

The Olympic legacy: Journal metrics in sports medicine and dentistry

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Abstract

Systematic analysis of integral aspects within sport enables improvement in performance. One key aspect is the management and prevention of injuries. Bibliometrics is a systematic method for evaluating research output. It may be expected that the quantity and quality of sports injury research over time may strongly correlate with the timing of the Olympic games. This study was conducted to determine the effect of the Olympic legacy on academic sports medicine and evidence to prevent injuries of the face and teeth. A literature search within the PubMed database was undertaken to identify the quantity of literature published annually between 1996 and 2015 in the fields of sports injuries and injury prevention. The top 5 journals publishing in each field were then identified and the change in their impact factor (IF) was investigated. It was seen that, since 1996, there has been an overall increase in the quantity of literature published regarding sports injuries and prevention of sports injuries of 209% and 217%, respectively. Publications regarding facial injuries and dental injuries within sport show an increase of 114% and 71%, respectively. There was an increase in IF since 2000 in almost every journal investigated. A strong, positive correlation is seen among journals publishing on the prevention of sports injuries, showing a median IF increase of 2.8198. No statistical significance was found between Olympic years and the number of publications. Hence, there has been a gradual increase in both the quality and quantity of publications regarding sports injuries since 1996. However, there appears to be no immediate added effect of the “Olympic legacy” following each Olympic games on the quantity or quality of publications in these fields.

Key words: *Bibliometrics, injury prevention, olympic legacy, sports injuries*

INTRODUCTION

Following the London 2012 Olympic and Paralympic games, the International Olympic Committee publicized their vision of maintaining an “Olympic legacy.”^[1] They stated “Olympic host cities have the opportunity to provide lasting sporting legacies that help promote and develop sport.” They identified the unique

ability of the Games to catalyze change and therefore potentially advance sport.

One key aspect of any sporting legacy is to understand the elements that underpin sports performance and participation through research and surveillance. Systematic analysis of these elements within sport has played an important role in the maintenance and

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improvement of sporting performance for many years. The management and prevention of sports injuries is one such element. Without prevention, sports injuries can be extremely detrimental and occasionally career ending for high performance athletes.^[2] Continued advancement in sport science and the prevention of injury allows athletes to continue training, and therefore performing at the highest level. Examples include research regarding hydration^[3] and nutrition in sport.^[4] Since sports science research has been shown to have a positive effect on sporting performance, it could be assumed that one effect of the “Olympic legacy” should be reflected in the quality and volume of research. This article aims to seek evidence of this within existing publications.

Research drives evidence-based practice, and areas with a greater impact will attract more research funding to further advance knowledge in a given area. Determining the impact of research can be done in a number of ways. Bibliometrics is a systematic method for evaluating research output and can help map changes in the interest of a scientific community over time. The journal impact factor (IF) is the most commonly used bibliometric indicator and is based on the number of citations in the current year to items published in the previous 2 years over the number of substantive articles and reviews published in the same 2 years. Bibliometrics applied to oncology has been effectively used to investigate whether research yield regarding each cancer is reflected by their respective disease burden.^[5] This aids in directing research towards areas of highest disease incidence, and therefore ensures resources are being used in areas of highest need. Ultimately, this ensures we are providing the most effective evidence-based health care possible.

Investigation of output across search domains related to sports injuries and prevention allows assessment of interest in these areas with time. By further examining these domains in terms of proportion, the temporal interest in them by the scientific sports community can be assessed.

Aims

To determine the effect of the Olympic legacy on academic sports medicine and evidence to prevent injuries of the face and teeth.

MATERIALS AND METHODS

A search was undertaken through PubMed to identify the number of articles published each year between 1996 and 2015 in each of the following domains: “Sports

Injuries,” “Sports Injuries AND Prevention,” “Sports Injuries AND Tooth Injuries,” and “Facial Injuries AND Sport.” The same domains were also searched without “sport” or “sports injuries” as a control.

PubReMiner was then used to identify the top five journals publishing in the chosen domains and their IF identified over the years 2000 to 2015 using Thomson Reuters Journal Citation Reports Database. This data was correlated with the dates of Olympic games. Statistical significance was evaluated using a two-tailed, independent sample *t*-test.

RESULTS

Host cities of the Olympic games

Table 1 shows the location of the host cities of the Olympic games from 1996 to 2016.

Number of publications

From PubMed literature searches, regarding each of the chosen domains, the total number of publications are tabulated in Table 2.

Since 1996, there has been an overall rise in publications regarding sports injuries of 209% and 217% regarding prevention of sports injuries. Publications regarding facial injuries and dental injuries within sport show a far less consistent pattern of increase, with an overall percentage increase of 114% regarding facial injuries in sport and 71% regarding dental injuries in sport.

The total number of publications per year regarding each domain from 1996 to 2015 are shown in Figures 1–4.

Table 1: Olympic host cities

Year	Olympic host city
1996	Atlanta
2000	Sydney
2004	Athens
2008	Beijing
2012	London
2016	Rio De Janiero

Table 2: Total publications

Search domain	Total publications
Sports Injuries	22800
Sports Injuries AND Prevention	4595
Sports Injuries AND Tooth Injuries	244
Facial Injuries AND Sport	494

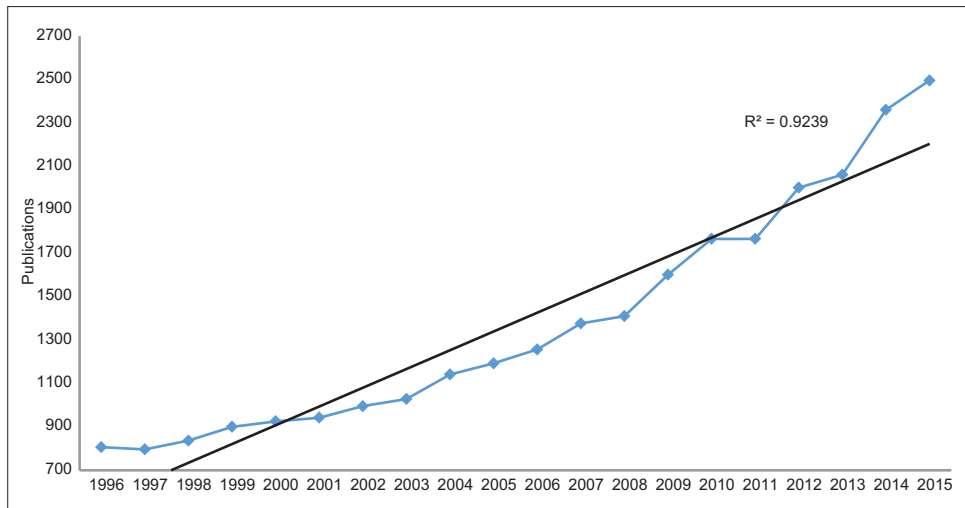


Figure 1: Total number of publications using the search terms "sports injuries"

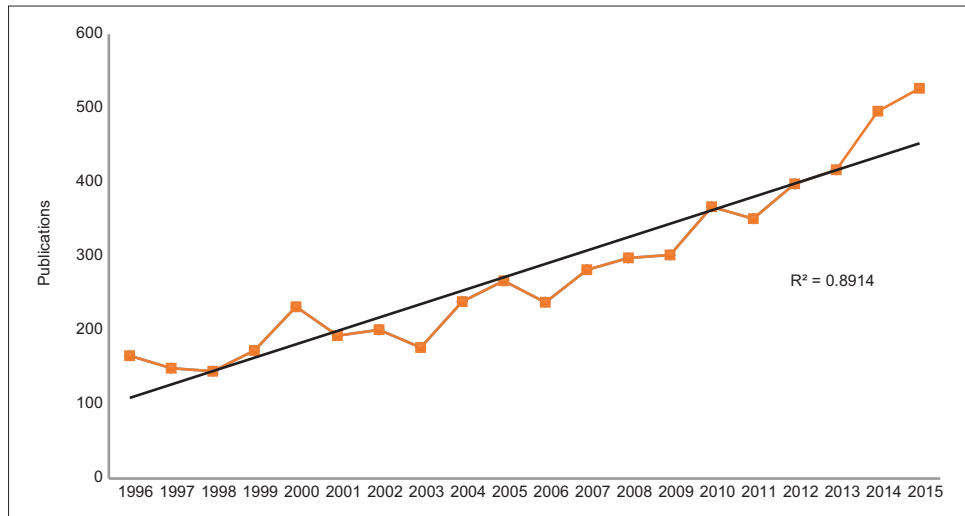


Figure 2: Total number of publications using the search terms "sports injuries" AND "Prevention"

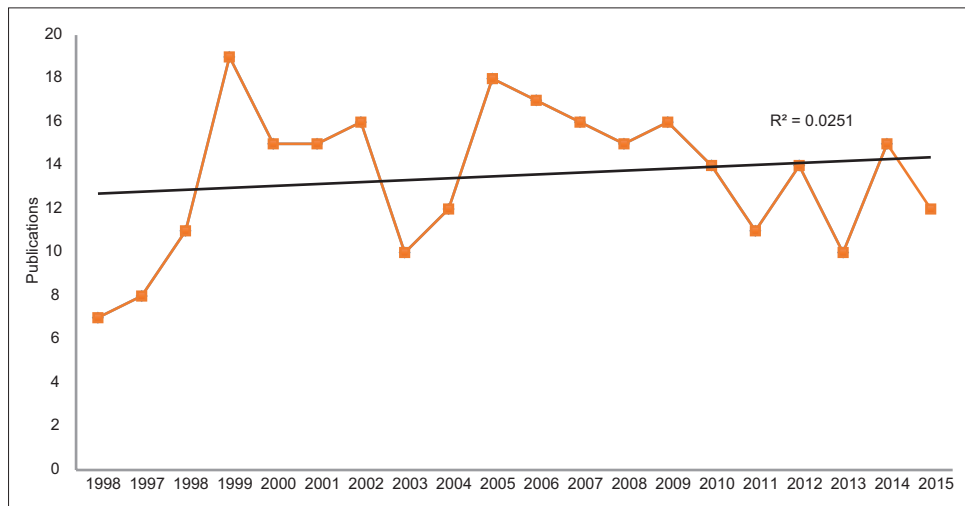


Figure 3: Total number of publications using the search terms "sports injuries" AND "Tooth Injuries"

Linear regression analysis shows a positive correlation between the number of publications and year regarding all search domains. In relation to the search domains “sports injuries” and “sports injury AND prevention,” this is a strong positive correlation reflected by R^2 values of 0.9239 and 0.89142, respectively [Figures 1 and 2].

In relation to the search domains “Sports Injuries AND Tooth Injuries” and “Facial Injuries AND Sport,” this is a weak positive correlation reflected by R^2 values of 0.02511 and 0.49011, respectively [Figures 3 and 4]. This suggests that there has been a generalized steady increase in the quantity of publications written regarding sports injuries over time.

From further observational analysis of the data, there appears to be a positive correlation between number

of publications and the Olympic years – seen as peaks in Figures 2 and 4 – Corresponding to Olympic years.

Unpaired two-tailed t -test analysis of the relationship between number of publication and Olympic years and number of publication and non-Olympic years was, however, shown to have no statistical significance with regard to all of our search domains ($P = 0.952, 0.740, 0.481, \text{ and } 0.106$, respectively, for Figures 1-4).

Impact factor

The Thomson Reuters Journal Citation Reports Database was used to investigate the IF of the top 5 journals publishing articles regarding our chosen search domains. This data was tabulated from years 2000 up to 2015 [Figures 5-7 and Tables 3-5].

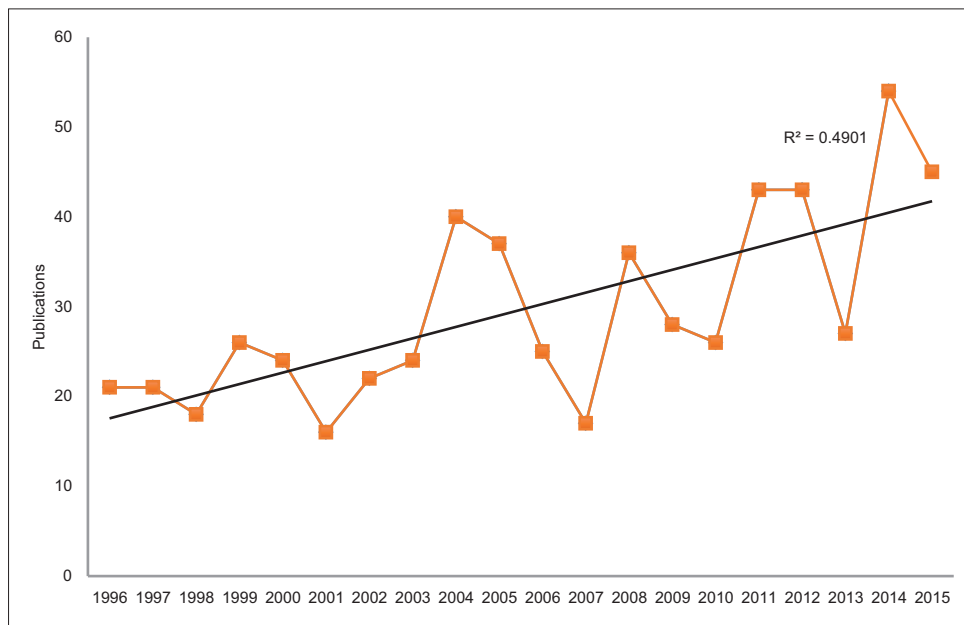


Figure 4: Total number of publications using the search terms “Facial Injuries” AND “Sport”

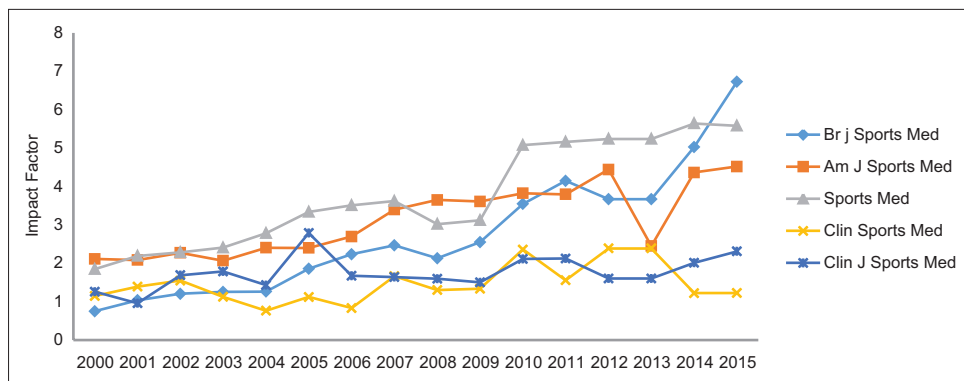


Figure 5: Change in impact factor of the top 5 journals publishing on “Sports Injuries” AND “Prevention”

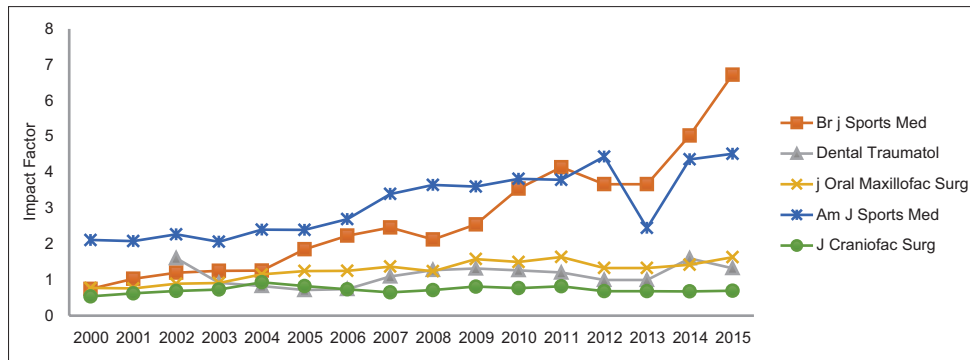


Figure 6: Change in impact factor of the top 5 journals publishing on “Facial Injuries” AND “Sport”

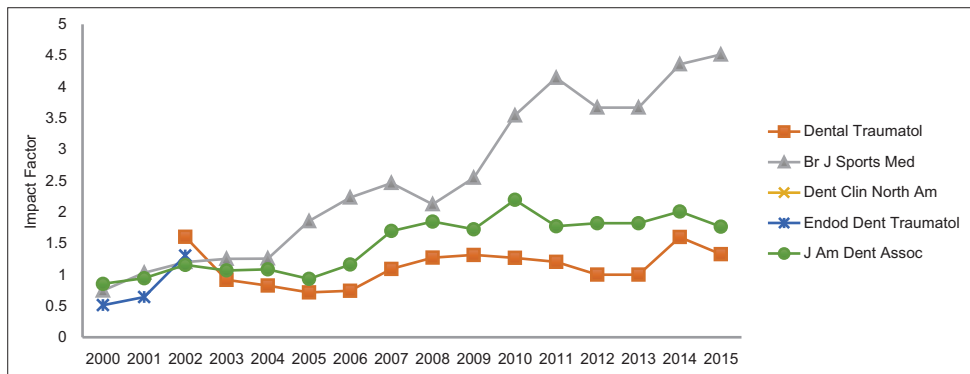


Figure 7: Change in impact factor of the top 5 journals publishing on “Sport Injuries” AND “Tooth Injuries”

Table 3: Impact factor per year of top 5 journals publishing in the field of sports injury prevention

Journal	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Br J Sports Med	0.75	1.03	1.20	1.25	1.26	1.86	2.23	2.46	2.13	2.55	3.55	4.14	3.67	3.668	5.025	6.724
Am J Sports Med	2.11	2.08	2.27	2.06	2.40	2.40	2.69	3.40	3.65	3.61	3.82	3.79	4.44	2.448	4.362	4.517
Sports Med	1.85	2.19	2.28	2.40	2.78	3.33	3.50	3.62	3.02	3.12	5.07	5.16	5.24	5.237	5.638	5.579
Clin Sports Med	1.14	1.39	1.55	1.12	0.76	1.12	0.83	1.66	1.30	1.33	2.36	1.55	2.38	2.384	1.22	1.221
Clin J Sports Med	1.26	0.96	1.69	1.78	1.43	2.78	1.67	1.64	1.60	1.50	2.11	2.12	1.60	1.6	2.012	2.308

Table 4: Impact factor per year of top 5 journals publishing in the field of facial injuries in sport

Journal	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Br J Sports Med	0.75	1.03	1.20	1.25	1.26	1.86	2.23	2.46	2.13	2.55	3.55	4.14	3.67	3.668	5.025	6.724
Dental Traumatol			1.60	0.92	0.83	0.72	0.74	1.09	1.27	1.32	1.27	1.20	1.00	1	1.601	1.327
J Oral Maxillofac Surg	0.77	0.76	0.89	0.91	1.15	1.25	1.25	1.37	1.24	1.58	1.50	1.64	1.33	1.33	1.425	1.631
Am J Sports Med	2.11	2.08	2.27	2.06	2.40	2.40	2.69	3.40	3.65	3.61	3.82	3.79	4.44	2.448	4.362	4.517
J Craniofac Surg	0.54	0.62	0.69	0.73	0.94	0.83	0.74	0.65	0.72	0.81	0.77	0.82	0.69	0.686	0.678	0.7

Table 5: Impact factor per year of top 5 journals publishing in the field of tooth injuries in sport

Journal	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Dental Traumatol			1.60	0.92	0.83	0.72	0.74	1.09	1.27	1.32	1.27	1.20	1.00	1	1.601	1.327
Br J Sports Med	0.75	1.03	1.20	1.25	1.26	1.86	2.23	2.46	2.13	2.55	3.55	4.14	3.67	3.668	4.362	4.517
Dent Clin North Am																
Endod Dent Traumatol	0.51	0.64	1.31													
J Am Dent Assoc	0.85	0.94	1.16	1.07	1.09	0.94	1.16	1.70	1.85	1.73	2.20	1.77	1.82	1.822	2.01	1.767

Mean IF of the five journals in the first year investigated (2000) and the last (2015) were also used to calculate the increase in mean IF over the 15-year period within each domain [Tables 6-8].

Table 6: Sports injury prevention – Mean impact factor per year

Year	Mean IF
2000	1.25
2015	4.0698
Median increase	2.8198

Table 7: Facial injuries in sport – Mean impact factor per year

Year	Mean IF
2000	0.76
2015	2.9798
Median increase	2.2198

Table 8: Tooth injuries in sport – Mean impact factor per year

Year	Mean IF
2000	0.75
2015	2.537
Median increase	1.787

From observational analysis of this data, it is evident that there has been a steady increase in IF since 2000 in almost every journal. Again, a particularly strong, positive correlation is seen among journals publishing on the prevention of sports injuries (median IF increase of 2.8198). The British Journal of Sports Medicine achieved a 796.5% increase in IF between 2000 and 2015 and Sports Medicine Journal achieved a 201.5% increase in IF over this period. Missing data is due to lack of these values within the Thomson Reuters Journal Citation Reports Database. Pub Med ReMiner was unable to deal with the large volume of publications in the domain of “Sports Injuries.”

DISCUSSION

Olympic legacy

The Olympic games have a unique power to provide long-term benefit to local, national, and international sports as well economic benefit to the host city and nation.^[1] The games inspire athletes from grass root level all the way through to motivating top standard elite athletes to become the very best on an international stage. The “Olympic legacy” describes

the lasting effects the games have beyond the closing ceremony. The value in harnessing these benefits is recognized by the International Olympic Committee, but little research exists regarding the effect of the Olympic legacy on the publication of sports medicine research.

Bibliometrics

Bibliometrics has been used to great effect within many medical fields. It has the potential to identify key authors and institutions publishing on individual research topics as well as giving an overview of how health care within a chosen area has evolved over time.^[6-10]

Despite being shown to be highly effective in specialized fields of medicine, very few bibliometric studies have been carried out regarding the aspects of dentistry.^[11-13] Those that have been published show large shifts in treatment choices as well as increased government funding for research.^[13] Existing studies are in agreement that there is an urgent need for further research of higher quality into management and prevention of dental injuries.^[13,14]

Bibliometrics in sports medicine

Very little research has been undertaken regarding bibliometric analysis of publications and research relating to sports medicine. Level 1 research evidence within sports medicine is extremely rare, with case reports and cohort studies being the most common types of publication.^[14] While top level evidence is highly desirable, other research methods are also very helpful in advancing medical care, and therefore should not be discounted.^[15]

Literature reviews relating to the impact of oral health on sport show that there is very little research regarding oral health and dental care among elite athletes. While the literature is limited, the relatively poor oral hygiene of elite athletes is often reported.^[16,17]

There is emerging evidence that dental trauma has a negative effect on oral health-related quality of life.^[18-21] The psychosocial aspect of sport is often overlooked but it is clear how poor oral health and dental aesthetics could affect athletes.^[22] This is particularly important among elite athletes where the differences between top competitors are so marginal; these subtle aspects affecting training and performance are key to success.^[17,22]

The Olympic Charter states that the International Olympic Committee and the International Sport Federations have an obligation “to encourage and support measures for protecting the health of athletes.” This would support the need for further research into the oral health and prevention of orofacial injuries in sport.

This bibliometric study shows that research with regards to sports injuries is improving with time, with particular advances seen in the field of sports injury prevention. The generalized increase in the number of publications relating to all domains investigated, with the exception of dental injuries, suggests that the positive effect of sports medicine research on sporting performance is being increasingly recognized. However, the lack of a statistically significant correlation shown between the quantity of publications produced and the Olympic years suggests that the “Olympic legacy” does not stimulate an added increase in the quantity of publication in this field.

While evidence is weak regarding facial and dental injuries in sport when compared with sports injuries in general, this must be interpreted with caution. The relatively low total number of publications existing with regard to these specific injuries is likely to have reduced the likelihood of producing a statistically significant correlation. These results both highlight and support the need for further research into the impact of dental and facial injuries within sport upon the health and performance of athletes.

PubMed literature searches were also carried out regarding our chosen domains within the field of Paralympic/disability sport. These were excluded from the results due to extremely low number of publications. With the introduction of the “Invictus Games” and growing popularity of Paralympic sport, this is a rapidly developing area of sports medicine; however, at present, there is a paucity of publications within this domain.

Investigation into the IF of journals publishing in our chosen domains suggests that the overall quality of publication is also increasing with time. There was again a weaker correlation seen regarding dental and facial injuries in sport. PubMed ReMiner was unable to analyze the 22800 publications in the domain “Sports Injuries” and was therefore excluded. This meant that the IF of top journals publishing in this field could not be analyzed.

Publications analyzing the various metrics used in bibliometric studies show a huge variation in journal ranking according the metric used. Eigenfactor has been shown to be a better measure of quality or “prestige” of journals publishing on individual topics.^[23] However, this metric was only introduced in 2007, and therefore, data available is relatively limited at present.

CONCLUSIONS

Since 1996, there has been a steady increase in both the quantity and quality of publications relating to sports injuries. Although no statistical significance was found, graphical analysis suggests that there may be a positive correlation between Olympic years and the number of publications regarding the prevention of sports injuries and facial injuries in sport. This would support the idea of the “Olympic legacy” having a positive effect on research relating to sports medicine, and therefore a positive impact on sport itself. Further research is indicated into the effect of orofacial injuries in sport on the general health and performance of athletes, as well as the prevention and management of such injuries.

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Conflicts of interest

There are no conflicts of interest

REFERENCES

1. International Olympic Committee. (2013). Olympic legacy. Available: <http://www.olympic.org/content/footer-pages/documents/olympic-legacy/>. [Last accessed 30th April 2015].
2. Whittaker JL, Small C, Maffey L, Emery CA. Risk factors for groin injury in sport: An updated systematic review. *Br J Sports Med* 2014;48:803-9.
3. Oppliger RA, Bartok C. Hydration testing of athletes. *Sports Med* 2002;32:959-71.
4. Braakhuis AJ, Hopkins WG. Impact of Dietary Antioxidants on Sport Performance: A Review. *Sports Med* 2015;45:939-55.
5. Glynn RW, Chin JZ, Kerin MJ, Sweeney KJ. Representation of cancer in the medical literature - A bibliometric analysis. *PLoS One* 2010;5:e13902.
6. Glynn RW, Scutaru C, Kerin MJ, Sweeney KJ. Breast cancer research output, 1945-2008: A bibliometric and density-equalizing analysis. *Breast Cancer Res* 2010;12:R108.
7. Joyce CW, Sugrue CM, Joyce KM, Kelly JL, Regan PJ. 100 citation classics in the melanoma literature: A bibliometric analysis. *Dermatol Surg* 2014;40:1284-98.
8. O'Sullivan KE, Kelly JC, Hurley JP. The 100 most cited publications in cardiac surgery: A bibliometric analysis. *Ir J Med Sci* 2015;184:91-9.
9. Kavanagh RG, Kelly JC, Kelly PM, Moore DP. The 100 classic papers of pediatric orthopaedic surgery: A bibliometric analysis. *J Bone Joint Surg Am* 2013;95:e134.
10. Kelly JC, Glynn RW, O'Briain DE, Felle P, McCabe JP. The 100 classic papers of orthopaedic surgery: A bibliometric analysis. *J Bone Joint Surg Br* 2010;92:1338-43.

11. Primo NA, Gazzola VB, Primo BT, Tovo MF, Faraco IM Jr. Bibliometric analysis of scientific articles published in Brazilian and international orthodontic journals over a 10-year period. *Dental Press J Orthod* 2014;19:56-65.
12. Venkatakrishnan CJ. Bibliometric study of publication by Indian prosthodontists between 1996-2007: A medline approach. *J Indian Prosthodont Soc* 2013;13:536-40.
13. Geminiani A, Ercoli C, Feng C, Caton JG. Bibliometrics study on authorship trends in periodontal literature from 1995 to 2010. *J Periodontol* 2014;85:e136-43.
14. Feldens CA, Kramer PF, Feldens EG. Exploring the profile of articles on traumatic dental injuries in pediatric dental journals. *Dent Traumatol* 2013;29:172-7.
15. Lubowitz JH, Provencher MT, Poehling GG. Arthroscopic and sports medicine science: looking beyond the level of evidence (for now). *Arthroscopy* 2014;30:281-2.
16. Ashley P, Di Iorio A, Cole E, Tanday A, Needleman I. Oral health of elite athletes and association with performance: A systematic review. *Br J Sports Med* 2015;49:14-9.
17. Needleman I, Ashley P, Fine P, Haddad F, Loosemore M, de Medici A, *et al.* Oral health and elite sport performance. *Br J Sports Med* 2015;49:3-6.
18. Porritt JM, Rodd HD, Baker SR. Quality of life impacts following childhood dento-alveolar trauma. *Dent Traumatol* 2011;27:2-9.
19. Ramos-Jorge ML, Bosco VL, Peres MA, Nunes AC. The impact of treatment of dental trauma on the quality of life of adolescents: A case-control study in southern Brazil. *Dent Traumatol* 2007;23:114-9.
20. Aldrigui JM, Abanto J, Carvalho TS, Mendes FM, Wanderley MT, Bonecker M, *et al.* Impact of traumatic dental injuries and malocclusions on quality of life of young children. *Health Qual Life Outcomes* 2011;9:78.
21. Traebert J, de Lacerda JT, Foster Page LA, Thomson WM, Bortoluzzi MC. Impact of traumatic dental injuries on the quality of life of schoolchildren. *Dent Traumatol* 2012;28:423-8.
22. Gau LS. Trends and topics in sports research in the Social Science Citation Index from 1993 to 2008. *Percept Mot Skills* 2013;116:305-14.
23. Sillet A, Katsahian S, Rangé H, Czernichow S, Bouchard P. The Eigenfactor™ Score in highly specific medical fields: the dental model. *J Dent Res* 2012;91:329-33.