

Trigger Finger: A Bibliometric Analysis

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ABSTRACT:

Purpose: Trigger finger (TF) describes stenosing tenosynovitis of the flexor tendon at the level of the first annular pulley and is a common cause of finger pain, triggering, and locking. The aim of this study is to reveal the structure and productivity of the fields of study related to the concept of TF and its historical development. Additionally, by revealing the conceptual richness of TF-related studies. This study can help researchers in anatomy and other health sciences understand current and future research trends. And thus design more innovative and creative studies.

Material and Methods: In the study, R Studio software was used for performance analysis and scientific mapping of TF-related articles in the Scopus database. VOSviewer software was preferred for keyword analysis to visualize the results. The filtering we conducted to determine the scope of our study included the parameters of time period, health science fields, article format and English language.

Results: Initially, 1858 studies were found regarding the keyword "trigger finger". When all filters were applied, 992 studies were included in the study. The annual average number of citations per article is 15. Of the 24 years included in the study, the most publications were made in 2023. The number of annual publications increased continuously from 2000 to 2023. The most frequently used keyword related to TF was "trigger finger".

Conclusion: This research provides precious data regarding the analysis of the concept of TF regarding the most influential sources, the most influential authors, the most efficient links and the most efficient studies in available literature. The findings of our study, in which we summarized the research on the concept of TF in depth, are expected to provide guidance for the rapidly increasing TF research. Our study is valuable because it is the second study in the literature that analyzes TF bibliometrically and the analysis was conducted until 2023.

Keywords: Anatomy; bibliometric analysis; hand deformities

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INTRODUCTION

Trigger finger (TF) describes stenosing tenosynovitis of the flexor tendon at the level of the first annular pulley (A1) and is a common cause of finger pain, triggering, and locking (Benson and Ptaszek, 1997; Doğru et al., 2020). The primary pathology is the incompatibility between the diameter of the flexor tendons and the diameters of the fibroosseous canals in which these tendons are located. This situation causes the tendon functions required for

hand and finger movements to be limited (Öner, 2023). Although it is often referred to as stenosing tenosynovitis (Carlson and Curtis, 1984; Rayan, 1990; Rhoades et al., 1984), histological studies have shown that the pathological inflammatory changes are localized specifically in the tendon sheath (tendovagina) and not in the tenosynovium (Fahey and Bollinger, 1954). If TF is left untreated, it can cause contracture in the proximal interphalangeal joints (PIP) (Wolfe, 2005).

Hypertrophy and inflammation of the retinacular sheath in the TF progressively limits flexor tendon mobility (Newport et al., 1990; Sampson et al., 1991; Lin et al., 1989). This sheath normally forms a pulley system consisting of a series of ring-shaped pulleys that help maximize the force production and movement effectiveness of the flexor tendon in each finger (Lin et al., 1989). A1 is by far the most commonly affected pulley, followed by pulleys A2 and A3 (Akhtar et al., 2005).

Although various reasons for the formation of TF have been suggested, its exact etiology has not been explained. Recurrent finger movements and local trauma are probabilities (Ametewee, 1983; Bonnici and Spencer, 1988; Verdon, 1996). At the same time, stress and degenerative force also cause an increase in the incidence of TF in the dominant hand (Sampson et al., 1991; Patel and Bassini, 1992).

TF is most common in people in their fifties and sixties, being up to 6 times more common in women than in men (Fahey and Bollinger, 1954; Newport et al., 1990; Patel and Bassini, 1992; Weilby, 1970), although this does not depend on age and gender distribution. The reasons are not fully clear (Bunnel, 1955). Although the lifetime risk of developing TF is between 2% and 3%, this rate increases up to 10% in diabetics (Stahl et al., 1997; Strom, 1977).

The classic appearance and locking of the TF is typically all that is required for diagnosis, but in cases of acute onset of symptoms, patients might exist with pain and edema over the relative flexor sheath while avoiding finger movement (Makkouk et al., 2008). In the diagnosis of TF, other possible causes of pain and edema in the metacarpophalangeal (MCP) joint (de Quervain tenosynovitis, ulnar collateral ligament (UCL) injury of the thumb, MCP joint sprain, MCP osteoarthritis, etc.) must be excluded (Laing, 1986; Lapidus, 1953; Oni, 1984; Seybold and Warhold, 1996). In atypical versions of trigger finger, ultrasound (US) or magnetic resonance imaging (MRI) helps diagnose TF.

Primary treatment of TF is conservative and includes activity modification, non-steroidal anti-inflammatory drugs (NSAIDs) for pain control, MCP joint immobilization, and corticosteroid injection (Ryzewicz and Wolf, 2006).

Both percutaneous and open release are highly

successful and are widely considered the definitive treatment for TF. The indication for surgical treatment is usually when conservative treatment fails to relieve pain and symptoms. The timing of surgery is somewhat contentious, with studies recommending that surgical intervention be considered if both single and multiple corticosteroid injections fail (Benson and Ptaszek, 1997; Anderson, 2005).

Bibliometrics is a quantitative evaluation of bibliographic data that provides a systematic and data-driven method for understanding the research landscape. Bibliometric analysis is an effective tool used to examine studies written in different fields and follow developments. Bibliometric analysis has found widespread use in various fields of study. Bibliometric analysis plays an important role in gaining a comprehensive understanding of the existing literature. This approach not only helps map the intellectual structure of research, but also facilitates the identification of influential publications, authors, and research clusters (Demir et al., 2024a; Demir et al., 2024b; Demir et al., 2024c).

The aim of this study is to reveal the structure and productivity of the fields of study related to the concept of TF and to reveal its historical development. Additionally, by revealing the conceptional abundance of TF-related studies. This study can help researchers in anatomy and other health sciences grasp present and future research trends. And thus design more innovative and creative studies.

MATERIAL and METHODS

Purpose and Questions of the Study

In line with our purposes, answers to the consequent interrogations were sought in the study;

- What is the growth trend and citation status of TF-related articles?
- Who are the most cited leading authors in the field of TF?
- Which are the most cited documents, journals, organizations and countries?
- What are the main research points and thematic issues in TF studies?
- Which publication is most cited?

Creating the Data Set

Our research was administrated through the Scopus database. The occasions for choosing the Scopus database include the fact that it is a database that covers a wide range of scientific journals, congress proceedings, books and other scientific publications, and that it provides the researcher with a wide range of bibliometric data (number of citations, h-index, working groups, etc.).

Initially, 1858 studies were found regarding the keyword "trigger finger". The filtering we conducted to determine the scope of our study included the parameters of time period, health science fields, article format and English language. The time period

of the study was chosen as between 2000 and 2023 and 1575 studies were included in the study. While there are 1478 studies in the fields of health sciences, 1154 studies are in article format. 1473 studies are published in English. While 1500 of the studies were published in a journal, a total of 1555 studies were published. When all filters were applied, 992 studies were included in the analysis.

Exclusion criteria of the study; (i) research conducted before 2000 and after 2023, (ii) research conducted outside the field of health sciences, (iii) research in book chapters, congress proceedings, compilations and letters to the editor, and (iv) research written outside the English language.

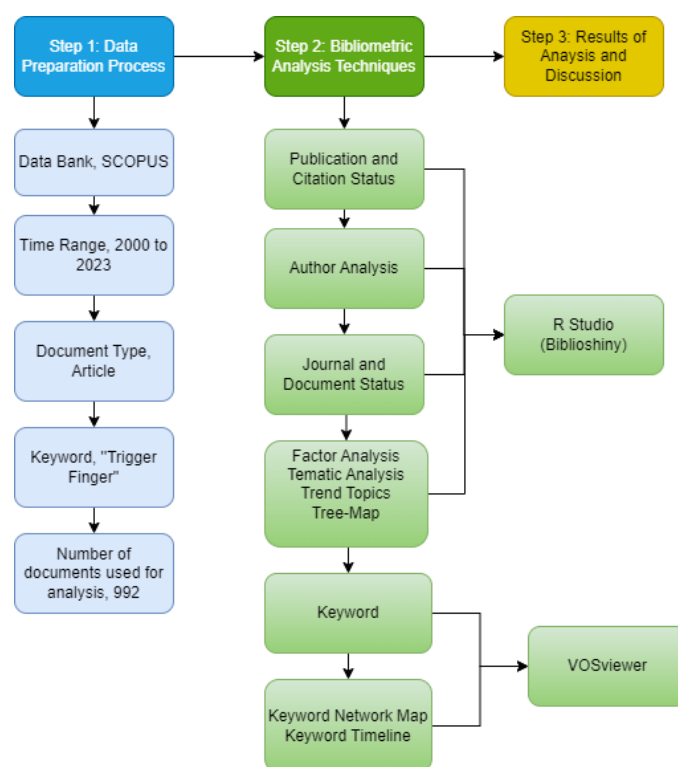


Figure 1. Data Preparation Process

Software Used

In the study, R Studio software was used for performance analysis and scientific mapping of TF-related articles in the Scopus database. VOSviewer software was preferred for keyword analysis to visualize the results (Figure 1).

This study provides a detailed summary of publications, evaluating the annual growth rate in publications and the average number of citations per

publication. In addition, the journal and university that contributed the most to the literature and received citations were determined. Then, the authors and countries with the most works in the literature and those cited for these works are shown. With the Sankey diagram, the most prominent relations between country, keyword and author were determined.

RESULTS

Analysis of Data

A general evaluation of publications for the use of TF was made using Biblioshiny. The information obtained is given in Figure 2. With the keyword "Trigger finger", 992 articles and 3928 authors were found in the Scopus database between 2000 and 2023. 41 of these authors published single-author

publications. The annual average number of citations to articles is 15. Additionally, the average age of the articles is 7.49 years.

Change in the Number of Publications by Years

It is shown in Figure 3 that TF studies have increased with each passing year.



Figure 2. Identifying Information

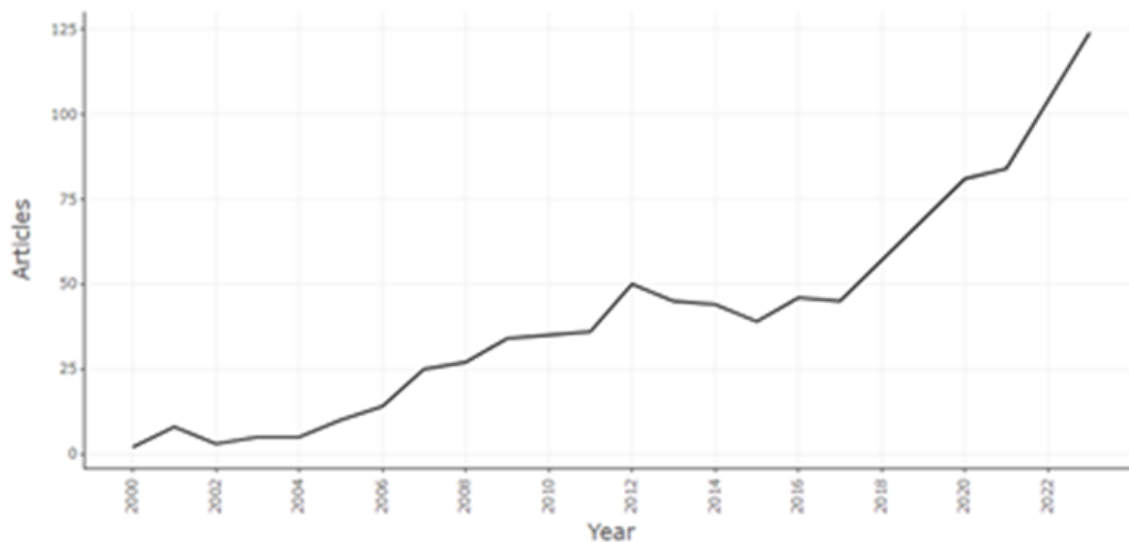


Figure 3. Change in the Number of Publications by Years

Of the 24 years included in the study, the most publications were made in 2023. From 2000 to 2023, the number of annual publications decreased only between 2012 and 2015, while it increased continuously in other periods. 81 articles were published in a journal in 2020, 84 in 2021, 104 in

2022 and 124 in 2023.

Change in Annual Average Number of Citations

The change in the annual average number of citations received by publications related to the keyword "Trigger finger" is shown in Figure 4.

The annual average number of citations varies from year to year. It is seen that the annual average number of citations reached peak values in 2000, 2004, 2006 and 2016. It is known that publication date is an important parameter in the annual average number of citations. Therefore, as we approach 2023, the average annual number of citations decreases. The annual average number of

citations is 7.42 in 2020, 3.39 in 2021, 2.79 in 2022 and 1.15 in 2023.

Sankey Diagram

The 3 variables that were desired to be associated (author - country - keyword) were analyzed using the Biblioshiny program and are shown in Figure 5.

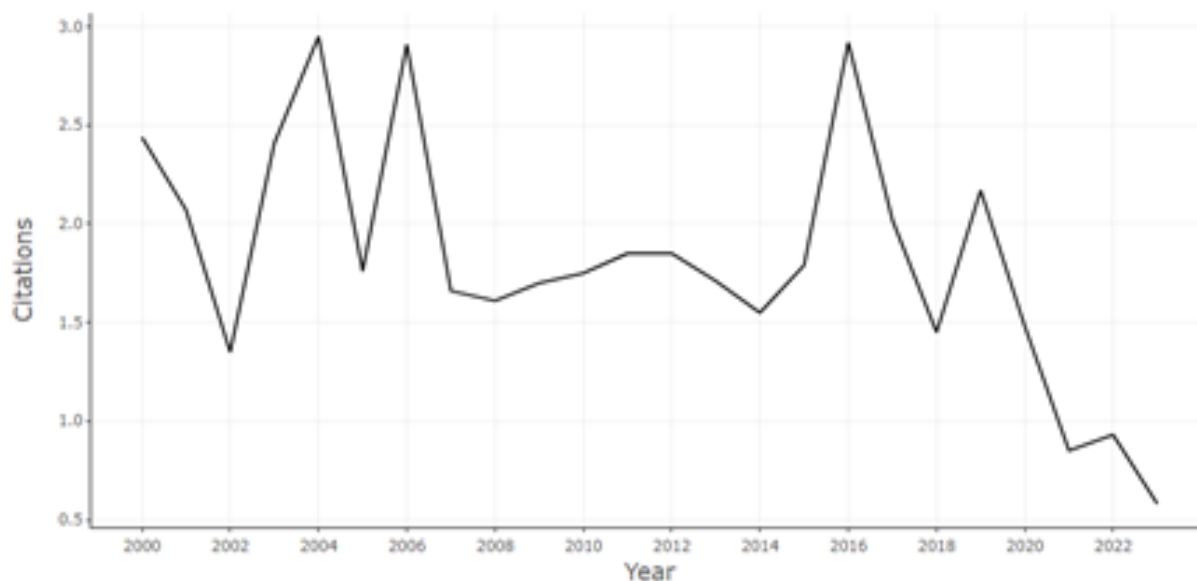


Figure 4. Change in Annual Average Number of Citations

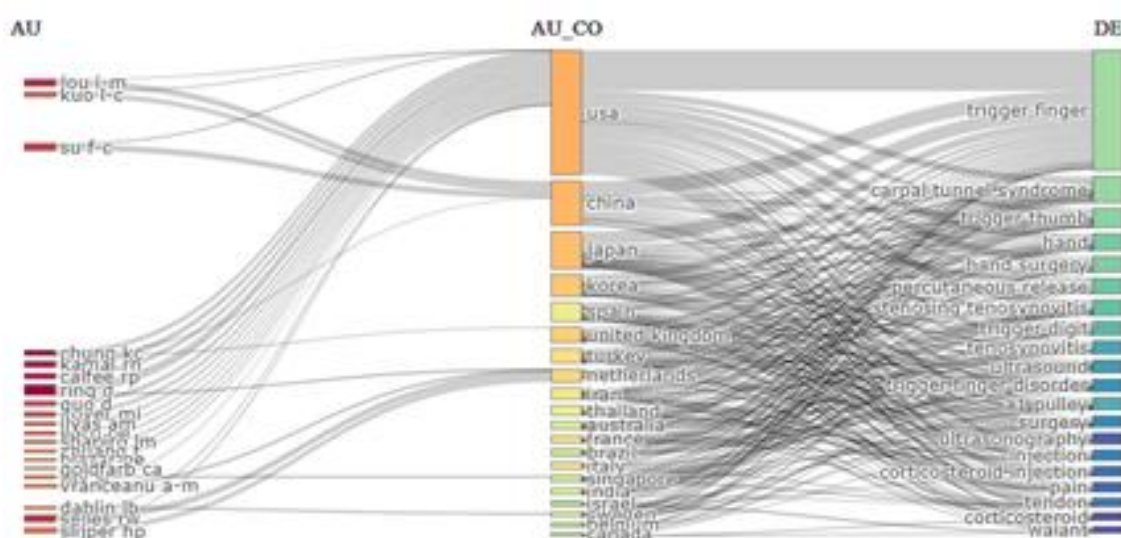


Figure 5. Sankey Diagram

The size of the rectangles in the Sankey diagram shows the importance of the associated variables in the literature. Accordingly, the author who published the most articles in the field of TF is Ring D, and the country that published the most articles is the USA. The most used keyword related to TF was "trigger finger".

Analysis of Journals

The analysis of journals publishing articles on TF is shown in Figure 6. In the list of journals that mostly

cover the subject of TF, "Journal of Hand Surgery" ranks first, "Hand" ranks second, and "Journal of Hand Surgery: European Volume" ranks third.

Analysis of Universities

The analysis of the universities to which the authors studying the subject of TF are affiliated is shown in Figure 7. Among the universities that the authors working on TF are affiliated with, "Stanford University" ranks first, "Harvard Medical School" ranks second, and "University of Utah" ranks third.

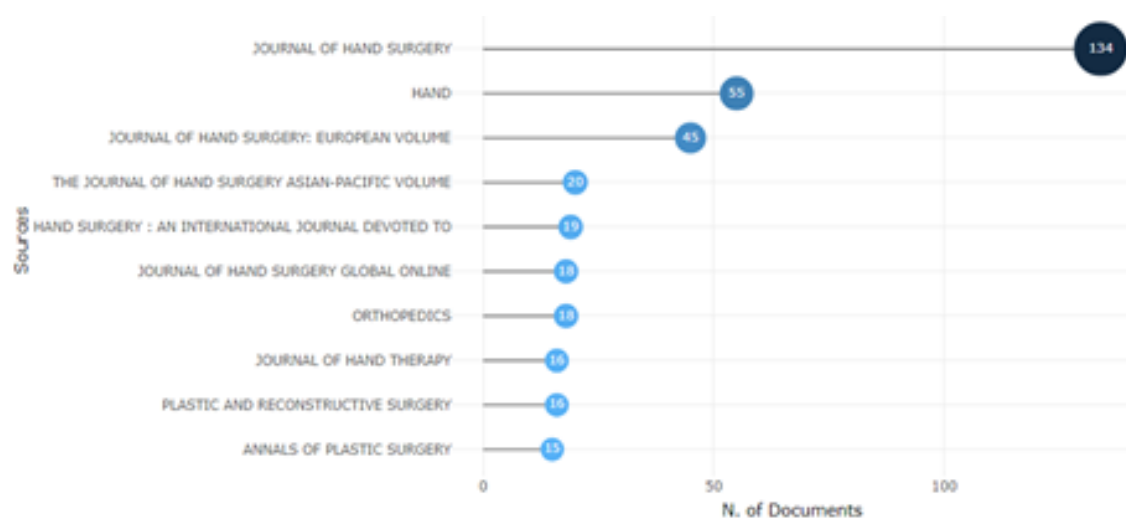


Figure 6. Analysis of Journals Publishing Articles on TF

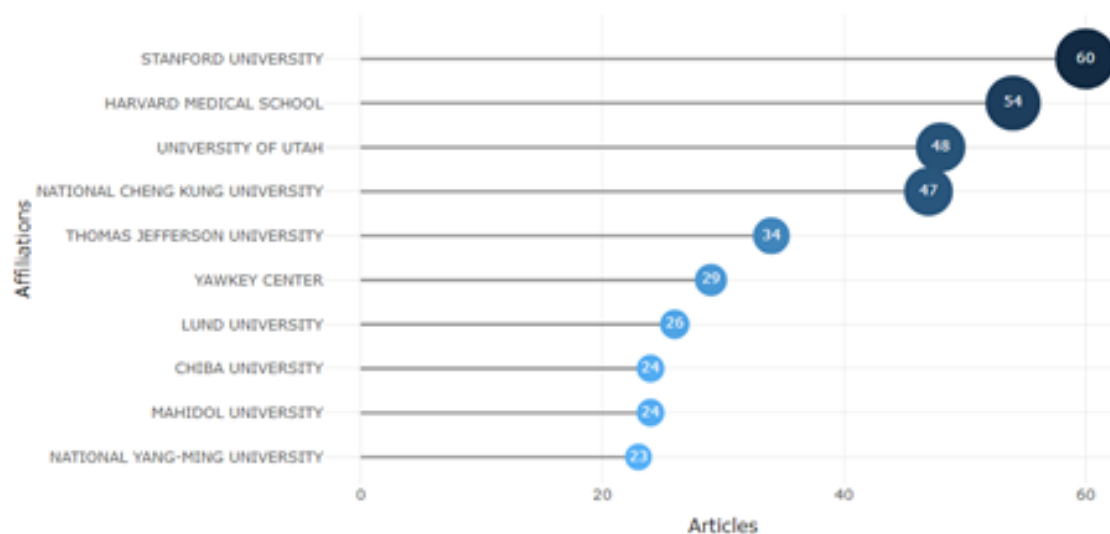


Figure 7. University Analysis of Authors Publishing on TF

Analysis of Authors

The analysis of the authors who published the most articles on TF is shown in Figure 8. In the list of authors who published the most articles on TF, Ring D ranks first, Chung KC ranks second, and Kamal RN ranks third.

Most Productive Countries

The most productive countries in TF are shown in Figure 9. Additionally, the relationship between these countries was analyzed and shown in Figure

10. In the list of the most productive countries in terms of TF, the USA ranks first, China ranks second, Japan ranks third, South Korea ranks fourth and England ranks fifth.

In the ranking of international cooperation on TF, the USA - Netherlands ranks first with 7 articles, and England - Netherlands ranks second with 6 articles. In third place, 3 different collaborations were established with 5 articles. These are Italy – Spain, USA – China and USA – Italy.

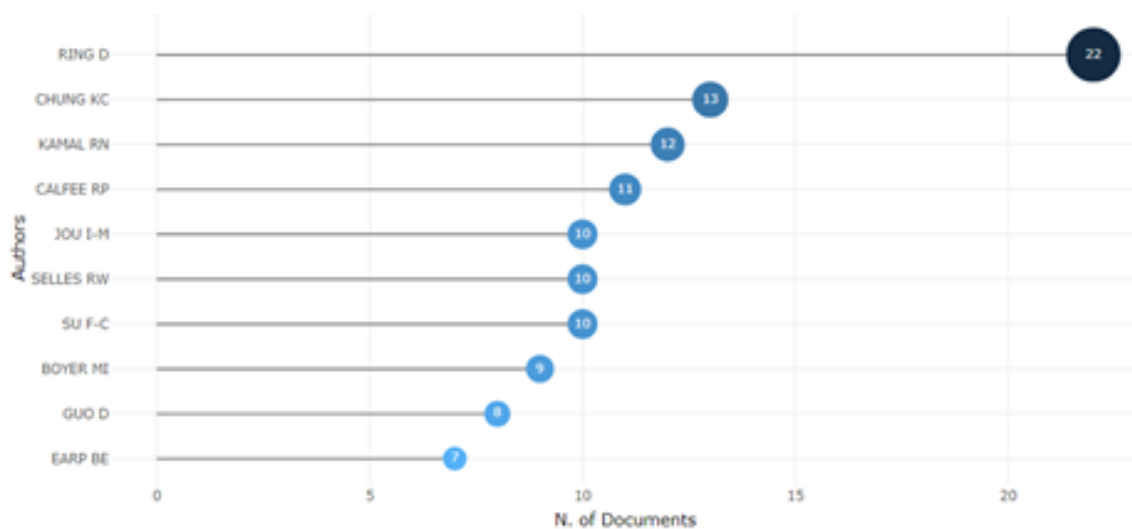


Figure 8. Analysis of Authors Publishing on TF



Figure 9. Analysis of the Most Productive Countries for TF



Figure 10. Analysis of Cooperation of Countries Publishing on TF

Most Cited Countries

The countries with the most citations on TF are shown in Figure 11. In the list of countries with the most citations regarding TF, the USA ranks first, South Korea ranks second, and the England ranks third.

Most Cited Articles

The most cited articles on TF are shown in Table 1. The most cited article can be considered the most important article. In this regard, the most important article about TF is the article titled "Trigger digits:

principles, management, and complications" written by Ryzewicz and Wolf and published in the "Journal of Hand Surgery" in 2006. In second place, Johnson et al. There is an article titled "Risk of prolonged opioid use among opioid-naïve patients following common hand surgery procedures" written by and published in the "Journal of Hand Surgery" in 2016. In third place, Ring et al. There is an article titled "Self-reported upper extremity health status correlates with depression" written by and published in the "Journal of Bone & Joint Surgery" in 2006.

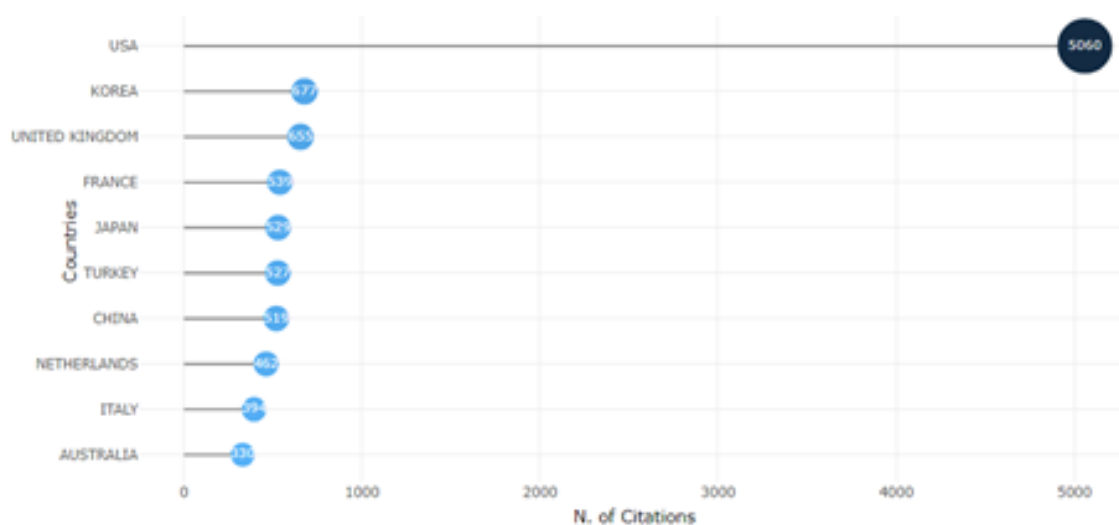


Figure 11. Countries Most Cited on TF

Table 1. Most Cited Articles

Paper	DOI	Total Citations
Ryzewicz M, 2006, J Hand Surg (USA)	10.1016/j.jhsa.2005.10.013	276
Johnson SP, 2016, J Hand Surg (USA)	10.1016/j.jhsa.2016.07.113	273
Ring D, 2006, J Bone Jt Surg Ser A	10.2106/JBJS.E.00932	222
Eisman JA, 2011, J Bone Miner Res	10.1002/jbmr.212	221
Boileau P, 2004, J Shoulder Elbow Surg	10.1016/j.jse.2004.01.001	192

Analysis of Scientific Maps

Scientific mapping is the implementation of computational methods as a whole to visualize, analyze and model varied scientific and technical activities with maps29-31. This section includes factor analysis, thematic map analysis, trending topics, tree map, author - keyword network map.

Factor Analysis

Factor analysis regarding the TF issue is shown in Figure 12. According to factor analysis, the most important keywords used in the literature are collected in the red group. Accordingly, “trigger finger”, “tenosynovitis”, “hand”, “pain”, “case report”, “tendon”, “prospective studies”, cohort analysis” etc. keywords are in the red group.

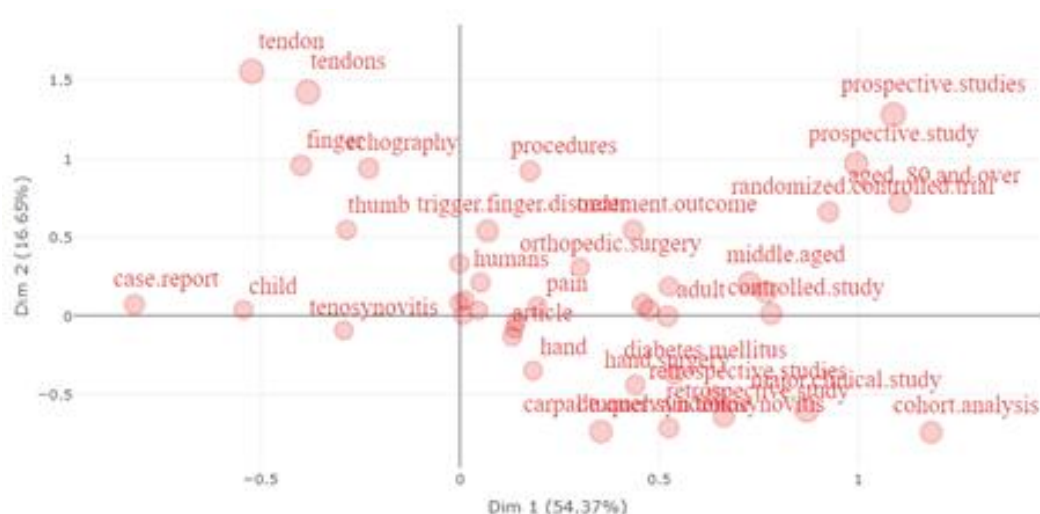
Thematic Map Analysis

The thematic map of articles expresses the keywords used by the most important authors in the field. The thematic map regarding TF is shown in Figure 13. According to the thematic map analysis, the keywords "case report", "tendons" and "child" are in

the "Emerging or Declining Themes" group. Common keywords used in the “Motor Themes” and “Basic Themes” groups are “human”, “humans” and “article”. The keywords commonly used in the “Motor Themes” and “Niche Themes” groups are “major clinical study”, “carpal tunnel syndrome” and “retrospective study”.

Trending Topics

The most important words mentioned in articles about TF between 2000 and 2023 are given in Table 2. The most used keyword in articles about TF is "female" and it was used 1021 times. It is also the most used word in the first quarter of 2012, the second quarter of 2017 and the third quarter of 2020. The second most used word is “male” and it was used 990 times. The word “Male” was used most in the first quarter of 2012, the second quarter of 2017 and the third quarter of 2020. The third most used word is “human” and was used 904 times. The word “Human” was used most in the first quarter of 2012, the second quarter of 2018 and the third quarter of 2021.

**Figure 12.** Factor Analysis

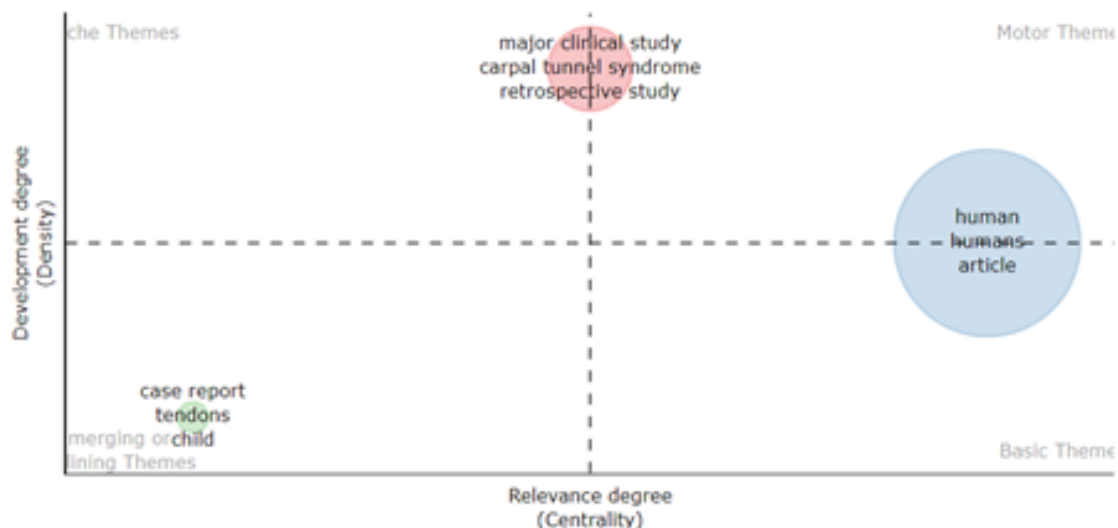


Figure 13. Thematic Map Analysis

Table 2. Distribution of Keywords by Years

Item	Frequency	Year_q1	Year_med	Year_q3
Female	1021	2012	2017	2020
Male	990	2012	2017	2020
Human	904	2012	2018	2021
Trigger finger	815	2014	2019	2022
Adult	808	2012	2017	2021
Article	722	2011	2016	2021
Aged	595	2012	2016	2019
Trigger finger disorder	527	2013	2016	2021
Carpal tunnel syndrome	424	2014	2018	2021
Controlled study	299	2013	2019	2022

Tree Map

The size of the rectangles in the treemap refers to the number of keywords used in articles and is a visual diagram of trending topics. The tree map of the keyword "Trigger finger" is shown in Figure 14. According to the tree map of the keyword "trigger finger", the most used word is "female" with 1021 times (8%). The word "male" comes second with 990 times (7%), and the word "human" comes third with 904 times (7%).

Keyword Network Map

Keywords are important words or groups of words that describe an article. In the network map, the keywords in the articles are presented as a cluster using the most common ones. For this, keyword network map analysis was performed using

VOSviewer software and shown in Figure 15. According to the network map analysis of the keyword "Trigger finger", 196 connections were established with 1673 keywords, creating a total of 17 groups. The important ones from these groups are turquoise (trigger finger), red (carpal tunnel syndrome) and light green (hand surgery).

Timeline of Keywords

The analysis of the use of keywords between 2014 and 2022 is shown in Figure 16. When the usage pattern of keywords by years is examined, keywords such as "pulley", "mobility" and "disability" were used more frequently around 2014, and in recent years, keywords such as "trigger finger", "digits", "speciality" and "orthopedics" are preferred.

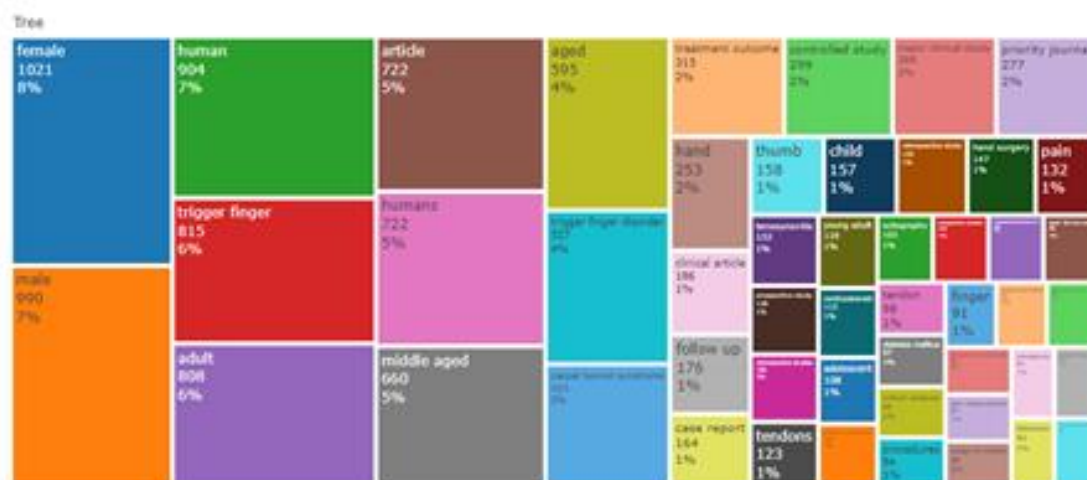


Figure 14. Tree Map

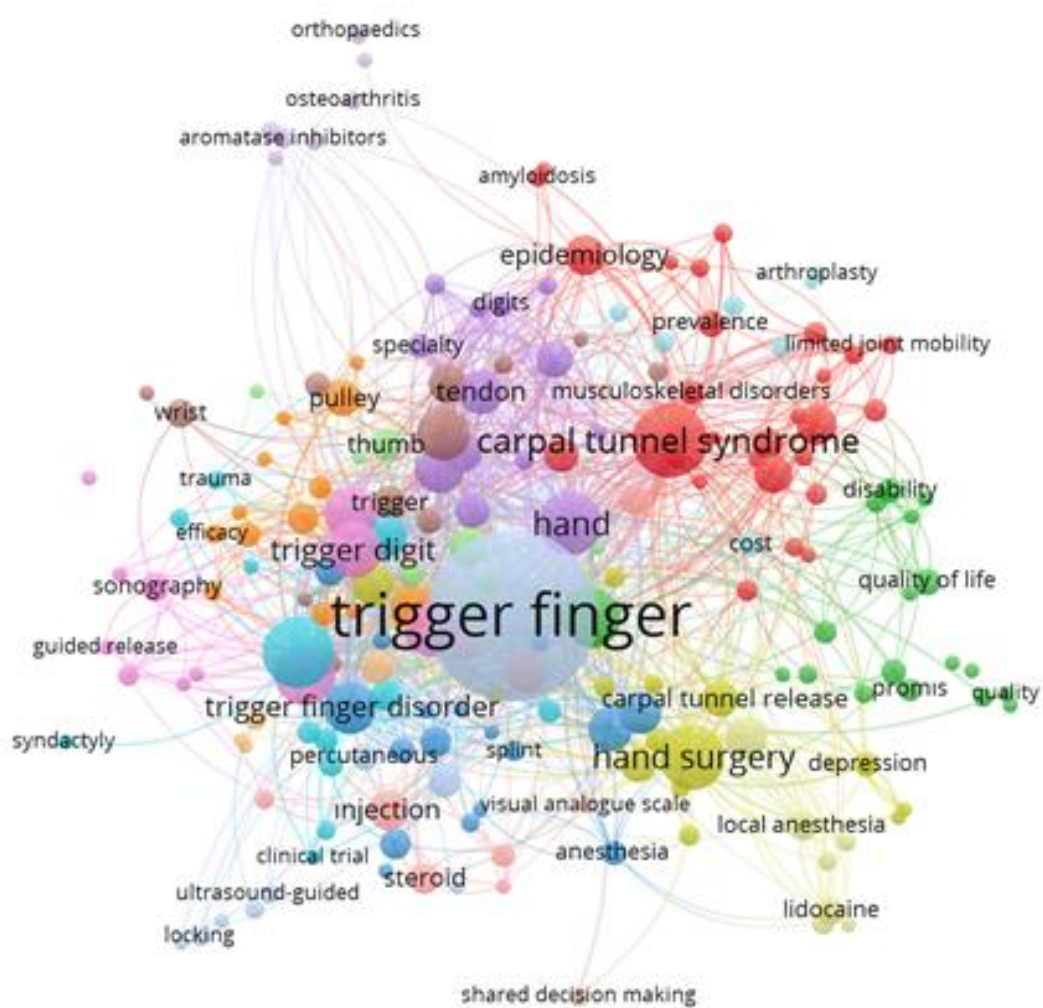


Figure 15. Keyword Network Map

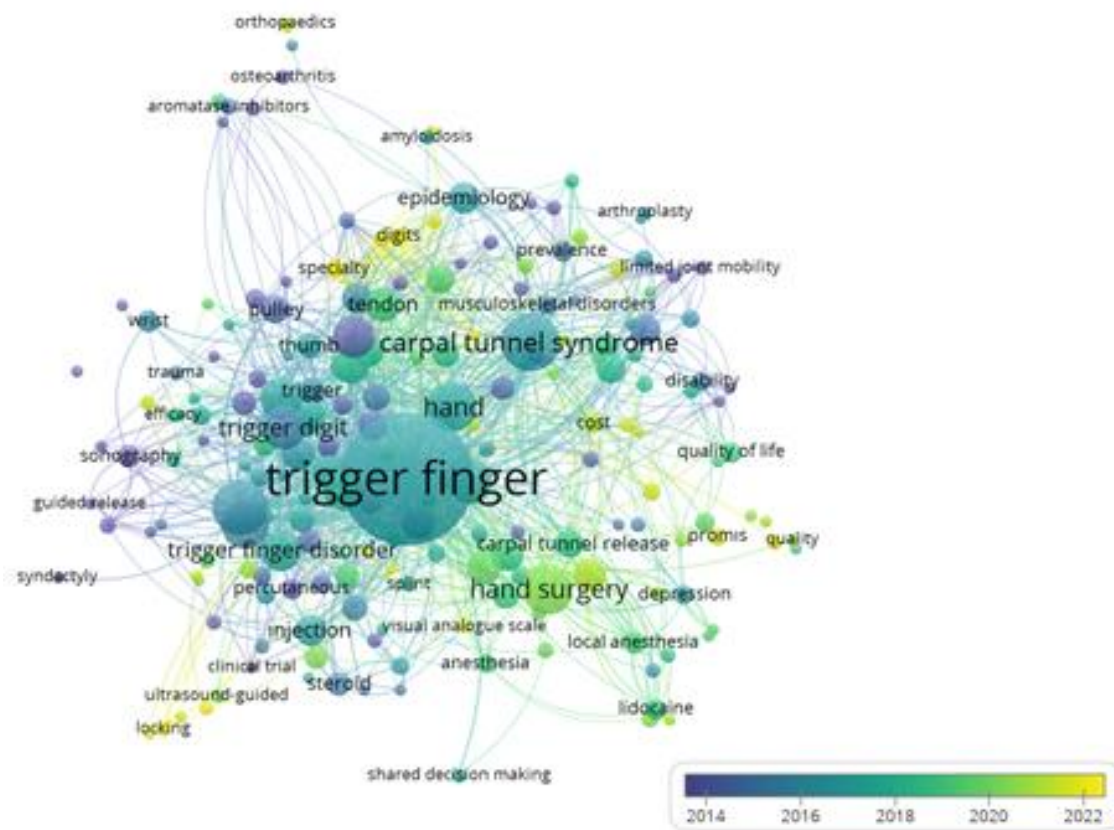


Figure 16. Timeline of Keywords

DISCUSSION

We aimed to reveal the structure and productivity of the fields of study related to the concept of TF, to reveal its historical development, and to help researchers in the fields of anatomy and other health sciences grasp present and future research trends. And thus design more innovative and creative studies by revealing the conceptional abundance of studies on TF. In our study, it is observed that the popularity of TF and the number of studies on TF are increasing every year. Scopus database was preferred to conduct bibliometric analysis of these increasing studies. The reasons for choosing the Scopus database include the fact that it is a database that covers a wide range of scientific journals, congress proceedings, books and other scientific publications, and that it provides the researcher with a wide range of bibliometric data (number of citations, h-index, working groups, etc.).

In our study, which was carried out using R Studio

and VOSviewer software, articles written in English, initially published in 992 journals, were downloaded from the Scopus database. Between 2000 and 2023, the annual growth rate of publications is 19.65%, the average age of articles is 7.49, and the average number of citations per article is 15. 41 of 3928 authors published with a single author. The international co-authorship rate was found to be 7.359%. According to the Sankey diagram, the most important country regarding TF is the USA, the most important author is Ring D, and the most important keyword is "trigger finger". The most important journal was determined as "Journal of Hand Surgery" and the most important university was determined as "Stanford University". In terms of cooperation between countries, the USA and the Netherlands rank first with 7 articles. The most cited country is the USA with 5060 citations, and the most cited author is Ryzewicz and Wolf with 276 citations.

When the literature was examined, major

deficiencies were seen in bibliometric analysis on TF. To our knowledge, only a bibliometric analysis study published by Markowitz et al. in 2023 has been found (Markowitz et al., 2023). In this study, Markowitz et al. investigated the 50 most cited TF-related studies. Markowitz et al., who conducted the study in November 2021, included the period between 1954 and 2014 in their study (Markowitz et al., 2023). Unlike Markowitz et al., we conducted a more detailed study that included recent years. The journal with the most articles published is "Journal of Hand Surgery", and the country that publishes the most articles is the USA. Our study is also parallel to this study. Our study is valuable because it is the second study in the literature that analyzes TF bibliometrically and the analysis was conducted until 2023.

Among the limitations of our study, we include only the Scopus database, only articles published in journals, and only articles written in English. In future studies, databases such as Dimensions, Web of Science, Cochrane Library and PubMed should also be investigated. We also think that publication types such as books, book chapters, reviews, letters, and publications written outside the English language should also be investigated.

CONCLUSION

The findings of our study, in which we summarized the research on the concept of TF in depth, are expected to provide guidance for the rapidly increasing TF research. This research provides precious data regarding the analysis of the concept of TF regarding the most influential sources, the most influential authors, the most efficient links and the most efficient studies in available literature. Researchers and clinicians have the alternative to choose which articles to cite, which articles are most suitable, and which articles have the greatest impact on TF. For studies on TF, this bibliometric analysis will help provide a comprehensive overview of past and present research and identify future research directions. The findings of the study reflect the current state of research on the concept of TF. Additionally, as a reference point, this study enables researchers to comprehensively grasp the concept of TF. With this bibliometric analysis, gaps in the

literature on TF can be identified and become a subject of study for clinicians and researchers in the future.

Conflict of Interest

Authors declare that there are no conflict of interest between them. Also, we note that our manuscript contains original material.

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