



Articles published in *Acta Orthopaedica et Traumatologica Turcica* between 2003-2012: content, characteristics and publication trends

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Objective: The aim of this study was to examine publications in *Acta Orthopaedica et Traumatologica Turcica* (AOTT) between 2003 and 2012 using bibliometric methods and to describe publication trends, characteristics and patterns of orthopedic publications in Turkey.

Methods: All articles published in AOTT between 2003 and 2012 were identified and classified according to their study design and subspecialty of orthopedics. The following parameters from each manuscript were also identified: (1) the number of authors, (2) the number of institutions of the authors, (3) institutional affiliation of the first author, (4) origin of country of the first author, (5) sample size, (6) study outcome, (7) presence or absence of statistical methods, (8) presence of funding, and (9) time from submission to acceptance.

Results: A total of 699 eligible articles were identified. The most common study designs were retrospective observational studies and case reports. The most common subspecialties of orthopedics were orthopedic trauma and hand and microsurgery. Institutional affiliation of the first author was a university hospital in 56.4% of the studies and origin of country of the first author was Turkey in 93.4%. Time from submission to acceptance was a mean of 7.11 months.

Conclusion: This study revealed the current status and trends of orthopedic publications in Turkey in the leading Turkish orthopedic journal AOTT over a 10-year period. The impact factor of AOTT shows a slow but stable increasing trend indicating a growing attention towards the journal.

Key words: Bibliometric analysis; content; orthopedics; publication; publication trend.

Bibliometric analysis, the quantitative analysis of content and characteristics of scientific literature, aims to evaluate peer-reviewed literature and describe publication trends and patterns within an academic discipline or between disciplines.^[1] Bibliometric study of scientific publications in a particular field, in a particular field in a particular

country, or in a particular journal is a widely used method to measure scientific achievement.^[2] A systematic assessment of orthopedic surgery-related research publication in Turkey is not available. Without such objective information about research output, it is difficult to comprehend the current status in a scientific field.

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Acta Orthopaedica et Traumatologica Turcica (AOTT), the leading medical journal in the field of orthopedic surgery in Turkey, is the official publication of Turkish Association of Orthopedics and Traumatology (TOTDER) and Turkish Society of Orthopedics and Traumatology (TOTBID). It has been indexed in the Index Medicus since 2002^[3] and the Science Citation Index Expanded (SCIE) since 2008.^[4]

Since the quality and quantity of published articles define the academic level of a scientific journal, an institution, a society or a country, examining the content in AOTT would reveal an evaluation of the scientific knowledge relevant to clinicians and researchers working in this specialty area of medicine in Turkey. The objective of this bibliometric analysis was to examine publications in AOTT over a 10-year period between 2003 and 2012 and describe publication trends, characteristics, and patterns of orthopedic publications in Turkey.

Materials and methods

All manuscripts published online on the AOTT website (www.aott.org.tr) from January 2003 through December 2012 were identified. Manuscripts published under the section headings "Original Article", "Experimental Study", "Technical Note", and "Case Report" were included. Editorials, letters to the editor, retraction notes, supplement issues and invited review articles (AOTT 2009, Volume 43, No. 2, except the 3 case reports printed in this issue) were excluded.

Eligible articles were classified according to their study design as (1) prospective observational, (2) retrospective observational, (3) basic science studies, (4) surveys, (5) case reports, (6) reviews (nonsystematic, systematic, and meta-analysis), or (7) technical notes. Prospective and retrospective observational studies were further subclassified as (1) surgical treatment, (2) conservative treatment, (3) laboratory, (4) radiologic, or (5) epidemiologic studies. Basic science studies were further subclassified as (1) human cadaver, (2) experimental animal, (3) laboratory, or (4) biomechanical studies. Case reports were also further subclassified as (1) surgical or (2) conservative treatment.

Eligible articles were also classified according to the subspecialty of orthopedics as (1) general orthopedics, (2) pediatric orthopedics, (3) spine, (4) adult reconstruction/arthroplasty, (5) orthopedic trauma, (6) sports injury and arthroscopy, (7) shoulder and elbow, (8) hand and microsurgery, (9) orthopedic oncology, (10) foot and ankle, or (11) external fixation. All fractures were classified as "orthopedic trauma" except spinal fractures, which were classified as "spine". All hand or wrist fractures were

also classified as "orthopedic trauma" except the studies in which microsurgical procedures were involved, which were then classified as "hand and microsurgery".

The following parameters from each manuscript were also identified: (1) the number of authors, (2) the number of institutions of the authors, (3) institutional affiliation of the first author (university hospital, state-owned training and research hospital, state hospital, military hospital, private hospital, and other (private office practice, non-medical university affiliation, institute, etc.), (4) origin of country of the first author, (5) sample size, (6) study outcome (positive, negative or neutral), (7) presence or absence of statistical methods, (8) presence of funding, and (9) time from submission to acceptance.

Positive outcomes were defined as those that resulted in a significant difference between the control and treatment groups, or within a group comparing pre- and post-treatment status with favorable effects. Negative outcomes were defined as those that resulted in significant differences between the groups or within a group comparing pre- and post-treatment status with negative conclusions or undesirable outcomes. Neutral outcomes were those with no significant differences between groups or within a group comparing pre- and post-treatment status with no obvious conclusion.^[5] The impact factor for AOTT for the years of 2006, 2007, 2008, 2009 and 2010 were noted according to the unofficial impact factor values calculated by the technical board of AOTT.^[6] The impact factor for AOTT for the years of 2011 and 2012 were noted according to the official impact factor values from the Journal Citation Reports which were calculated by Thomson Reuters.^[7,8] Analysis of the references was not performed.

Data were analyzed using the PASW Statistics 18 statistical software package (SPSS Inc., Chicago, IL, USA).

The Pearson correlation test was used to assess the correlation between the time from submission to acceptance and number of authors and sample size. Spearman's nonparametric correlation test was used to assess the correlation between the time from submission to acceptance and study design, subspecialty and study outcome.

The logistic regression test was used to further analyze the correlation between the time from submission to acceptance and study design and subspecialty with regards to 0 to 3, over 3, 0 to 6 and over 6 month periods. Odds ratio values with 95% confidence intervals were also calculated to measure the association between variables.

Statistical differences between the journal's annual trends in means of sample size and the time from sub-

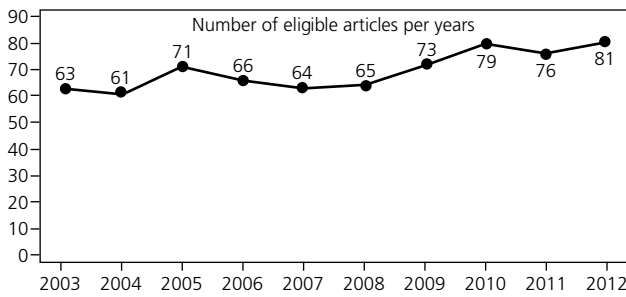


Fig. 1. The numbers of eligible articles for the years studied.

mission to acceptance were evaluated using the one-way ANOVA test. When a p value <0.05 was achieved in the one-way ANOVA test, post hoc Tukey and Tamhane tests were used to further understand which specific years differed. Statistical differences between the journal's annual trends in terms of the number of articles published each year, study design, subspecialty and origin of country of the first author were evaluated using the Pearson's chi-square test. The statistical differences between the journal's annual trends in terms of institutional affiliation of the first author, study outcome, presence or absence of statistical methods and presence of funding were evaluated using multinomial logit log-linear analysis.

Values of $p < 0.05$ and correlation coefficient of $r > +/- 0.3$ were considered significant.

Results

Acta Orthopaedica et Traumatologica Turcica published 5 issues per year from 2003 through 2008 and 6 issues per year beginning in 2009. A total of 699 eligible articles

were identified from January 2003 through December 2012. The numbers of eligible articles for each year studied are shown in Figure 1. There were no significant differences in regards to the number of eligible articles between the years studied ($p=0.688$)

Classification of the eligible articles according to their study designs for each year studied is given in Table 1. Study design was specified in 422 (60.4%) instances as prospective or retrospective. In the remaining 277 (39.6%) instances, the study design was not explicitly declared and the authors had to make a decision. The most common study designs were retrospective observational study (339, 48.5%) with a Level 4 evidence^[9] and case reports (153, 21.9%) with a Level 4 evidence. There were no significant differences in regards to the study design between the years studied with the exception of 2011. In 2011, retrospective surgical articles (21/76 articles, 27.6%) were published less than the rest of the years studied ($p=0.035$).

Classification of the articles according to the subspecialty of orthopedics is given in Table 2. The most common subspecialties of orthopedics were orthopedic trauma (128, 18.3%) and hand and microsurgery (100, 14.3%). There were no significant differences in subspecialty of orthopedics between the years studied between 2003 and 2012 ($p=0.228$), and the numbers of eligible articles belonging to the same subspecialties of orthopedics during the study period was similar.

The number of authors ranged from 1 to 22 (mean: 4.63 ± 1.62 ; median 5). The number of institutions of the authors was a mean of 1.72 ± 1.23 (range: 1 to 21; median: 1).

Table 1. Classification of the eligible articles according to their study designs for the years studied.

	PS	PC	PE	PL	PR	RS	RC	RE	RL	RR	BSC	BSA	BSL	BSB	CRS	CRC	S	R	TN	Total
2003	1	0	4	1	1	34	0	1	0	0	2	3	2	1	8	5	0	0	0	63
2004	1	1	5	1	1	29	2	2	0	0	0	1	0	2	10	4	1	0	1	61
2005	1	3	0	0	0	38	0	2	0	0	0	3	2	4	12	3	2	0	1	71
2006	1	3	2	1	0	26	2	4	0	2	2	2	2	3	13	2	1	0	0	66
2007	0	0	1	1	0	33	2	3	0	0	1	6	2	2	11	2	0	0	0	64
2008	5	1	3	0	0	30	0	3	0	2	0	4	3	1	9	4	0	0	0	65
2009	7	7	5	0	0	24	0	2	1	2	0	3	2	2	13	5	0	0	0	73
2010	3	4	3	1	1	31	4	3	0	1	2	7	0	1	12	4	2	0	0	79
2011	15	4	4	0	0	21	1	2	0	2	3	2	2	2	13	5	0	0	0	76
2012	6	7	6	0	0	26	2	0	0	2	1	9	0	0	16	2	3	0	1	81
Total	40	30	33	5	3	292	13	22	1	11	11	40	15	18	117	36	9	0	3	699

PS: Prospective surgical; PC: Prospective conservative; PE: Prospective epidemiological; PL: Prospective laboratory; PR: Prospective radiological; RS: Retrospective surgical; RC: Retrospective conservative; RE: Retrospective epidemiological; RL: Retrospective laboratory; RR: Retrospective radiological; BSC: Basic science cadaver; BSA: Basic science animal; BSL: Basic science laboratory; BSB: Basic science biomechanical; CRS: Case report surgical; CRC: Case report conservative; S: Survey; R: Review; TN: Technical note.

Table 2. Classification of the articles according to the subspecialty of orthopedics for the years studied.

	A	B	C	D	E	F	G	H	I	J	K	L
2003	8	5	3	3	14	5	7	9	5	1	3	63
2004	8	9	2	2	8	8	2	10	7	3	2	61
2005	6	6	6	2	14	8	8	8	6	1	6	71
2006	5	4	4	5	11	8	6	11	9	3	0	66
2007	8	4	5	2	8	3	3	12	13	4	2	64
2008	13	6	3	6	14	4	0	7	8	3	1	65
2009	9	1	5	5	16	12	6	7	5	5	2	73
2010	8	4	4	7	16	8	11	9	5	7	0	79
2011	14	6	3	3	13	9	7	14	6	1	0	76
2012	12	2	4	6	14	13	5	13	6	5	1	81
Total	91	47	39	41	128	78	55	100	70	33	17	699

A: General orthopedics; B: Pediatric orthopedics; C: Spine; D: Adult reconstruction/arthroplasty; E: Orthopedic trauma; F: Sports injury&arthroscopy; G: Shoulder&elbow; H: Handµsurgery; I: Orthopedic oncology; J: Foot&ankle; K: External fixation; L: Total.

Institutional affiliation of the first author was a university hospital in 394 (56.4%), training and research hospital in 215 (30.8%), state hospital in 25 (3.6%), private hospital in 55 (7.9%), military hospital in 6 (0.9%), and other in 4 (0.6%) instances. There were no significant differences in terms of institutional affiliation of the first author for the years studied, with the exception of 2004 and 2011. In 2004, institutional affiliation of the first author was a university hospital (47/61 articles, 77%) more often than the rest of the years studied (multinomial logit log-linear analysis; $p=0.0001$, adjusted residual value=3.409). Similarly, in 2011, institutional affiliation of the first author was a state hospital (10/76 articles, 13.2%) more often in terms of ratio than the rest of the years studied (multinomial logit log-linear analysis, $p=0.0001$, adjusted residual value=4.764).

Origin of country of the first author was Turkey in 653 (93.4%) instances, India in 10 (1.4%), United Kingdom in 8 (1.1%), Greece in 6 (0.9%), Iran in 4 (0.6%), United States of America and Germany in 3 each (0.4%), South Korea and Oman in 2 each (0.3%), and Pakistan, Turkish Republic of Northern Cyprus, Belgium, Morocco, Austria, Netherlands, Thailand, and Italy in 1 each (0.1%). There were no significant differences in the origin of country of the first author between the years studied ($p=0.310$).

Sample sizes ranged from 1 to 8,946 (mean: 92.06 ± 488.45 ; median: 22). Sample sizes were calculated from 697 studies because it was not indicated in 2 technical notes. There were no significant differences in sample sizes between the years studied ($p=0.663$).

Study outcome was positive in 494 (70.7%), negative

in 72 (10.3%) and neutral in 133 (19%) instances. There were no significant differences in terms of study outcome of eligible articles for the years studied, with the exception of 2007 and 2009. In 2007, the study outcome was positive (55/64 articles, 85.9%) more often than the other years (multinomial logit log-linear analysis; $p=0.002$, adjusted residual value=2.799). In 2009, the study outcome was neutral (23/73 articles, 31.5%) more often in terms of ratio than the rest of the years studied (multinomial logit log-linear analysis, $p=0.002$, adjusted residual value=2.863).

Statistical methods were used in 338 (48.4%) and not used in 361 (51.6%) instances. There were no significant differences in the presence or absence of statistical methods in eligible articles in the years studied except for 2012. In 2012, the presence of statistical methods (51/81 articles, 63%) occurred more often in terms of ratio than the rest of the years studied (multinomial logit log-linear analysis, $p=0.026$, adjusted residual value=2.943).

There were no indications of funding or conflicts of interest until 2011 and starting with the first issue of 2011 (volume 45, No 1) a "Conflicts of Interest" note began to appear in each article published. Before 2011, the use of funding was indicated in only 6 studies. Overall, the presence or absence of funding was not mentioned in 536 (76.7%) studies, the absence of funding was indicated in 151 (21.6%) and the presence of funding was indicated in 12 (1.7%) studies. The presence of conflicts of interest was never indicated.

The time from submission to acceptance was a mean of 7.11 ± 3.70 (range: 1 to 32 months; median 7)

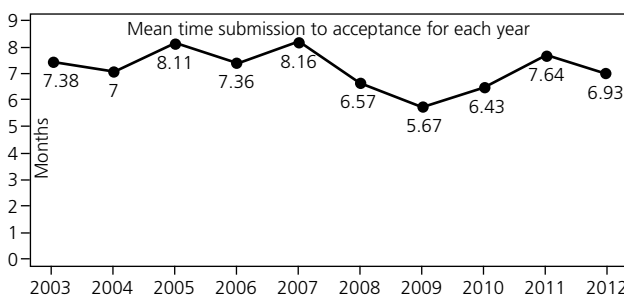


Fig. 2. Mean period of time from submission to acceptance for the years studied.

months. The mean period of time from submission to acceptance for each year studied are shown in Figure 2. There were no correlations between the time from submission to acceptance and the number of authors ($r=-0.014$, $p=0.711$), sample size ($r=-0.039$, $p=0.305$) or study outcome ($r=0.016$, $p=0.675$). However, there was a correlation between the time from submission to acceptance and study design ($r=-0.076$, $p=0.045$) and the subspecialty ($r=0.092$, $p=0.015$). Since the correlation between the time from submission to acceptance and study design ($r=-0.076$, $p=0.045$) and subspecialty ($r=0.092$, $p=0.015$) were only slightly significant, the time period was divided into 3-month time units and logistic regression test was performed to further analyze the variable which caused the correlation.

With the logistic regression test, the time from submission to acceptance and study design had a statistically significant correlation for the 0 to 6 month period ($p=0.023$; odds ratio=1.036 (1.005-1.069, confidence interval [CI] 95%). Of the 349 (49.9%) articles accepted in the first 6 months, the study design were retrospective surgical in 140 (40.1%) and surgical case reports in 62 (17.8%) articles. All of the accepted prospective radiological studies (3/3, 100%) and technical notes (3/3, 100%) and the vast majority of the accepted basic science biomechanical studies (14/18, 77.8%), basic science laboratory studies (11/15, 73.3%), surveys (6/9, 66.7%) and conservative case reports (22/36, 61.1%) were accepted within the first 6 month period. None of the retrospective laboratory studies (0/1, 0%) were accepted in the first 6 month period.

Also with the logistic regression test, the time from submission to acceptance and the subspecialty of orthopedics had a statistically significant correlation for the 0 to 3 month period ($p=0.013$; odds ratio=1.100 (1.020-1.186, CI 95%). Of the 104 (14.9%) articles accepted in the first 3 months, their subspecialty was orthopedic trauma in 27 (26%), hand surgery and microsurgery in 19 (18.3%) and general orthopedics in 18 (17.3%).

The vast majority of the accepted trauma (27/128, 21.1%), general orthopedics (18/91, 19.8%) and hand surgery and microsurgery (19/100, 19%) articles were accepted within the first 3 month period whereas only 7.3% (3/41) of adult reconstruction/arthroplasty, 7.3% (4/55) of shoulder and elbow and 5.9% (1/17) of external fixation articles were accepted for publication within the first 3 month period. None of the foot and ankle (0/33, 0%) articles were accepted within the first 3 month period.

The unofficial impact factor values for AOTT calculated by the technical board of the journal were 0.07 in 2006, 0.15 in 2007, 0.23 in 2008, 0.23 in 2009 and 0.31 in 2010.^[6] The official impact factor values from the Journal Citation Reports calculated by Thomson Reuters for the years of 2011 and 2012 were 0.337^[7] and 0.597,^[8] respectively.

Discussion

Although there have been great advances in orthopedic surgery in Turkey over the past decades, musculoskeletal disorders still constitute a major health problem and orthopedic surgery related diseases and musculoskeletal trauma contribute substantially to morbidity and mortality. Accordingly, orthopedic surgery-related research should be carried out extensively in order to achieve scientific progress in this field.

Scientific medical journals in the field of orthopedic surgery provide an important forum to convey current research findings, with AOTT serving as the leading journal in Turkey in this field. It first published in 1962 and is the official publication of the Turkish Association of Orthopedics and Traumatology and the Turkish Society of Orthopedics and Traumatology. It has been indexed in the Index Medicus since 2002^[3] and the SCIE since 2008.^[4] *Acta Orthopaedica et Traumatologica Turcica* has always been a great inspiration for the Turkish academic orthopedic community and since 2010 has acquired an international role, being published in English as well as in Turkish. Between 2000 and 2010, the mean impact factor of orthopedic journals listed in the Journal Citation Reports printed in any language increased from 0.842 to 1.400. However, journals printed in the English language had a significantly higher impact factor in the year 2010 (1.64 vs. 0.33) than those printed in other languages.^[10]

The research productivity for several medical fields in various world regions has been studied.^[11,12] However, the literature lacks studies estimating the quantity or quality of research production in orthopedic surgery in Turkey. This study was carried out with the intention

of evaluating AOTT in a given period of time so as to comprehend the current status and trends of academic orthopedic surgery in Turkey. A 10-year period between 2003 and 2012 was chosen as the "time window", i.e. the time over which the journal's publication performance was studied, because the most used period of time for such analyzes is 8 to 10 years.^[1]

There is an increased interest in publication in the field of orthopedic surgery worldwide. In the year 2000, 2,889 articles were published in the field of orthopedic surgery and in 2009 the number rose to 6,909, with a worldwide annual increase of 10.2%.^[11] However, the number of articles published in AOTT remained virtually the same, due to the unchanging number of issues per year and the number of pages per issue; AOTT published 5 issues per year until the year 2009, when the number of issues per year rose to 6. In every issue, AOTT publishes a limited number of articles, around 14, typically comprising 7 to 9 observational, 2 to 3 basic science studies and 2 to 3 case reports. The total number of articles published in 2001 was 63 whereas in 2012 it was 81, despite the increase in the number of issues per year.

Since the number of published articles is considered as an index of quantity of research productivity,^[13,14] the role of AOTT in orthopedic surgery research output in Turkey in the given period of time may be described as stationary. This is important because the quantity, as well as the quality, of published articles define the academic level of a society and the country. *Acta Orthopaedica et Traumatologica Turcica* has published 699 articles during the period of study, with an average of only 69 per year.

Country rankings of orthopedics publications in major orthopedics journals are also available.^[11] Turkey is neither among the top 10 orthopedic research-producing countries nor among the top 20 countries that produced orthopedic articles in terms of the number of published orthopedic articles per capita. On the other hand, the quantity of research productivity is not the only indicator of academic level. Although important but not the sole indicator, quality is usually measured by the impact factor, which shows the citation numbers by an international body of researchers.^[14] In this study, the published articles were not evaluated in regards to quality by using citation numbers. However, the impact factor for AOTT, for the years it was available, were noted for information.

It is known that basic science articles and clinical articles with greater methodological advantages like randomized controlled trials and meta-analyses with a Level 1 evidence are cited more frequently than observational clinical studies and case reports,^[15] thus the

number of randomized trials published in a journal is significantly correlated with the impact factor.^[16] With this point of view, we may conclude that AOTT should publish randomized controlled trials and meta-analyses in order to raise its impact factor. However, in the period studied, AOTT had not published even one randomized controlled trial or meta-analysis. Furthermore, reviews of any kind, nonsystematic, systematic, or meta-analysis were lacking completely. Epidemiological surveys and etiologic analysis were also scarce. Under the heading "Instructions for Authors" on the AOTT website, it is stated that "*Acta Orthopaedica et Traumatologica Turcica* publishes diagnostic, treatment, and prevention methods related to orthopedics and traumatology and original studies in related disciplines. Contributions may be in the form of clinical and basic research articles, case reports, personal clinical and technical notes, and letters to the Editor. The Journal also publishes brief reports on original studies or evaluations, book reviews, and proceedings of scientific meetings."^[17] Reviews of any kind were not mentioned. The journal also lacked other kinds of manuscripts which are common in prominent international orthopedics journals, namely current concepts review, instructional review, topics in training, evidence-based medicine, specialty update and commentary and perspective.

Although the focus on evidence-based medicine has led to calls for increased levels of evidence in surgical journals, the most common study design in AOTT during the study period was retrospective observational with a Level 4 evidence and case reports, again with a Level 4 evidence (328, 46.9%). Prospective studies comprised only 105 (15%) of the studies.

The most common subspecialties of orthopedics during the study period was not a surprise; orthopedic trauma consisted of almost 20% of the articles and hand and microsurgery came second. This pattern was similar throughout all years, with external fixation and foot and ankle surgery being in last place.

We found the issues of the number of authors and the number of institutions of the authors rather interesting. The number of authors ranged from 1 to 22 (mean: 4.63 ± 1.62 ; median: 5) and the number of institutions of the authors was a mean of 1.72 ± 1.23 (range: 1-21; median: 1). It is our impression that there were too many authors in many articles and too many institutions in some articles. Sometimes there were 4 or 5 authors in a case report from 3 different institutions. The authorship proliferation in orthopedic surgery-related research, as well as in other fields of biomedical research, has been matter of debate and the unprecedented increase in the

number of authors per publication in orthopedic literature had been criticized.^[12,13] A study examining articles published in *The Journal of Bone and Joint Surgery American and British Volumes* over a period of 60 years showed that the mean number of authors per original research article increased from 1.6 in 1949 to 5.1 in 2009.^[18] Possible reasons for this trend included, underserved^[18,19] or inappropriate authorship^[18] and the pressure to publish,^[18-21] probably due to the pressure placed on young researchers caused by the evaluation of the academic careers of physicians by examining the number and quality of their publications.^[18,21,22] The phrase “publish or perish” seems to be working.

Institutional affiliation of the first author, which was a university hospital in the majority of the articles, was again not a surprise and this pattern was similar in all years. The origin of country of the first author was overwhelmingly Turkey in 93.4% of the articles. Although statistically insignificant, there was an increasing trend in the number of articles from other countries, especially in the more recent years. Greater internationalization of the journal would be expected in the near future as the official language is now English and the impact factor is following a rising trend.

Although an increase would be expected through the years, there were no significant differences in terms of the sample sizes in the years studied, probably due to the paucity or lack of multicenter studies. The number of institutions of the authors in many articles should not be misleading as these were not multicenter studies; rather the study was carried out in a single institution with the authors from different institutions.

Study outcome was positive in 70.7% of the articles and neutral in 19%. The low percentage of negative outcomes (10.3%) might be interpreted as the authors' inclination to report on studies with positive outcomes.

Statistical methods were used in 48.4% of the articles. We believe this fact reflects the issue of study design which are usually retrospective, single-centered and without a control group.

Although a much more precise evaluation of the journals' publication trends would have been carried out if data on rejected articles were available, this study revealed the current status and trends of orthopedic publications in Turkey in the leading Turkish medical journal in the field of orthopedic surgery over a 10-year period. The impact factor of AOTT shows a slow but stable increasing trend indicating a growing attention towards the journal. The authors sincerely hope that the information presented here will encourage research and

publication and provide useful information to enable policy-making.

Conflicts of Interest: No conflicts declared.

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