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REVIEW ARTICLE

TRENDING TOPICS IN PLATELET CONCENTRATES: PLATELET-RICH FIBRIN AND PLATELET-RICH PLASMA BIBLIOMETRIC ANALYSIS

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Abstract

Objectives: This paper aims to provide a bibliometric analysis on publication trends and a list of the top 100 most cited articles on platelet concentrates over the past 20 years.

Methods: A bibliographic search was performed on Microsoft Academic using the following strategy "(platelet-rich)". The number of citations related to specific use, favorable outcomes, and disciplines were analyzed using Microsoft Excel and XLSTAT. A second table with the number of citations, the altmetric attention score (AAS) and the year of publication was created. A ranking was sorted according to the number of citations with the 100 most frequently cited articles and variables being discussed. A graphical visualization of keywords was created with VOSviewer. Statistical analyzes have taken into account a 95% confidence interval.

Results: A helpful list of the top 100 articles has been developed to help professionals in a wide variety of ways. Platelet concentrates trends are valuable for researchers to visualize what interests' readers and editors more. Surgical use of platelet concentrates and some results are in the uptrend of publications ($p < .05$).

Conclusions: Bibliometrics and altmetrics are valuable tools to be updated in any healthcare profession. Both tools save those interested in the topic a lot of effort and time. Having a suitable keyword is critical to article dissemination.

Keywords: *Blood platelet; Fibrin; Growth Factors; PRP; Platelet-rich plasma*

Introduction

Over 4 million scientific articles were published in 2020 and updating them becomes an arduous task. Scientometrics is the measurement and analysis of scientific literature, and bibliometrics and altmetrics are, among others. Here it is one and perhaps a major function of any bibliometric analysis, a high-quality bibliographic search. Bibliometric analysis produces a list of highly effective articles that is so important that

many other articles have cited it. Another form of scientific evaluation is on the rise, the altmetric study. This name is the combination of alternative + metrics, alternative forms of evaluating scientific work through web citations.[1]

Bibliometrics seeks to identify the most influential articles on a given topic and to examine the characteristics of those articles.[2] The ranking created relates to the scientific interest of another researcher (bibliometric), or an internet user (altmetric). Of course, a much cited and commented article has a higher probability of being a pivotal contribution to science, with an excellent methodological grade that provides a scientific foundation with high impact.

Citations refer to another scientific work; an author reads exciting work and uses it as a reference in his article. An altmetric citation refers to any type of internet quote, primarily social media, when a person writes about a specific article on social media or other web source such as Wikipedia.There is no graduation between these two analyzes,they complement each other.[3] This retrospective study provides a list of the most cited articles on platelet-rich plasma and platelet-rich fibrin. The author hypothesizes that bibliometric analysis could be supported at any research or professional level, saving time to get a high-quality bibliographic search.

The aim of this study was to do a bibliometric analysis, with some statistical tests being performed to confirm more exciting topics and trends. This analysis could help any healthcare professional dealing with platelet-rich concentrates, especially researchers due to publications trends.

Material and methods

This bibliometric analysis is a retrospective study that followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement.[4] This paper attempted to follow the principles of the Leiden Manifesto,[5] with particular attention to transparency, avoidance of false precision, and allowing data to be verified.

Search strategy

A literature search was done until April 29, 2021, using Microsoft Academic (MA) platform. An investigation was conducted using the term "(platelet-rich)". No language restrictions, publication year range, journal impact factor, or methodology selections were applied. As a review, this article is exempt from institutional review board approval.

Data extraction and Bibliometric Parameters

Articles were identified using the search at Microsoft Academic (MA). On the same day, a Pubmed search was done. The list of top 100 articles was ordered by number of citations and created using the following variables: citations per year, authors, and publication year. The investigator designed a table in Microsoft Office Excel, and each paper was retrospective hand-searched to identify the topic area, and year of publication. Another column was created with the Altmetric Attention Score (AAS) of each article, using the Dimensions app. Any missed data between MA and Dimensions were cross-matched to ensure the accuracy of collected information. To be included in this study sample, publications had to present platelet AND rich on the title and/or abstract, with no restriction about language or year of publication. Publications were excluded if articles are not related to platelet-rich plasma or fibrin.

Methodological design and data analysis

A list of 100 most-cited articles was created through the MA platform and ordered through citations. After this step, a table produced in Microsoft Excel was fulfilled manually with year of publication, authors reference, journals, institution, and country of origin. Another manual fill was performed using data from Dimensions, AAS. Finally, the citation density column was automatically calculated through Microsoft Excel, splitting the number of citations between years of publication.

A second analysis included all published articles about platelet concentrates. This second analysis aimed to evaluate publication trends through the last 20 years. This bibliometric analysis was conducted comparing specific use of concentrates (surgical or therapeutical), favorable outcomes (wound healing, bone regeneration, osteoarthritis and tendon injuries/tendinopathies) and main disciplines (orthopedics, oral and maxillofacial surgery, periodontics, implantology, and dermatology). In addition, correlation between open articles and number of citations, mentions were performed. Tables were created through Microsoft Excel. Statistical and

linear trend analysis performed through Microsoft Excel and XLSTAT. VOS-Viewer free software (Leiden University, The Netherlands) was used to create a graphical illustration of some critical elements, a visual form of bibliometric analysis. Pearson correlation test, Mann-Kendall test and Kruskal-Wallis test were performed in Microsoft Excel and XLSTAT ($p < .05$).

Results

There are 7,576 articles published in journals concerning platelet concentrates. An excellent manner to evaluate publishing trends is to assess MeSH (Medical Subject Headings) descriptors, relevant words used by own author to describe the subject of the article better. Therefore, a retrospective list of the top 100 most-cited articles was generated (table 1) with variables number of citations in two different platforms, AAS, year of publication, authors reference, and citation density (average number of citations per year).[6]

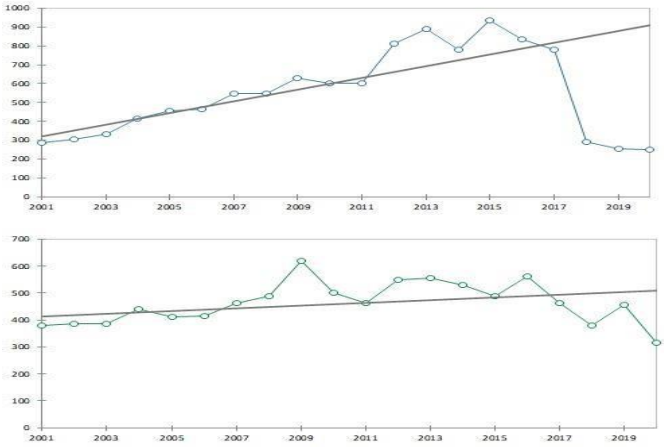
Table 1. List of top 100 most cited articles sorted by number of Microsoft citations

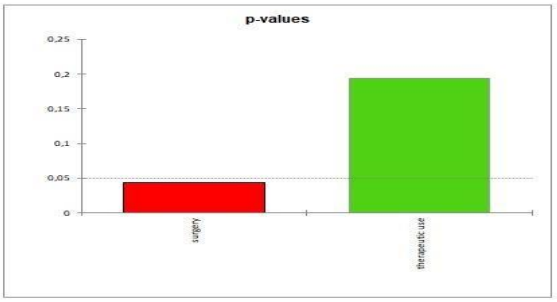
MA	Dimensions	AAS	citation density	reference	year
3440	1983	13	149,57	Marx et al [10]	1998
2007	1335	4	118,06	Marx [11]	2004
1677	834	14	111,80	Dohan et al [12]	2006
1539	901	31	128,25	Ehrenfest et al [31]	2009
1494	928	6	74,70	Marx [32]	2001
1265	797	17	105,42	Foster et al [33]	2009
1261	755	26	74,18	Eppley et al [34]	2004
1170	533	10	78,00	Choukroun et al [35]	2006
1127	592	10	75,13	Dohan et al [36]	2006
1111	632	37	74,07	Mishra, Pavelko [23]	2006
950	592	77	86,36	de Vos et al [21]	2010
866	438	0	57,73	Dohan et al [37]	2006
818	381	13	54,53	Choukroun et al [38]	2006
813	518	14	73,91	Peerbooms et al [39]	2010
774	452	3	40,74	Weibrich et al [40]	2002
770	459	11	55,00	Sánchez et al [41]	2007
742	412	3	43,65	Weibrich et al [42]	2004
720	398	0	40,00	Sánchez et al [43]	2003
692	413	11	57,67	Alsousou et al [44]	2009
667	423	53	83,38	Patel et al [19]	2013
654	329	6	32,70	Man et al [45]	2001
652	359	10	43,47	Anitua et al [46]	2006
644	394	29	58,55	Kon et al [22]	2010
599	364	36	46,08	Sampson et al [20]	2008
592	374	36	59,20	Kon et al [28]	2011
550	387	25	55,00	Gosens et al [26]	2011
548	395	8	36,53	Eppley et al [47]	2006
518	299	10	47,09	Lacci, Dardik [48]	2010
511	296	9	42,58	Mishra et al [49]	2009
511	288	3	24,33	Landesberg et al [50]	2000
504	307	3	38,77	de Mos et al [51]	2008
500	297	3	35,71	Schnabel et al [52]	2007
490	364	0	49,00	Castricini et al [53]	2011

484	324	0	34,57	El-Sharkawy et al [54]	2007
479	279	13	47,90	Filardo et al [55]	2011
479	26	0	47,90	Dhillon et al [56]	2011
476	291	9	31,73	Akeda et al [57]	2006
476	283	9	26,44	Okuda et al [58]	2003
474	264	8	22,57	Kassolis et al [59]	2000
472	195	0	24,84	Froum et al [60]	2002
471	334	13	47,10	Castillo et al [61]	2011
462	313	4	46,20	Sundman et al [62]	2011
456	293	20	57,00	Amable et al [63]	2013
439	290	0	36,58	Ehrenfest et al [64]	2009
431	291	11	35,92	Mishra et al [65]	2009
428	331	3	42,80	Randelli et al [66]	2011
427	293	0	47,44	Mazzocca et al [67]	2012
427	299	10	47,44	Boswell et al [68]	2012
427	295	10	47,44	DeLong et al [69]	2012
416	242	3	27,73	Driver et al [70]	2006
410	183	8	34,17	Mazor et al [71]	2009
409	269	0	34,08	Hall et al [72]	2009
407	191	72	58,14	Moraes et al [30]	2014
405	244	0	21,32	Aghaloo et al [73]	2002
404	255	3	25,25	Fréchette et al [74]	2005
402	255	3	33,50	McCarrel, Fortier [75]	2009
395	242	20	23,24	Yamada et al [76]	2004
391	254	6	27,93	Ishida et al [77]	2007
390	320	0	26,00	Everts et al [78]	2006
390	223	3	20,53	Camargo et al [79]	2002
388	105	5	48,50	Martinez-Zapata et al [80]	2013
385	269	27	42,78	Cerza et al [25]	2012
385	288	7	32,08	He et al [81]	2009
385	231	3	32,08	Sánchez et al [82]	2009
385	264	6	35,00	Bendinelli et al [83]	2010
383	237	9	34,82	Filardo et al [84]	2010
380	310	13	54,29	Dhurat, Sukesh [85]	2014
378	238	5	42,00	Filardo et al [86]	2012
378	241	6	31,50	Kon et al [87]	2009
378	249	35	37,80	de Jonge et al [24]	2011
377	204	2	53,86	Ghanaati et al [88]	2014
376	254	12	37,60	Thanasas et al [89]	2011
375	225	1	23,44	Pietrzak, Eppley [90]	2005
375	232	13	34,09	Niemeyer et al [91]	2010
375	236	4	34,09	Haleem et al [92]	2010
374	269	6	28,77	Kakudo et al [93]	2008
370	229	0	52,86	Ehrenfest et al [94]	2014
367	233	3	33,36	Ehrenfest et al [95]	2010
367	213	0	21,59	Wiltfang et al [96]	2004
357	245	17	39,67	Filardo et al [97]	2012

354	215	4	27,23	Kajikawa et al [98]	2008
347	205	15	38,56	Li et al [99]	2012
346	229	15	16,48	Hemker et al [100]	2000
342	173	0	19,00	Tözüm, Demiralp [101]	2003
341	231	13	34,10	van Buul et al [102]	2011
338	247	3	24,14	Murray et al [103]	2007
338	206	3	22,53	Van Den Dolder et al [104]	2006
337	255	10	37,44	Rodeo et al [105]	2012
335	220	16	27,92	Hammond et al [106]	2009
338	248	3	24,14	Murray et al [107]	2007
335	206	6	19,71	Kitoh et al [108]	2004
333	233	62	41,63	Krogh et al [18]	2013
331	223	2	36,78	Mishra et al [109]	2012
330	192	9	18,33	Carter et al [110]	2003
326	237	0	36,22	McCarrel et al [111]	2012
316	227	11	35,11	Sheth et al [112]	2012
314	205	30	28,55	Engebretsen et al [29]	2010
310	226	14	38,75	Zhu et al [113]	2013
307	206	8	27,91	Sampson et al [114]	2010
306	213	61	61,20	Meheux et al [27]	2016

Platelet concentrate related to surgical procedures (54,33%) have a little higher articles number than therapeutical procedures (45,66%). A Mann-Kendal test performed returned a Sen´s slope value of 30,885 and Kendall´s tau of 0,332 to surgical while a Sen´s slope of 5,031 and Kendall´s tau of 0,216 to therapeutical. This shows us, both procedures have an increasing number of publications, but surgical procedures have the most robust trend (figure 1).





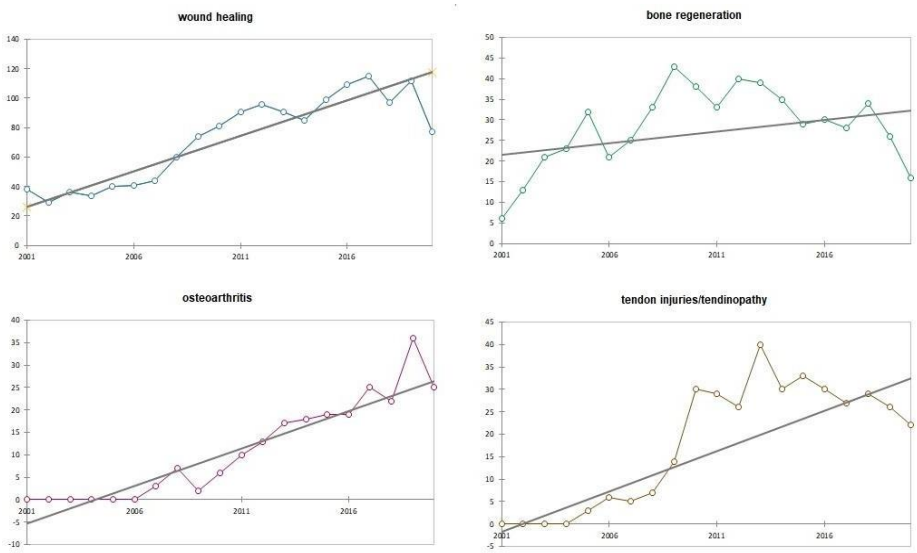
Furthermore, a p-value of surgical use of platelet concentrates is 0,044, statistically significant, but therapeutical use has a p-value of 0,194.

Favorable outcomes analysed included wound healing, bone regeneration, osteoarthritis and tendon injuries/tendinopathy. A resume of Kendall´stau, p-value and Sen´s slope is on table 2.

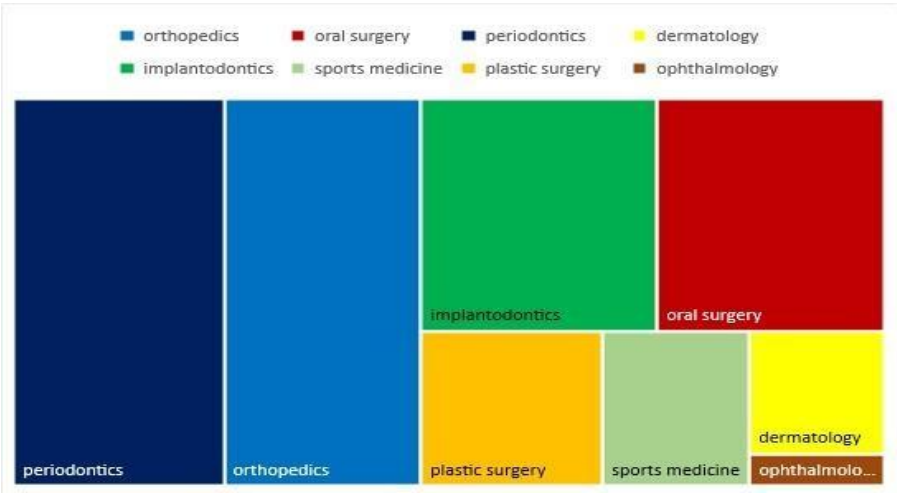
Table 2. Favorable outcomes Mann-Kendal test results

Series\Test	Kendall's tau	p-value	Sen's slope
wound healing	0,765	<0,0001	4,806
bone regeneration	0,222	0,183	0,569
osteoarthritis	0,899	<0,0001	1,667
tendon injuries/tendinopathy	0,569	0,001	1,806

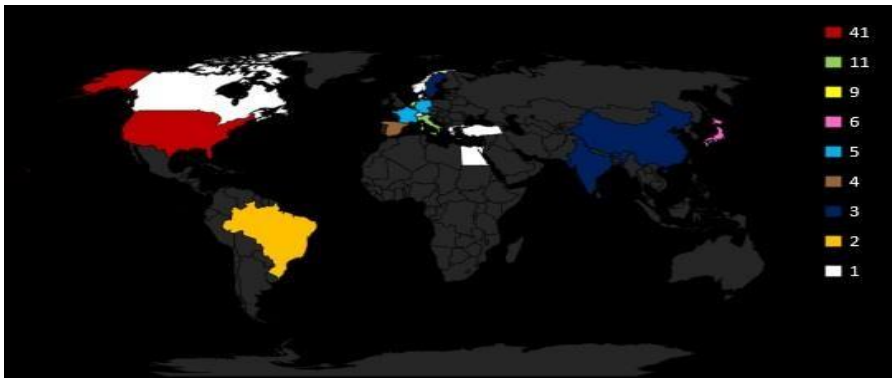
There is a clear uptrend in all outcomes, most notably on wound healing. Three results have statistically significant p-values while bone regeneration returns a p-value not statistically significant (p = 0,183). A graphic visualization of trends can be seen on figure 2.



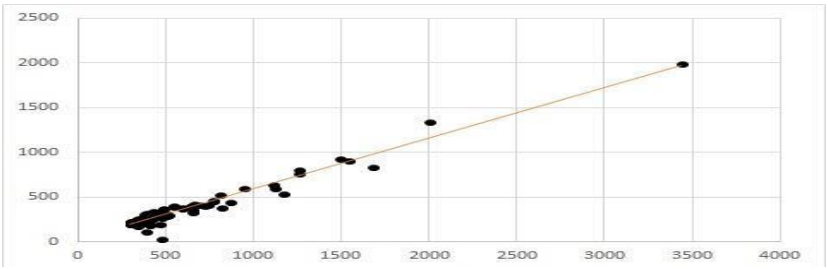
Platelet concentrates can be used in many indications, spread in some disciplines. For example, the medicine disciplines that most routinely use platelet concentrates are orthopedics, sports medicine, plastic surgery, dermatology, and ophthalmology while in dentistry, it is possible to cite oral surgery, implantodontics, and periodontics.[7] An area graphic demonstrates a visual comparison between number of articles in each discipline (figure 3).



In figure 4 is possible to see a map of the countries that are producing these papers.

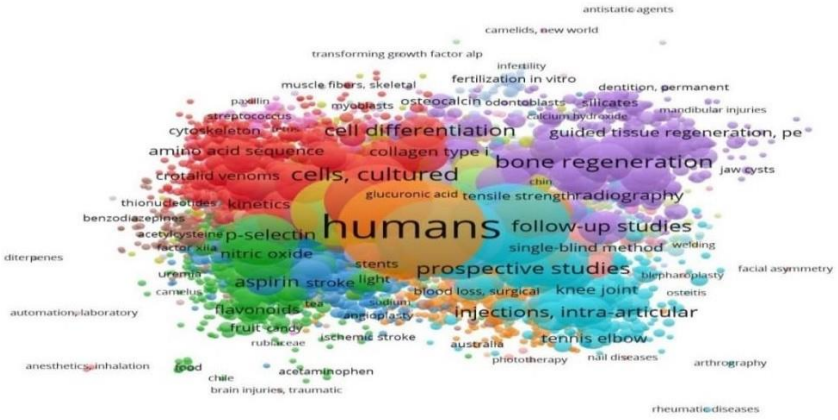


A Pearson´s correlation test was performed on the top 100 list, between two bibliographic search platforms, MA and Dimensions and between each platform and AAS. Pearson´s correlation coefficient between MA and Dimensions was 0.977 (figure 5), considered very high. MA and AAS have a coefficient of 0.1096 (poor) and between Dimensions and AAS, 0.36699 (moderate).



A Fisher exact test was performed to assess if an open-access article has more chances to be mentioned. Test statistic returned a statistically significant value of 0.0182 ($p < .05$). A Kruskal-Wallis test was performed to examine the relation between citation density and year of publication, returning a H statistic of 209.3354 (1, N=315, $p < .00001$).

The most frequent MeSH keyword were “humans”, “male”, “platelet-rich plasma”, “female”, and “animals”. In figure 6 is possible to see a graphical representation of keywords in a network visualization made through free software VOSviewer (Leiden University, Netherlands). The size of the circles is related to the number of citations using the determined keyword.[8]



Discussion

This paper aims to perform a bibliometric analysis of platelet concentrates and assess publications trends over time. Graphic data visualization through bibliometric software and statistical tests were performed to make information more assimilable ($p < .05$). Bibliometric analysis enables researchers and readers to identify research evolution in a specific area over time and to get a superior comprehension as well as some possible failures.[9]

Interest in surgical use of platelet concentrates has an uptrend. As a result, handling platelet concentrates with surgical purposes has a higher chance of publication and dissemination (p = 0,044), contrary to therapeutical use, in a downtrend. However, this trend is not statistically significant (p = 0,194).

Same statistically significant uptrend can be found on wound healing (p < .0001), osteoarthritis (p < .0001) and tendon injuries/tendinopathy (p = 0.001), what indicates these outcomes has a high chance of increase in number of publications. And although bone regeneration is in uptrend, this is not statistically significant (p = 0,183).

Number of publications about platelet concentrates on periodontics and orthopedics is higher than in other disciplines. This difference could get bigger over time due to constant interest in these two disciplines. However, the three more cited articles are related to oral surgery.[10–12] Thus, the list of top 100 most cited articles has an heterogeneous distribution on disciplines and journals. The only question with a higher predominance on the top 100 list is USA as country of origin, with 36 articles.

Keyword choose is critical on article dissemination,[13] specially in cases of some topic areas like platelet concentrates, used in various disciplines. A graphical analysis through a bibliometric software can be instrumental in choosing an appropriate keyword, increasing precision, sensitivity and efficiency on a bibliographic search.[14]

There is no surgical precision in bibliometrics analysis.[5] However, there is a high correlation between Microsoft Academic and Dimensions, which delineates these two platforms are equivalent. The same correlation is not found on AAS. These two search platforms lead us to conclude that altmetrics is complementary to bibliometrics, two utterly different manners to assess scientific articles. An open-access article has more chances to be mentioned (AAS) than a paid articled (p < .05), same conclusion of another paper [15] and contrary to a second one.[16]

Citation density is the number of citations per year of publication and is an essential manner for understanding the scientific strength and impact of a determined paper. A strong correlation was found (p < .05) between year of publication and citation density. An older article has a higher chance of increasing citations than a more recently published article.[6,17]

According to Altmetrics, a score that could be considered good is about.[20] Seventeen articles on this top 100 list are equal or higher than,[20] of these,[13] are related to orthopedics or sports medicine.[18–31] There is a growing interest on the web about platelet concentrates use on orthopedics and sports medicine.

Conclusions

Bibliometric and altmetric analysis are very useful for researchers, academics, and students since both can facilitate any study, research or publishing an article. Open articles have a higher chance to be mentioned than paid articles. Surgical use of platelet concentrates as wound healing, osteoarthritis and tendon injuries/tendinopathy are uptrend, with more opportunities to achieve publication. An appropriate keyword is crucial in article dissemination. Futures studies are necessary since science is very dynamic, and this list needs updating from times to times.

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ԹՐՈՄԲՈՑԻՏՆԵՐԻ ԽՏԱՆՅՈՒԹԵՐԻ ԱՐԴԻԱԿԱՆ ԹԵՄԱՆԵՐ. ԹՐՈՄԲՈՑԻՏՆԵՐՈՎ ՀԱՐՈՒՏ ՖԻԲՐԻՆ և ԹՐՈՄԲՈՑԻՏՆԵՐՈՎ ՀԱՐՈՒՏ ՊԼԱԶՄԱՅԻ ՄԱՏԵՆԱԳԻՏԱԿԱՆ ՎԵՐԼՈՒԾՈՒԹՅՈՒՆ

Ռիկարդո Գրիլլո,[1,2] Մարիանա Ապարեսիդա Բրոզոսկի,[1] Մարիա դա Գրասա Նակլերիո-Հոմեմ [1]

[1] Դիմածնոտային վիրաբուժության, վնասվածքաբանության և պրոթեզավորման ամբիոն,Ստոմատոլոգիայի ֆակուլտետ, Սան Պաուլոյի համալսարան, Բրազիլիա:

[2] Դիմածնոտային վիրաբուժության բաժանմունք, Faculdade Planalto Central, Բրազիլիա, Բրազիլիա:

Ամփոփում

Նպատակներ. Այս հոդվածի նպատակն է տրամադրել հրապարակումների միտումների մատենագիտական վերլուծություն և թրոմբոցիտների խտանյութերի վերաբերյալ 100 ամենաշատ մեջբերված հոդվածների ցանկը վերջին 20 տարիների ընթացքում:

Մեթոդներ. Մայքրոսոֆթ Ակադեմիկում իրականացվել է մատենագիտական որոնում՝ օգտագործելով հետևյալ ռազմավարությունը «(Platelet Rich)»: Հատուկ օգտագործման, բարենպաստ արդյունքների և առարկաների հետ կապված մեջբերումների քանակը վերլուծվել է Microsoft Excel-ի և XLSTAT-ի միջոցով: Ստեղծվել է երկրորդ աղյուսակը՝ հղումների քանակով, Altmetric Attention Score (AAS) և հրապարակման տարեթիվով: Վարկանիշը դասակարգվել է ըստ մեջբերումների քանակի՝ 100 ամենահաճախ մեջբերվող փաստաթղթերի և քննարկված փոփոխականների հետ միասին: Հիմնաբառերի գրաֆիկական վիզուալիզացիան ստեղծվել է VOSviewer-ի միջոցով: Վիճակագրական վերլուծությունը հաշվի է առել 95% վստահության միջակայքը:

Արդյունքներ. Լավագույն 100 հոդվածների օգտակար ցուցակը կազմվել է տարբեր ձևերով մասնագետներին օգնելու համար: Թրոմբոցիտների կոնցենտրացիայի միտումները արժեքավոր են հետազոտողների համար, քանի որ դրանք թույլ են տալիս պատկերացնել այն, ինչը ավելի շատ հետաքրքրում է ընթերցողներին և խմբագիրներին: Թրոմբոցիտների կոնցենտրատների վիրաբուժական օգտագործումը նորոշ արդյունքներ հրապարակումների աճի միտում ունեն ($p < 0.05$):

Եզրակացություններ. Bibliometrics-ը և altmetrics-ը արժեքավոր գործիքներ են, որոնք պետք է թարմացվենցանկացած առողջապահական մասնագիտության մեջ: Երկու գործիքներն էլ մեծ ջանք ու ժամանակ են խնայում նրանց համար, ովքեր հետաքրքրված են թեմայով: Ճիշտ բանալի բառ ունենալը կարևոր է հոդվածիտարածման համար:

АКТУАЛЬНЫЕ ТЕМЫ КОНЦЕНТРАТАХ ТРОМБОЦИТОВ: БОГАТЫЙ ТРОМБОЦИТАМИ ФИБРИН И БИБЛИОМЕТРИЧЕСКИЙ АНАЛИЗ БОГАТОЙ ТРОМБОЦИТАМИ ПЛАЗМЫ

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Резюме

Цели: Целью этой статьи является предоставление библиометрического анализа тенденций публикаций и списка 100 наиболее цитируемых статей о концентратах тромбоцитов за последние 20 лет.

Методы: Был проведен библиографический поиск в Microsoft Academic с использованием следующей

стратегии «(обогащенные тромбоцитами)». Количество цитирований, связанных с конкретным использованием, благоприятными исходами и дисциплинами, было проанализировано с использованием Microsoft Excel и XLSTAT. Была создана вторая таблица с количеством цитирований, альтметрической оценкой внимания (AAS) и годом публикации. Рейтинг был отсортирован по количеству цитирований со 100 наиболее часто цитируемыми статьями и обсуждаемыми переменными. Графическая визуализация ключевых слов была создана с помощью VOSviewer. Статистический анализ принял во внимание 95% доверительный интервал.

Результаты: Был составлен полезный список из 100 лучших статей, чтобы помочь профессионалам самыми разными способами. Тенденции концентратов тромбоцитов ценны для исследователей, поскольку позволяют визуализировать то, что больше интересует читателей и редакторов. Хирургическое использование концентратов тромбоцитов и некоторые результаты находятся в восходящем тренде публикаций ($p < 0,05$).

Выводы: Библиометрия и альтметрика являются ценными инструментами, которые необходимо обновлять в любой профессии здравоохранения. Оба инструмента экономят много сил и времени тем, кто интересуется темой. Наличие подходящего ключевого слова имеет решающее значение для распространения статьи.