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Research article

The level of evidence in prosthodontics in relation to author's characteristics: An analysis of three leading prosthodontics journals

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ABSTRACT

Purpose: The purpose of this study was to examine the level of evidence (LOE) characteristics and associated factors that change over time in three leading prosthodontics journals.

Materials and methods: Articles published in The Journal of Prosthetic Dentistry (JPD), International Journal of Prosthodontics (IJP), and Journal of Prosthodontics (JP) in 2013 and 2020 were reviewed by eight independent reviewers. After applying exclusion and inclusion criteria, the number of authors, the corresponding author's educational degree, corresponding author's origin in each clinical research article were recorded. The included articles were rated by reviewers according to the level of evidence criteria and proposed level of evidence-associated factors. Descriptive statistics, univariable, and binary logistic regression analysis were performed to investigate dependent variables and potentially associated factors. All independent variables with a significant effect were analyzed by using a multivariable test. The entry and exit alpha level were set at $\alpha_E = 0.15$. The statistical significance was set at $\alpha = 0.05$.

Results: A total of 439 articles from 3 selected journals for the years studied met the inclusion criteria. The percentages of level 1, 2, 3, 4, and 5 articles were 2.7 %, 11.4 %, 9.6 %, 13.4 % and 62.9 %, respectively. Univariable analysis results demonstrated significant associations related to the number of authors ($P = 0.005$), the corresponding author's educational degree ($P = 0.022$), and the corresponding author's geographic origin ($P = 0.042$). Multivariable analysis results demonstrated significant associations related to the number of authors ($P = 0.002$), and the corresponding author's geographic origin ($P = 0.014$).

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Conclusions: The number of authors, CA degree, and CA origin had a significant association with the LOE of included prosthodontic studies. Although there was an increase in the number of publications from 2013 to 2020, the level of evidence trend shows no improvement over the years.

1. Introduction

The level of evidence (LOE) is a hierarchy of likely best evidence, designed so that it can be used by clinicians to find the best practice [1]. The history of LOE originally came from the quality of evidence reported by the Canadian Task Force on the Periodic Health Examination in 1979 [2] to provide recommendations on the periodic health exam based on evidence from the medical literature [3]. Based on the LOE system, research articles can be ranked from the highest (level 1) to the lowest level of evidence (level 5) [4]. Results from high LOE studies tend to be more reliable and reproducible in clinical practices [5–7]. A review of the LOE of articles published in biomedical journals has produced contrasting outcomes, with some journals showing improvement, whereas others remained static [8–12].

Aside from the LOE, studies have examined trends in authorship in the medical field and indicated a significant increase of multiple authors and variation of authors' degrees over the last decades [12–19]. Despite these multiple authors trend, the advantages of single authorship [20] have become almost obsolete [21,22]. Positive factors associated with multi-authorship include professional development opportunities, increased research project complexity, increased multidisciplinary collaborations, improved written work quality, and the joy of collaboration [20,22–24]. Others have argued that multi-authorship undermines scientists' motivation and accountability and dilutes the inherent value of authorship [25]. As a result, the International Committee of Medical Journal Editors (ICMJE) established authorship criteria, which stated that the listed authors must make substantial contributions to the work's conception and design, data acquisition, and interpretation such as drafting the article or critically revising it for important intellectual content and providing final approval [26–28]. The occurrence of international authorship has also increased [12,17,19]. Articles from Europe, East Asia, and Oceania have increased in contribution, whereas publications from U.S. authors have decreased over time [29–31]. Some perceived this phenomenon as a positive influence on global research and development, noting an improvement in the quality of studies in the medical field [30,32,33].

Bibliometric methods such as citation analysis and science mapping are both based on the same network principle, which is counting citations of specific papers [34]. Researchers cite others' work in their papers for multiple reasons. Typically, they cite others in support of their methodologies or findings, also called supportive citations. Articles are also cited to be compared or to be criticized for the research design [35–37]. Regardless of the reason, the number of citations is the most commonly used metric in assessing the quality of papers, researchers, research institutions, and universities. The impact factor of the journal in which the article is published could also be used to predict the quality of the article. However, the impact factor is a result of citations and is frequently mistaken for a cause of citations. As a result, determining the quality of a scientific publication can be difficult at times. Furthermore, journals with a higher impact factor are more likely to publish level 1 or level 2 articles [5,38–40].

The LOE, similar to the trend of globalization authorship in dental literature, has received little attention and has not been widely investigated, particularly in the prosthodontics field. The purpose of this study was to examine the LOE characteristics in prosthodontics journals and the associated factors: number of authors, corresponding author's (CA) educational degree, and geographic origin. The null hypothesis was that the number of authors, CA origin, and CA educational degree would not affect LOE.

2. Materials and methods

Eight experienced independent researchers (prosthodontists) from different affiliations assessed the LOE and the proposed associated factors in each article included in this review. All authors were trained and calibrated online regarding LOE by senior author (C. S). The authors divided the work during the scanning and classification of the articles and discussed in online meetings the final determination of the level of the articles. A hand search of three peer-reviewed prosthodontics journals was performed for articles published in 2013 and 2020. Since the present study was conducted in 2021, it was decided to take 2020 as the last year and took seven years back to 2013 to see the trends. The three journals selected for this study were: The Journal of Prosthetic Dentistry (JPD), The International Journal of Prosthodontics (IJP), and The Journal of Prosthodontics (JP). These journals were selected because they are most representative of the prosthodontics specialty and organizations and have relatively higher impact factors.

A 2003 version LOE assessment tool [4] which consists of five levels was used to review and classify the included articles and to accommodate the nature of the prosthodontics specialty which provides many case reports in the journals. Based on the sort of study, there are four distinct classifications at each level: economic and decision analyses, diagnostic, prognostic, and therapeutic. Based on the hierarchical rating system, the two highest positions (Level 1 and 2) correspond to randomized controlled trials (RCTs), followed by cohort research at Level 2 or 3, case-control studies at Level 3, and case series, pre-post and post-tests at Level 4. Expert opinions, case reports, techniques, and observation studies are categorized at Level 5. Only clinical studies (research, systematic review, case report/series, expert opinion) were included in the study. Abstracts, letters to the editor, book reviews, and in-vitro studies were excluded from the review. The kappa score of agreement on the identification of the original article was 0.90, which confirms a high level of agreement. In the case of disagreement, the senior author (CS) made the final classification. The screening flow chart of the study is shown in Fig. 1. For each of the included articles, the following information was collected: the number of authors, the author's

educational degree, and CA geographic origin and educational degree. The categories of the educational degrees of all authors including CA were DDS/DMD/BDS, DDS-MS, DDS-PhD, MS, PhD, and others [12]. The CA geographic origin categories consisted of five continents: North America, South America, Europe, Asia, Africa, and Oceania [12].

Data was recorded and entered into a software database (Microsoft Excel 2010; Microsoft Corp., Redmond, WA). Statistical analyses were performed using software (IBM SPSS Statistics version 23; Chicago, Illinois, USA). Descriptive statistics were performed to determine the characteristics and LOE of included studies. In the LOE hierarchical rating system, Level 1 and 2 studies are rated as the highest positions, while Level 3,4, and 5 studies are rated as the lowest positions. Hence, Level 1 and Level 2 were defined as High Level, and Level 3, Level 4, and Level 5 were defined as Low Level for ease of description [41]. Quantitative data were presented as mean (min-max), and categorical data as frequency (%). Binary logistic regression analysis was performed to investigate (dependent variable; high level versus low level) and potentially associated factors (independent variables; the number of authors, the educational degree of the corresponding author, geographic origin of the corresponding author). Initially, all variables were independently analyzed by using a univariable test. Then, all independent variables with a significant effect were analyzed by using a multivariable test. The first category of each variable was defined as the reference category. The entry and exit alpha level were set at $\alpha_E = 0.15$. The statistical significance was set at $\alpha = 0.05$.

3. Results

A total of 932 manuscripts published in three journals in 2013 and 2020 were collected and reviewed. 439 articles met the inclusion criteria. The total number of articles in each journal increased in 2020 compared to 2013. Level 5 articles contributed the highest number, whereas level 1 articles contributed the least. Across the journals, JPD had the highest number of clinical research articles; followed by JP and IJP (Table 1). JPD had an increased trend in the number of clinical articles included in the review between the two observed years, whereas those of JP and IJP showed a decrease (Table 1). When reviewing different LOE and journals for the highest average number of authors per journal and LOE, level 1 articles had the highest number of authors with an average of 6 and 6.6 in JP and IJP, respectively, while level 2 articles had the highest number of authors with an average of 4.9 in JPD (Table 1).

Authors with DDS-PhD had the most contributions in the two time points observed, followed by authors with DDS-MS (Fig. 2). Furthermore, authors with DDS-PhD also had the highest number of contributions in each LOE. The CA degree with a DDS-PhD degree authored the greatest number of articles (220 articles) (Fig. 3). The CA originated from North America authored the most articles and Africa was the least. (Fig. 4), where the CA educational degree in North America was dominated by MS/MSc, while in other origins was dominated by DDS-PhD (Fig. 5).

Univariable analysis results demonstrated significant associations related to the number of authors ($P = 0.005$), the corresponding author's educational degree ($P = 0.022$), and the corresponding author's geographic origin ($P = 0.042$). Multivariable analysis results demonstrated significant associations related to the number of authors ($P = 0.002$), and the corresponding author's geographic origin ($P = 0.014$) (Table 2). In Table 2 and 5 % ($n = 7$) of North American authors had high level articles, 95 % ($n = 132$) had low level articles. Which means North American authors had the highest % of low level articles compared to high level article within each geographic group. And according to univariable test results, corresponding authors from North America were 0.16 times less likely to publish high-level articles compared with Africa and Oceania. Every unit increase in authors from North America was associated with an 84 % decrease in the odds of having a high-level article ($P = 0.042$). According to multivariable test results, corresponding authors from North America were 0.09 times less likely to publish high-level articles, compared with Africa and Oceania. In other words, every

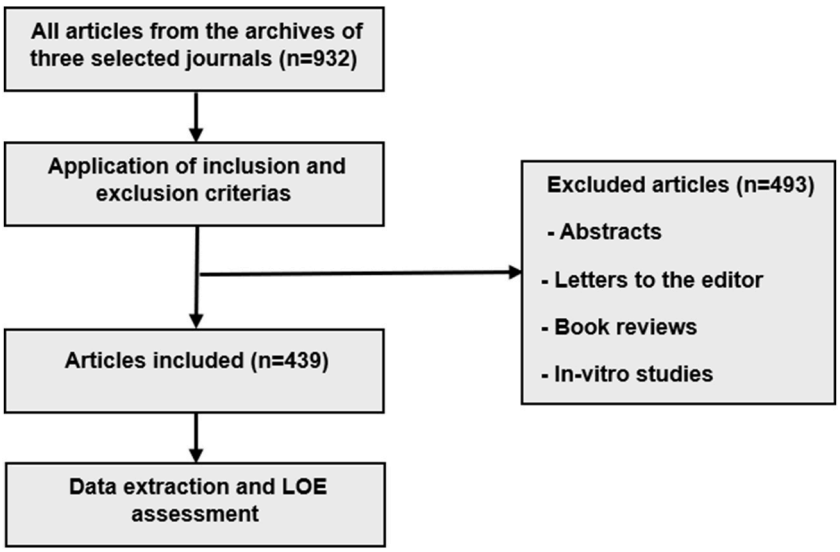
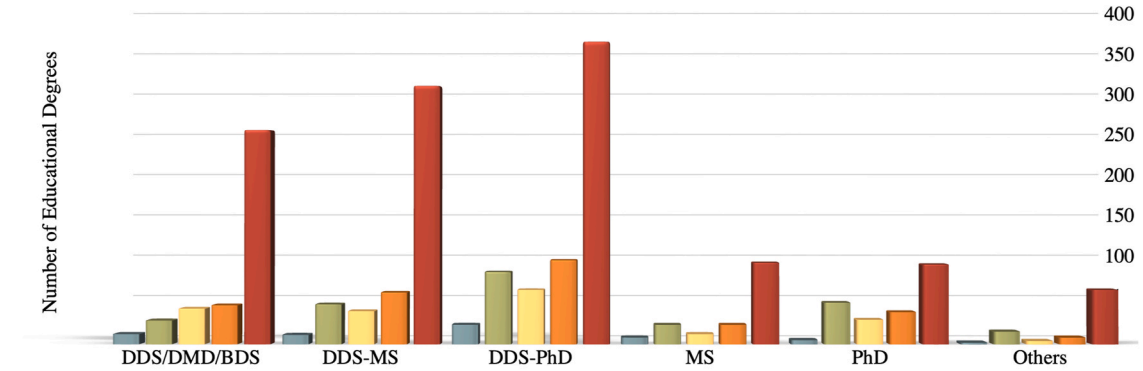


Fig. 1. Flow chart of study design.

Table 1
The level of evidence, number of articles, and number of authors across the journals and study period.

JPD					
Level of Evidence	Number of Articles		Number of Authors		Average Number of Authors
	2013 (163 articles)	2020 (362 articles)	2013	2020	
1	0	8	0	35	4.3
2	2	19	10	93	4.9
3	3	15	12	67	4.3
4	6	11	25	57	4.8
5	57	103	202	389	3.7
Total	68 included (41.71 %)	156 included (43.09 %)	241	641	3.9
JP					
Level of Evidence	Number of Articles		Number of Authors		Average
	2013 (103 articles)	2020 (140 articles)	2013	2020	Number of authors
1	1	0	6	0	6
2	4	6	18	29	4.7
3	5	5	26	21	4.7
4	4	7	20	42	5.6
5	43	39	161	177	4.1
Total	57 included (55.34 %)	57 included (40.71 %)	231	269	4.4
LJP					
Level of Evidence	Number of Articles		Number of Authors		Average
	2013 (77 articles)	2020 (90 articles)	2013	2020	Number of authors
1	1	2	7	13	6.6
2	8	11	41	57	5.1
3	7	7	33	33	4.7
4	20	11	84	48	4.2
5	19	15	134	70	6
Total	55 included (71.42 %)	46 included (51.11 %)	299	221	5.1



	DDS/DMD/BDS	DDS-MS	DDS-PhD	MS	PhD	Others
Level 1	12	11	23	8	5	2
Level 2	28	47	85	23	49	15
Level 3	42	39	64	12	29	4
Level 4	46	61	99	23	38	8
Level 5	252	304	356	96	94	64

Fig. 2. Educational degrees across the level of evidence.

unit increase in authors from North America was associated with a 91 % decrease in the odds of having a high-level article (P = 0.014) (Table 2).

4. Discussion

4.1. Main results

The results of the present study reject the null hypothesis as a correlation was found between the LOE and the number of authors, CA degree, and CA origin. Between 2013 and 2020, several changes in the publication pattern were found. The total number of

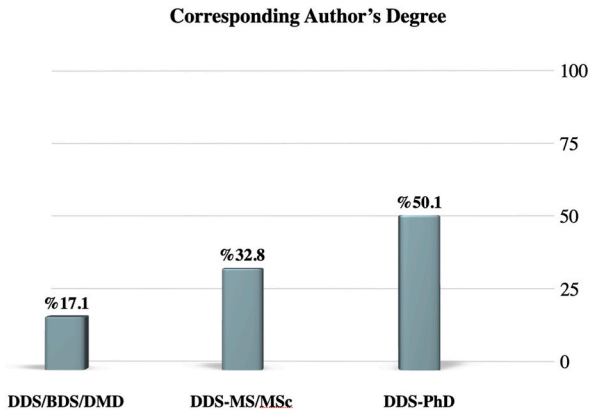


Fig. 3. Corresponding author's degree across the LOE, journals, and study period.

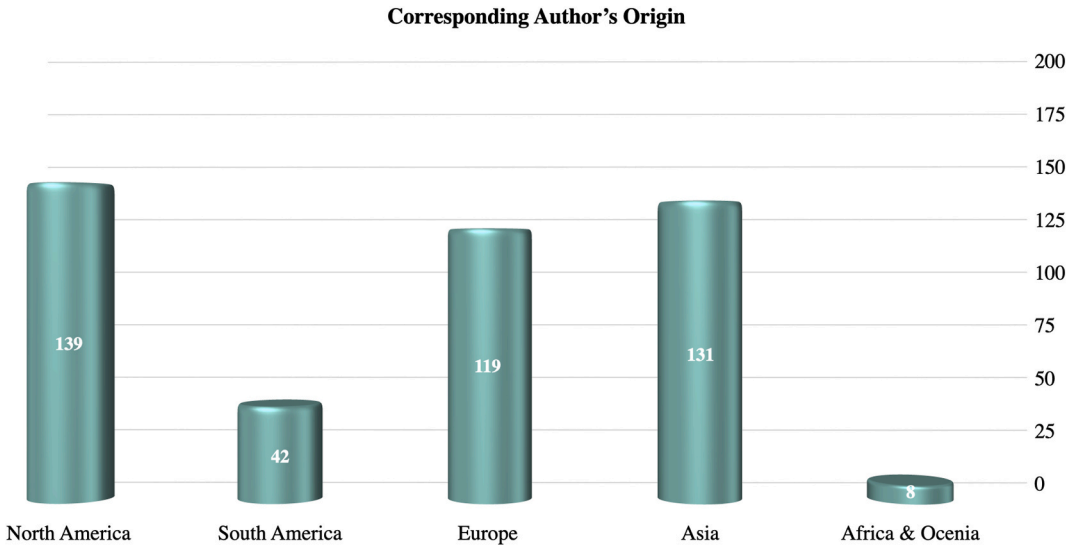


Fig. 4. Number of corresponding author's origin across the LOE, journals, and study period.

published manuscripts in the prosthodontics field almost doubled, similar to that in the oral and maxillofacial surgery field [39]. High LOE studies (levels 1 and 2) such as randomized controlled trials, prospective or retrospective cohort studies, and systematic reviews of randomized controlled studies, are not always feasible to conduct due to certain circumstances [3,7]. Ethical, financial, patient consent or other challenging issues often become barriers to leading such studies [7]. On the contrary, low level evidence studies (levels 3, 4, and 5) such as clinical reports, expert opinions, and case-control studies are easier, more practical, and less expensive to perform than high-level studies [7,10]. Furthermore, although considered lower evidence than the controlled and randomized interventional design studies, observational studies may be the most feasible in clinical scenarios [8,10,27].

An increased number of authors per article was observed between 2013 and 2020, consistent with previous studies indicating the trend in the rising number of authors who conducted clinical research over time [13,21,28]. This can be interpreted as a sign of increased multidisciplinary partnership of clinicians and researchers with various backgrounds in clinical research and more complex study designs [12]. In-depth analysis in the present study also showed that level 1 studies have more authors on average than level 5 studies, which suggests that more resources and expertise may be needed in conducting higher LOE studies.

DDS-PhD degree of the authors was the most common in articles of each level of evidence, followed by DDS-MS, together totaling more than half of the authors. Individuals who hold a higher education degree may be more inclined to conduct clinical research as part of their responsibility than those without such degrees [12], having acquired advanced training for planning and executing complex study designs. Furthermore, the highest academic degree, DDS-PhD, was the most often achieved educational degree of CA, it is assumed that potentially because they have the formal advanced training in leading research. Regarding the CA origin, North America was the most contributed origin, and Asia was the second most prevalent continent, ahead of Europe, indicating the improvement in Asia's scholarly activities in the past decade.

In addition, North America showed a different pattern of CA educational degrees compared to other origins. DDS-MS/MSc was the

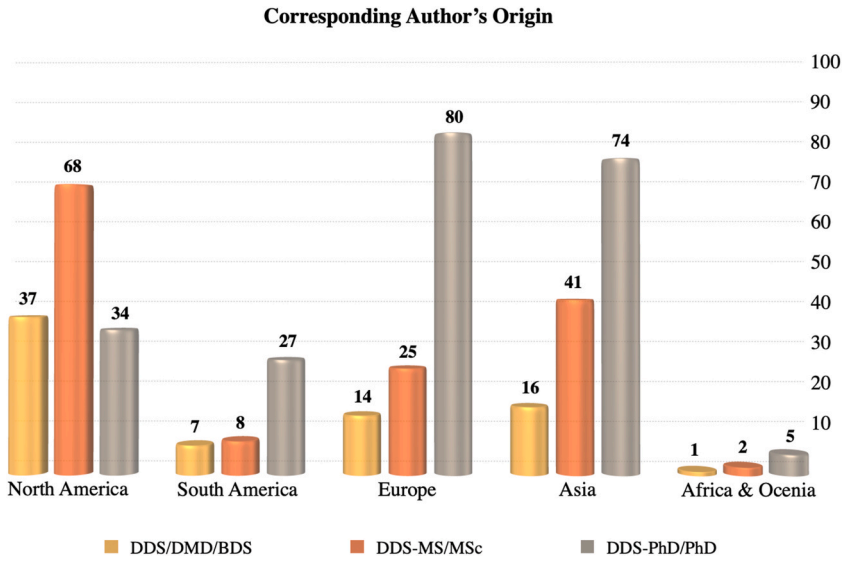


Fig. 5. The corresponding author's educational degree from different origins.

Table 2
Factors affecting high level articles.

	LOE		Univariable			Multivariable		
	High level (n = 62)	Low level (n = 377)	B	OR (%95 CI)	P	B	OR (%95 CI)	P
Number of Authors, [mean (min-max)]	5 (2–10)	4 (1–15)	0.162	1.18 (1.1–1.3)	**0.005**	0.225	1.25 (1.09–1.44)	**0.002**
Corresponding Author Degree [n (%)]								
DDS/DMD/BDS	5 (6.7 %)	70 (93.3 %)	−1.135	0.32 (0.12–0.85)	**0.022**	−0.591	0.55 (0.10–1.53)	0.255
MS/MSc	17 (11.8 %)	127 (88.2 %)	−0.507	0.60 (0.33–1.11)	0.104	−0.05	0.99 (0.52–1.93)	0.989
PhD/DrMedDent	40 (18.2 %)	180 (81.8 %)	Reference				Reference	
Corresponding Author Origin [n (%)]								
North America	7 (5 %)	132 (95 %)	−1.838	0.16 (0.03–0.94)	**0.042**	−2.381	0.09 (0.01–0.62)	**0.014**
South America	13 (31 %)	29 (69 %)	0.296	1.35 (0.24–7.58)	0.737	−0.127	0.88 (0.15–5.21)	0.888
Europe	21 (17.6 %)	98 (82.4 %)	−0.442	0.64 (0.12–3.41)	0.604	−0.723	0.49 (0.09–2.66)	0.404
Asia	19 (14.5 %)	112 (85.5 %)	−0.675	0.51 (0.1–2.71)	0.429	−0.939	0.39 (0.07–2.16)	0.281
Africa and Oceania	2 (25 %)	6 (75 %)	Reference				Reference	

P (Hosmer and Lemeshow) = 0.135; R^2(Nagelkerke) = 0.165; OR: Odds Ratio; CI: Confidence interval.

most contributed degree in North America and DDS-PhD/PhD was the most in South America, Europe, and Asia. Our study aligned with Yuan et al., 2010 and Sukotjo et al., 2018 [12,42]. Corresponding authors are mostly senior faculty members such as associate professor/professor and chair/program directors. A recent study indicated that most directors of U.S. Advanced Education in Prosthodontics Programs held the rank of associate professor and professor and DDS and MS degrees [42]. It would be interesting to investigate the academic rank of CA from South America, Europe, and Asia in the future.

Factors such as the quality of the paper, journal impact factor, number of authors, visibility, and international cooperation are stronger predictors for citations, than authors' gender, age and race, characteristics of results, and discussion [35]. According to Garfield [40], around 20 % of publications receive more than 80 % of citations, whereas the remaining papers are either not cited at all or are cited occasionally. One might conclude that articles that receive fewer citations are of poorer quality than those that receive more [36]. In addition, when a paper is cited more frequently than others, it is assumed that it is of greater quality [37].

4.2. Limitations and potential bias in the study

Limitations of the current study are the studies included were only from three journals and, therefore not representative of all

prosthodontics journals. Additionally, only two publication years were chosen and results may differ for other time points. Given that 2020 was the year of the COVID-19 pandemic, certain publications published at the end of 2020 may have been impacted by the pandemic; this would depend on the typical length of time it took for a journal to publish an article. Furthermore, only papers published in English were examined in this study; results may differ if including articles written in other languages. Finally, the LOE, like other literature evaluation systems, has significant limitations. Although the LOE classifies papers into different levels, it ignores aspects such as the methodological and reporting quality of clinical research and its clinical significance.

4.3. Implications for practice and future research

The findings of this study showed a snapshot of three prosthodontics journals at two certain time points. In terms of the practical results of this study, it can be determined at what level there is a literature gap in the prosthodontic literature and priority can be given to such studies. Researchers may want to conduct more clinical studies with high LOE in the prosthodontic specialty given the low number of Level-1 studies published in top prosthodontic journals. There is a need for additional studies to better understand the characteristics of publications in the field of prosthodontics.

5. Conclusion

Within the limitations of the present study, it was concluded that.

1. The number of authors, CA degree, and CA origin had a significant association with the LOE of included prosthodontic studies.
2. Most of the articles published originated from North America.
3. The number of studies of high LOE scores was found to be limited.

Data availability

The study data has not been deposited into a publicly available repository. The data will be available upon request.

CRediT authorship contribution statement

Hubban Nasution: Writing – review & editing, Writing – original draft, Software, Methodology, Investigation, Data curation. **Merve Koseoglu:** Writing – review & editing, Software, Methodology, Investigation, Data curation. **Berkman Albayrak:** Writing – review & editing, Software, Methodology, Investigation, Data curation. **Judy Chia-Chun Yuan:** Writing – review & editing, Supervision, Methodology, Investigation, Formal analysis. **Foteini Touloumi:** Writing – review & editing, Validation, Supervision, Investigation, Formal analysis. **Jiyeon J. Kim:** Writing – review & editing, Validation, Supervision, Investigation, Formal analysis. **Valentim A.R. Barão:** Writing – review & editing, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation. **Funda Bayindir:** Writing – review & editing, Supervision, Methodology, Investigation, Formal analysis, Data curation. **Cortino Sukotjo:** Writing – review & editing, Validation, Supervision, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interestsDr. Valentim Barao is the academic editor of this journal. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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