role of predoctoral director 47% (20/43). Women

lagged in moving up to the next level of postgraduate director, representing 21% (11/53). Both men and women at the predoctoral level had less time to perform research and spent more time in clinical activities.

By evaluating the research h-indexes of men and women at the postgraduate director level, this study noted that some men also had low research productivity and citation impact, which was lower than some women who were predoctoral directors. This suggests that women were not applying for positions that men with the same or fewer credentials were applying for, indicating a mistaken perception about the hiring process, not a mistaken perception about their competence to perform as leaders (Barsh and Yee, 2011, Mohr, 2014, Sandberg, 2013).

Although men published more as a cohort, some accepted more leadership responsibilities when their scholarly impact had yet to rise. Perhaps production-related barriers were not explanations for the slower promotion progress of women, such as work-life balance, less time allotted to research, and family care-taking responsibilities (Li et al., 2019; Simon et al., 2019; Tiwari et al., 2019, Jolly et al., 2014).

This methodology could not take variables such as time in rank into account, part-time faculty, and leaves of absence that may affect women more than men. Yet, overall, the results from our study support that low research impact was not a barrier to promotion for either gender. Underrepresentation of women as associate or full professors may have been more related to other explanations proposed by other researchers, such as under or over-inflated performance feedback, negotiation skills, or self-limiting mindsets (Correll and Simard, 2016; Jampol and Zayas, 2021; Nguyen et al., 2017; Arnold and McAuliff, 2020).

Study Limitations

Leadership roles, publication counts, and h-index (citation impact) are only three aspects of a person's academic accomplishments that can be consistently weighted across all fifty-four (54) endodontic programs. Teaching time, scholarly pursuits, and service projects were not evaluated because they are subjectively assessed and with different weights of importance across organizations.

This search was limited to only endodontic leadership and did not evaluate all endodontists working part-time and full-time in academia. This sample size was too limited to arrive at a threshold h-index for predictive rank promotion from associate professor to professor.

Gender was evaluated as a male/female (binary) determined by first names and website biographies (when needed). Socially constructed non-binary and pronoun self-identification was not available for this study.

Future Directions

Designing a survey of specialty journals asking how many women decline reviewing papers versus men, linking publishing rates to current academic rank and time in leadership roles would increase the sample size, allowing for a threshold h-index for predictive rank and promotion. Investigating these data points would require detailed journal data regarding submissions, editor assignments, reviewer assignments, and resulting decisions and recommendations.

Factors to consider for future studies include broadening the scope by evaluating leadership roles and h-indexes across all dental specialties and considering each institution's emphasis on research, teaching load, mentorship programs, time-in-rank, and research assistance.

Conclusion

Overall, our results demonstrate that women's representation as first authors, second authors, and last authors of full-length original research published in high-impact related endodontic journals, as peer reviewers, and as editorial board members increased from 2010 to 2023. Our findings further show that women have reached parity with men as first authors in *Dental Traumatology* and the *International Endodontic Journal*.

Although women's participation in publishing productivity has increased over time, they continue to lag in areas of publishing as last authors, peer reviewers, and editorial board members. Therefore, our first null hypothesis that there is no increase in the percentage of women authors, reviewers, and editorial board members is rejected, and our alternative hypothesis that women have increased their participation in publishing is accepted.

Our data also showed that there was a significant difference in faculty rank due to endodontic role and h-index but not due to gender. Therefore, our second null hypothesis was accepted: there is no evidence for a difference in the likelihood of holding higher academic rank due to gender.

Taken together, these findings underscore the continuing underrepresentation of women in high-impact endodontic journals and in academic leadership. Given our findings, after

adjusting for differences due to leadership roles and h-index, there is no evidence for a difference of holding higher academic rank due to gender. This insight is critical to improving women's understanding of the importance of pursuing leadership opportunities.

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