Top Cited Articles in Dental Trauma; A Bibliometric Study

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Abstract

Aim: Citation analysis describes the impact that different articles in various fields of science have made by counting the number of citations they have received. This study aimed to identify those published articles in medical and dental journals that have exerted the most influence in the field of dental traumatology, as signified by their citation count. **Methods:** The 100 top-cited articles on dental trauma were identified in August 2014 by using the ISI Web of Science Database and Google Scholar. Search terms used included dental trauma, trauma to tooth/teeth, traumatic dental injuries and dental injuries. The 100 top-cited articles starting from the year 1950 were selected and analyzed with regard to authors, institution, country of origin, publication name, publication year, number of citations, field of study, study design and publishing group. Data was analyzed using SPSS version 19.0. **Results:** The highest number of citations that an article related to dental traumatology received was 480 while the last article in the list had 67 citations. The journal which had the most number of cited articles was Dental Traumatology, with the highest number of top cited articles being published in 2001. The first author who contributed most to the top cited articles was JO Andreason, with seven articles in total. According to the country of origin of the first author, the top-cited list was led by Denmark, with the University Hospital [Rigshospitalet] of Demark producing the highest number of most cited publications in dental traumatology. Forty percent of the studies were based on epidemiology with 70% having an observational study design. Wiley Online Library was responsible for publishing the majority of the articles in the top cited list. **Conclusions:** According to our citation analysis, it was revealed that most of the researches in dental traumatology have been based on epidemiology with surveys being the most popular study design. More studies need to direct towards prevention of dental trauma, with experimental study designs. Dental Traumatology may be the best journal to study dental trauma, as this journal has the highest number of top cited articles related to dental traumatology.

Key Words: Bibliometrics, Citation analysis, Dental trauma research

Introduction

A citation is an abbreviated alphanumeric expression embedded in the body of an intellectual work that denotes an entry in the bibliographic references section of the work for the purpose of acknowledging the relevance of the works of others to the topic of discussion at the spot where the citation appears [1]. This definition from Google Scholar indicates that a citation can be a reference to any item, be it an article, book, dissertation, newspaper editorial or similar material. It not only provides adequate information at the end of the scholarly work, to locate the item from where the information has been borrowed but also helps to acknowledge the author of that information. In fact, plagiarism issues arise when the author uses a specific source in his body of work but fail to indicate what has been borrowed or do not mention the original author of the referenced material. To cite a particular work serves several important purposes including safeguarding intellectual honesty and integrity as well as giving credit to the original author for his authentic thinking and idea [2]. It provides the readers certain autonomy because they can decide, after reading through the references, whether the referenced material supports or refutes the author's argument in the way it has been claimed. The validity and strength of the material that has been included in the reference section can also be gauged by the readers independently [3].

Bibliometrics is statistical analysis of written publications, such as books or scientific articles. Bibliometric methods are commonly used in the field of library and information sciences. The purpose of bibliometrics is to get a quantitative analysis of the academic literature. Citation analysis is one of the approaches used in bibliometric methods. The other approach in bibliometrics is known as Content analysis.

Citation analysis focuses on the attributes of the paper such as number of times it's cited, its affiliation of its author, study designs etc. while content analysis deeply explores the contents of the paper, its results and conclusions [4]. Citation analysis looks at the frequency, patterns and graphs of citations received by different articles and books [5]. It helps to recognize and identify the trends of research and development in a particular field of science and to determine the gradual progression and accumulation of literature in this regard. The results of the analysis of the most frequently cited articles are also the determining aspect of journals' impact factor, which are figures of merit frequently looked upon by researchers when they are submitting their original research to a particular journal. In fact Journal Citation Report (JCR) ranks journals on citation data [6]. Although a high rank according to citations alone cannot be held as the ultimate criteria for the relevance and quality of the article, it does however indicate the impact that article has in that particular field of science. Nevertheless, citation analysis of literature and articles in various specialties is a well-accepted means of scientific recognition [7].

Various tools have been devised and suggested as a means of counting citations. Several resources can be utilized in this regard, in order to fully capture an article's or an author's impact in terms of the citations received. Each of these resources produces slightly variable results revealing the need for using more than one data base to count citations. Eugene Garfield founded the Institute for Scientific Information (ISI), which since 1945, has been the largest database for bibliographic information of more than 10,000 international journals through the Science Citation Index Expanded (SCI). Started in 1962, this index has been the tool used in different citation analysis studies done in order to capture the impacts

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of different articles and authors and to compile information regarding contributions of institutions and countries, and to link researchers through their scholarly work [8,9]. Other sources include Scopus and Google Scholar. Google Scholar is a freely accessible web search engine that allows the use of full text articles and scholarly literature, while indicating the number of citations received by them.

To our knowledge, no citation analysis has been done specifically for articles on dental traumatology, which is an important aspect of clinical dentistry. Therefore, the aim of this article was to identify those published articles, both from dental and medical journals, which have exerted the most influence in the field of dental traumatology, as suggested by the number of citations they have received. These top-cited articles were not only analyzed for their citation counts, but various characteristics including, but not limited to, the authors, year of publication and institute at which the research work was conducted.

Methods

We identified the 100 top cited articles published in dental and medical journals, from 1950 till August 2014, by using the Web of Science data base (through the Science Citation Index Expanded) and Google Scholar. The search terms that were used included 'dental trauma', 'trauma to tooth/teeth', 'traumatic dental injuries', 'dental injuries' and a combination of these terms. For the Web of Science, the results were sorted by using the 'Times Cited' option to get the list of articles in descending order in terms of number of citations they had received. For Google Scholar, a manual search was performed to identify the articles for the highest number of citations.

The selected articles were then grouped by the title of the articles, number of citations they had received, the journal in which they were published, year of publication, the name of first authors and their country of origin, the number of authors that had contributed to each article, the institute were the study had been conducted, the topic of dental trauma that the article covered, the study design followed and the publisher responsible for publishing the journal from which the articles were selected. The topic or field of study related to dental trauma into which the articles were categorized, was classified as etiology, epidemiology, complications and treatment, as well as different forms of dental trauma like avulsions, luxations, fractures or those dealing with non-specific or generalized forms of dental trauma. Sports related trauma and trauma to primary teeth were also included in the classification. With regards to study design, the articles were divided into basic science articles (dealing with histology or basics of dental traumatology), guidelines, reviews, observational studies and surveys, experimental studies and letters to the editor. The first authors of all the selected articles were identified, as well as their country of origin by the address that had been provided by them. The number of the remaining contributing authors for each article was also noted. Statistical analysis of the collected data was done using SPSS version 19.0. The data analysis was confined to simple descriptive measures such as frequency distribution, mean, mode and median of the top cited articles.

Results

The top 100 articles in dental trauma are listed in descending order according to the number of citations they had received *(Table 1)*. The article on the top of the list had received 480 citations while the last articles on the list had 58 citations. The

Table 1. *Top-cited articles in dental traumatology with number of citations.*

Rank	Article	No. of Citation
1	Andreasen JO. Etiology and pathogenesis of traumatic dental injuries A clinical study of 1,298 cases. European Journal of Oral Sciences. 1970;78(1-4):329-42.	480
2	Andreasen JQ, Ravn JJ. Epidemiology of traumatic dental injuries to primary and permanent teeth in a Danish population sample. International Journal of Oral surgery. 1972;1(5):235-9.	426
3	Trabert KC, Caputo AA, Abou-Rass M. Tooth fracture-A comparison of endodontic and restorative treatments. Journal of Endodontics. 1978;4(11):341-5.	301
4	Flores MT, Andersson L, Andreasen JO, Bakland LK, Malmgren B, Barnett F et al. Guidelines for the management of traumatic dental injuries. II. Avulsion of permanent teeth. Dental Traumatology. 2007;23(3):130-6.	284
5	Bastone EB, Freer TJ, McNamara JR. Epidemiology of dental trauma: a review of the literature. Australian Dental Journal. 2000;45(1):2-9.	242
6	Andreasen JO. Luxation of permanent teeth due to trauma A clinical and radiographic followup study of 189 injured teeth. European Journal of Oral Sciences. 1970;78(1-4):273-86.	213
7	Flores MT, Andersson L, Andreasen JO, Bakland LK, Malmgren B, Barnett F, et al. Guidelines for the management of traumatic dental injuries. I. Fractures and luxations of permanent teeth. Dental Traumatology. 2007;23(2):66-71.	208
8	Malmgren O, Goldson L, Hill C, Orwin A, Petrini L, Lundberg M. Root resorption after orthodontic treatment of traumatized teeth. American Journal of Orthodontics. 1982;82(6):487-91.	207
9	Trope M. Clinical management of the avulsed tooth: present strategies and future directions. Dental Traumatology. 2002;18(1):1-11.	201
10	Ilma de Souza Cortes M, Marcenes W, Sheiham A. Impact of traumatic injuries to the permanent teeth on the oral health related quality of life in 12, 14 years old children. Community Dentistry and Oral Epidemiology. 2002;30(3):193-8.	200
11	Marcenes W, Beiruti NA, Tayfour D, Issa S. Epidemiology of traumatic injuries to the permanent incisors of 9 12 years old school children in Damascus, Syria. Dental Traumatology. 1999;15(3):117-23.	200
12	Hamilton FA, Hill FJ, Holloway PJ. An investigation of dento-alveolar trauma and its treatment in an adolescent population. Part 1: the prevalence and incidence of injuries and the extent and adequacy of treatment received. British Dental Journal. 1997;182(3):91-5.	190

13	Andreasen FM, Noran JrG, Andreasen JO, Engelhartsen S, Linh-Stramberg U. Long-term survival of fragment bonding in the treatment of fractured crowns: A multicenter clinical study. Quintessence International. 1995;26(10).	171
14	Flores, M. T. Traumatic injuries in the primary dentition. Dental Traumatology. 2002; 18: 287–98.	164
15	Boorum MK, Andreasen JO. Sequelae of trauma to primary maxillary incisors. I. Complications in the primary dentition. Dental Traumatology. 1998;14(1):31-44.	163
16	Andreasen JO, Andreasen FM, Skeie A, Hjorting□Hansen E, Schwartz O. Effect of treatment delay upon pulp and periodontal healing of traumatic dental injuries-a review article. Dental Traumatology. 2002;18(3):116-28.	162
17	Ravn JJ. Dental injuries in Copenhagen schoolchildren, school years 1967 to1972. Community Dentistry and Oral Epidemiology. 1974;2(5):231-45.	162
18	Flores MT, Andreasen JO, Bakland LK, Feiglin B, Gutmann JL, Oikarinen K, et al. International Association of Dental Traumatology. Guidelines for the evaluation and management of traumatic dental injuries. Dent Traumatol. 2001;17(5):193-8.	160
19	Olsburgh S, Jacoby T, Krejci I. Crown fractures in the permanent dentition: pulpal and restorative considerations. Dental Traumatology. 2002;18(3):103-15.	160
20	Marcenes W, Alessi ON, Traebert J. Causes and prevalence of traumatic injuries to the permanent incisors of school children aged 12 years in Jaragua do Sul, Brazil. International Dental Journal. 2000;50(2):87-92.	158
21	Cortes MIS, Marcenes W, Sheiham A. Prevalence and correlates of traumatic injuries to the permanent teeth of school children aged 9 to14 years in Belo Horizonte, Brazil. Dental Traumatology. 2001;17(1):22-6.	156
22	Glendor U. Epidemiology of traumatic dental injuries-a 12 year review of the literature. Dental Traumatology. 2008;24(6):603-11	152
23	Gassner R, Bosch R, Tuli T, Emshoff Rd. Prevalence of dental trauma in 6000 patients with facial injuries: implications for prevention. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 1999;87(1):27-33.	149
24	Kramer PF, Zembruski C, Ferreira SH, Feldens CA. Traumatic dental injuries in Brazilian preschool children. Dental Traumatology. 2003;19(6):299-303.	139
25	Nguyen QV, Bezemer PD, Habets L, Prahl-Andersen B. A systematic review of the relationship between overjet size and traumatic dental injuries. The European Journal of Orthodontics. 1999;21(5):503-15.	138
26	Newsome PRH, Tran DC, Cooke MS. The role of the mouthguard in the prevention of sports related dental injuries: a review. International Journal of Paediatric Dentistry. 2001;11(6):396-404.	136
27	Zerman N, Cavalleri G. Traumatic injuries to permanent incisors. Dental Traumatology. 1993;9(2):61-4.	132
28	Onetto JE, Flores MT, Garbarino ML. Dental trauma in children and adolescents in Valparaiso, Chile. Dental Traumatology. 1994;10(5):223-7.	132
29	de Franca Caldas A, Burgos MEA. A retrospective study of traumatic dental injuries in a Brazilian dental trauma clinic. Dental Traumatology. 2001;17(6):250-3.	128
30	Traebert J, Peres MA, Blank V, Boell RdS, Pietruza JA. Prevalence of traumatic dental injury and associated factors among 12â€ yearâ€ old school children in Florianapolis, Brazil. Dental Traumatology. 2003;19(1):15-8.	126
31	Flores MT, Malmgren B, Andersson L, Andreasen JO, Bakland LK, Barnett F, et al. Guidelines for the management of traumatic dental injuries. III. Primary teeth. Dental Traumatology. 2007;23(4):196-202.	125
32	Chan AWK, Wong TKS, Cheung GSP. Lay knowledge of physical education teachers about the emergency management of dental trauma in Hong Kong. Dental Traumatology. 2001;17(2):77-85.	125
33	Borssen E, Holm AK. Traumatic dental injuries in a cohort of 16-year olds in northern Sweden. Dental Traumatology. 1997;13(6):276-80.	124
34	Kaste LM, Gift HC, Bhat M, Swango PA. Prevalence of incisor trauma in persons 6-50 years of age: United States, 1988-1991. Journal of Dental Research. 1996;75:696-705.	124
35	Reis A, Loguercio AD, Kraul A, Matson E. Reattachment of fractured teeth: a review of literature regarding techniques and materials. Operative Dentistry. 2003;29(2):226-33.	123
36	Andreasen FM, Zhjie Y, Thomsen BL, Andersen PK. Occurrence of pulp canal obliteration after luxation injuries in the permanent dentition. Dental Traumatology. 1987;3(3):103-15.	122
37	Marcenes W, Murray S. Social deprivation and traumatic dental injuries among 14 year old schoolchildren in Newham, London. Dental Traumatology. 2001;17(1):17-21.	122
38	Forsberg CM, Tedestam G. Traumatic injuries to teeth in Swedish children living in an urban area. Swedish Dental Journal. 1989;14(3):115-22.	114
39	Diab M, Eibadrawy HE. Intrusion injuries of primary incisors. Part III: Effects on the permanent successors. Quintessence International. 2000;31(6)	113
40	Flores MT, Andreasen JO, Bakland LK. Guidelines for the evaluation and Management of traumatic dental injuries Editors Note. Dental Traumatology. 2001;17(5):193-6.	113
41	Cohenca N, Simon JH, Roges R, Morag Y, Malfaz JM. Clinical indications for digital imaging in dentoalveolar trauma. Part 1: traumatic injuries. Dental Traumatology. 2007;23(2):95-104	113
42	Forsberg CM, Tedestam G. Etiological and predisposing factors related to traumatic injuries to permanent teeth. Swedish Dental Journal. 1992;17(5):183-90	112
43	Cunha RF, Pugliesi DMC, De Mello Vieira AE. Oral trauma in Brazilian patients aged 0-3 years. Dental Traumatology. 2001;17(5):206-8	110
44	De Carvalho Rocha MJ, Cardoso M. Traumatized permanent teeth in Brazilian children assisted at the Federal University of Santa Catarina, Brazil. Dental Traumatology. 2001;17(6):245-9.	110

45	Arx T. Developmental disturbances of permanent teeth following trauma to the primary dentition. Australian Dental Journal. 1993;38(1):1-10.	109
46	Andreasen JO, Andreasen FM, Mejare I, Cvek M. Healing of 400 intra-alveolar root fractures. 1. Effect of pre-injury and injury factors such as sex, age, stage of root development, fracture type, location of fracture and severity of dislocation. Dental Traumatology. 2004;20(4):192-202..	107
47	Nicolau B, Marcenes W, Sheiham A. Prevalence, causes and correlates of traumatic dental injuries among 13 year olds in Brazil. Dental Traumatology. 2001;17(5):209-13.	103
48	McNutt T, Shannon SW, Wright JT, Feinstein RA. Oral trauma in adolescent athletes: a study of mouth protectors. Pediatr Dentistry. 1989;11(3):209-13.	103
49	Rajab LD. Traumatic dental injuries in children presenting for treatment at the Department of Pediatric Dentistry, Faculty of Dentistry, University of Jordan, 1997-2000. Dental Traumatology. 2003;19(1):6-11.	103
50	Jacobsen I, Kerekes K. Long-term prognosis of traumatized permanent anterior teeth showing calcifying processes in the pulp cavity. European Journal of Oral Sciences. 1977; 85: 588–598	101
51	Carvalho JC, Vinker F, Declerck D. Malocclusion, dental injuries and dental anomalies in the primary dentition of Belgian children. International Journal of Pediatric Dentistry. 1998;8(2):137-41.	101
52	Cohenca N, Simon JH, Mathur A, Malfaz JM. Clinical indications for digital imaging in dentoalveolar trauma. Part 2: root resorption. Dental Traumatology. 2007;23[2):105-13	100
53	Altay N, Gungor HC. A retrospective study of dento-alveolar injuries of children in Ankara, Turkey. Dental Traumatology. 2001;17(5):197-200.	100
54	Şaroğlu, I. and Sönmez, H. The prevalence of traumatic injuries treated in the pedodontic clinic of Ankara University, Turkey, during 18 months. Dental Traumatology. 2002; 18: 299–303	99
55	Tapias MA, Jimenez-Garcia R, Lamas F, Gil AA. Prevalence of traumatic crown fractures to permanent incisors in a childhood population: Mostoles, Spain. Dental Traumatology. 2003;19(3):119-22.	99
56	Lockhart PB, Feldbau EV, Gabel RA, Connolly SF, Silversin JB. Dental complications during and after tracheal intubation. The Journal of the American Dental Association. 1986;112(4):480-	98
57	Andreasen JO, Andreasen FM. (Dental trauma: quo vadis). Tandlaegebladet. 1989;93(11):381-4.	97
58	Skaare AB, Jacobsen I. Dental injuries in Norwegians aged 7-18 years. Dental Traumatology. 2003;19(2):67-71.	97
59	Trope M. Root resorption due to dental trauma. Endodontic Topics. 2002;1(1):79-100	96
60	Bijella MF, Yared FN, Bijella VT, Lopes ES. Occurrence of primary incisor traumatism in Brazilian children: a house-by-house survey. ASDC J Dent Child. 1990;57(6) 424-427	93
61	Sae-Lim V, Lim LP. Dental trauma management awareness of Singapore pre-school teachers. Dental Traumatology. 2001;17(2):71-6.	93
62	Levin L, Friedlander LD, Geiger SB. Dental and oral trauma and mouthguard use during sport activities in Israel. Dental Traumatology. 2003;19(5):237-42.	91
63	Marcenes W, Zabot NE, Traebert J. Socioeconomic correlates of traumatic injuries to the permanent incisors in schoolchildren aged 12 years in Blumenau, Brazil. Dental Traumatology. 2001;17(5):218-22	90
64	Kargul B, Caglar E, Tanboga I. Dental trauma in Turkish children, Istanbul. Dental Traumatology. 2003;19(2):72-5.	90
65	Soriano EP, Caldas AdF, Carvalho MVDD, Amorim Filho HDA. Prevalence and risk factors related to traumatic dental injuries in Brazilian schoolchildren. Dental Traumatology. 2007;23(4):232-40.	89
66	Ferrari CH, De Medeiros JoMF. Dental trauma and level of information: mouthguard use in different contact sports. Dental Traumatology. 2002;18(3):144-7.	87
67	Macdonald JB, Hare GC, Wood AWS. The bacteriologic status of the pulp chambers in intact teeth found to be nonvital following trauma. Oral surgery, Oral medicine, Oral pathology. 1957;10(3):318-22	87
68	Gutmann JL, Gutmann MS. Cause, incidence, and prevention of trauma to teeth. Dental Clinics of North America. 1995;39(1) 1-13	86
69	Rosario ME, Alfaro VM, Garcia-Godoy F. Traumatic injuries to primary teeth in Mexico City children. Dental Traumatology. 1992;8(5):213-4.	84
70	Cardoso M, De Carvalho Rocha MJ. Traumatized primary teeth in children assisted at the Federal University of Santa Catarina, Brazil. Dental Traumatology. 2002;18(3):129-33.	84
71	Trope M. Root resorption of dental and traumatic origin: classification based on etiology. Practical Periodontics and Aesthetic Dentistry: PPAD. 1998;10(4):515-22.	84
72	Schatz JP, Joho JP. A retrospective study of dentoalveolar injuries. Dental Traumatology. 1994;10(1):11-4	84
73	Oliveira LB, Marcenes W, Ardenghi TM, Sheiham A, Bonecker M. Traumatic dental injuries and associated factors among Brazilian preschool children. Dental Traumatology. 2007;23(2):76-81.	84
74	Garcia-Godoy F, Garcia-Godoy FM. Primary teeth traumatic injuries at a private pediatric dental center. Dental Traumatology. 1987;3(3):126-9	83
75	Rappelli G, Massaccesi C, Putignano A. Clinical procedures for the immediate reattachment of a tooth fragment. Dental Traumatology. 2002;18(5):281-4.	83
76	Stockwell AJ. Incidence of dental trauma in the western Australian school dental service. Community Dentistry and Oral Epidemiology. 1988;16(5):294-8.	83
77	Skaare AB, Jacobsen I. Primary tooth injuries in Norwegian children (1-8 years). Dental Traumatology. 2005;21(6):315-9	82
78	Burden DJ. An investigation of the association between overjet size, lip coverage, and traumatic injury to maxillary incisors. The European Journal of Orthodontics. 1995;17(6):513-7.	81

79	Caliskan MK TM. Clinical investigation of traumatic injuries of permanent incisors in Izmir, Turkey. Endodontics and Dental Traumatology. 1995 1995;11(5):4	80
80	O'Neil DW, Clark MV, Lowe JW, Harrington MS. Oral trauma in children: a hospital survey. Oral surgery, Oral medicine, Oral pathology. 1989;68(6):691-6.	80
81	Andreasen JO, Bakland LK, Matras RC, Andreasen FM. Traumatic intrusion of permanent teeth. Part 1. An epidemiological study of 216 intruded permanent teeth. Dental Traumatology. 2006;22(2):83-9.	79
82	Davis GT, Knott SC. Dental trauma in Australia. Australian Dental Journal. 1984;29(4):217-21.	79
83	Traebert, J., Bittencourt, D. D., Peres, K. G., Peres, M. A., De Lacerda, J. T. and Marcenes, W. Aetiology and rates of treatment of traumatic dental injuries among 12-year-old school children in a town in southern Brazil. Dental Traumatology. 2006; 22: 173–178	79
84	Jarvinen S. Incisal overjet and traumatic injuries to upper permanent incisors: A retrospective study. Acta Odontologica. 1978;36(5-6):359-62.	79
85	Sane J, Ylipaavalniemi P. Dental trauma in contact team sports. Dental Traumatology. 1988;4(4):164-9.	78
86	Wilson CF. Management of trauma to primary and developing teeth. Dental Clinics of North America. 1995;39(1]:133-67	77
87	Andreasen JO. Challenges in clinical dental traumatology. Dental Traumatology. 1985;1(2):45-55.	77
88	Wilson S, Smith GA, Preisch J, Casamassimo PS. Epidemiology of dental trauma treated in an urban pediatric emergency department. Pediatric Emergency Care. 1997;13(1):12-5.	77
89	Perez R, Berkowitz R, McLlveen L, Forrester D. Dental trauma in children: a survey. Dental Traumatology. 1991;7(5):212-3.	77
90	Hunter ML, Hunter B, Kingdon A, Addy M, Dummer PMH, Shaw WC. Traumatic injury to maxillary incisor teeth in a group of South Wales school children. Dental Traumatology. 1990;6(6):260-4	76
91	Al-Jundi SH. Dental emergencies presenting to a dental teaching hospital due to complications from traumatic dental injuries. Dental Traumatology. 2002;18(4):181-5.	75
92	Cavalleri G, Zerman N. Traumatic crown fractures in permanent incisors with immature roots: a follow-up study. Dental Traumatology. 1995;11(6):294-6.	74
93	Zuhal Kro, Semra OEM, Huseyin Kl. Traumatic injuries of the permanent incisors in children in southern Turkey: a retrospective study. Dental Traumatology. 2005;21(1):20-5.	74
94	Petti S, Cairella G, Tarsitani G. Childhood obesity: a risk factor for traumatic injuries to anterior teeth. Dental Traumatology. 1997;13(6):285-8	73
95	Ranalli DN. Sports dentistry and dental traumatology. Dental Traumatology. 2002;18(5):231-6.	72
96	Gábris, K., Tarján, I. and Rózsa, N. (2001), Dental trauma in children presenting for treatment at the Department of Dentistry for Children and Orthodontics, Budapest, 1985–1999. Dental Traumatology. 2001; 17: 103–108.	72
97	Hargreaves JA, Cleaton-Jones PE, Roberts GJ, Williams S, Matejka JM. Trauma to primary teeth of South African pre-school children. Dental Traumatology. 1999;15(2):73-6.	70
98	Al-Jundi SH, Al-Waeili H, Khairalah K. Knowledge and attitude of Jordanian school health teachers with regards to emergency management of dental trauma. Dental Traumatology. 2005;21(4):183-7.	70
99	Bauss O, Rohling J, Schwestkaâ€ Polly R. Prevalence of traumatic injuries to the permanent incisors in candidates for orthodontic treatment. Dental Traumatology. 2004;20(2):61-6	66
100	Von Arx, T, Filippi A, Buser D. Splinting of traumatized teeth with a new device: TTS (Titanium Trauma Splint). Dental Traumatology. 2001; 17: 180–184	66

mean, median and mode of these most cited articles were 121, 100 and 84 respectively. There were 52 papers identified in our top-cited list that can be considered as citation classics i.e. receiving at least 100 citations.

Journals which published the top-cited articles

A total of 26 journals were identified rom where the top-cited articles had been selected. Out of these, the top ten journals are depicted in *Table 2*. Dental Traumatology was at the top of the list, having published 64 articles out of 100.

Date of publication

In our search from older publications, we found the top-cited having been published in 1970. From 1970 till August 2014, it was found that the highest number of top cited articles were published in year 2001 (n=15), followed by 2002 (n=12), 2003 (n=8) and 2007 (n=7). A total of 22 top-cited articles had been published between 1957 and 1990, 28 articles between 1991 and 2000, and 50 articles after year 2000 *(Graph 1)*.

Authors

A total of 76 first uthors were identified, w o had contributed to our top-cited list. The top three authors are given in *Graph 2*. The top three authors in terms of number of publication as first author were Andreasen JO [n=7], Flores MT [n=6] and Marcenes W [n=4]. A deeper analysis of these top three authors revealed that they had also contributed as second, third and fourth authors in other publications. Andreason JO having four articles as second authors, and two articles each as third and fourth author. Flores contributed to one article as second author while Marcenes had four articles in which he was the second author *(Graph 3)*.

In terms of the number of authors of each of the top-cited articles, it was found that 18 studies were monographs with only a single author, 30 articles had two researchers contributing to it and 25 publications had three authors *(Graph 4)*.

Countries of origin

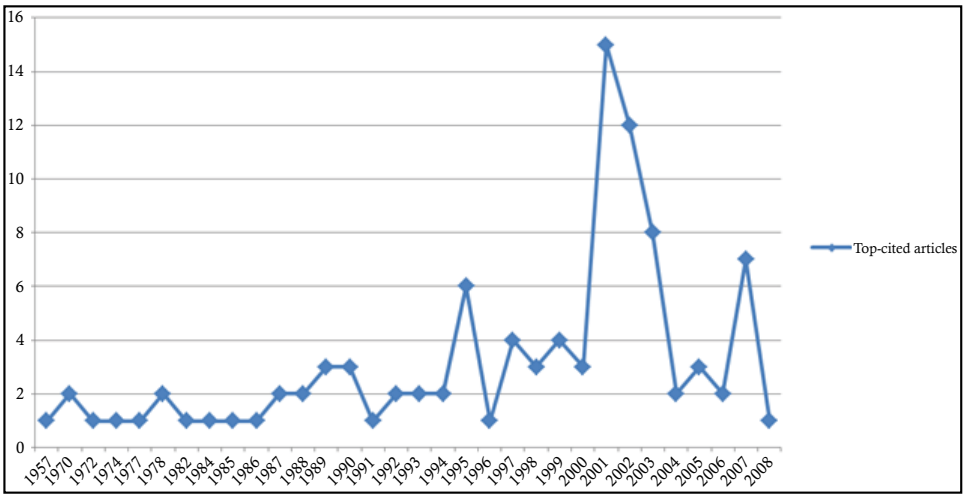
There were twenty five countries which contributed dental trauma data in our top-cited article list, with Denmark in the lead with 14 articles, followed by USA (n=14) and Brazil (n=13). The top ten countries are shown in the *Table 3*.

Institutions

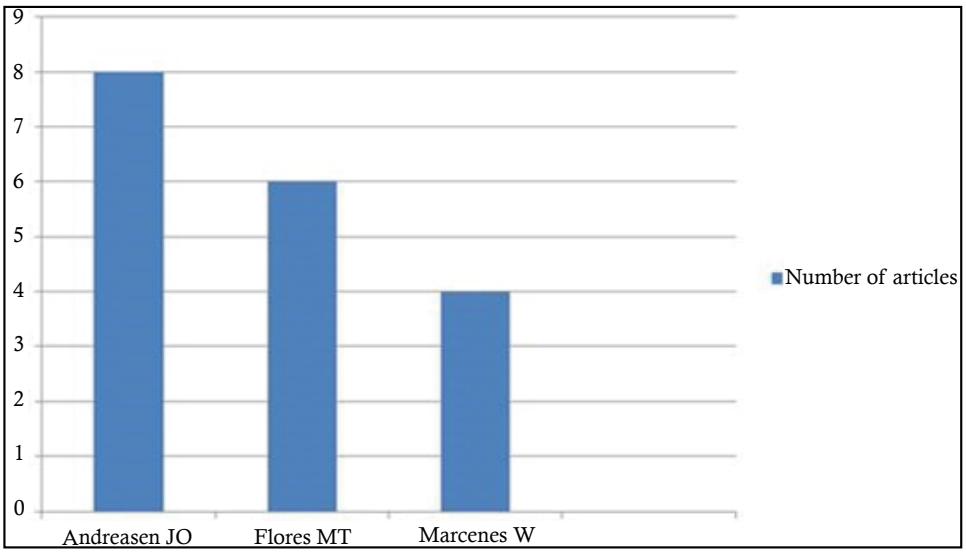
A total of 70 institutions were recognized to have contributed to the top-cited list with one private practice. The University

Table 2. *Top ten journals according to the number of published top-cited articles.*

Name of Journal	Number of times top articles cited
Dental Traumatology	64
Australian Dental Journal	03
Community Dentistry and Oral Epidemiology	03
European Journal of Oral Sciences	03
Dental Clinics of North America	02
Oral Surgery, Oral Medicine, Oral Pathology	02
Quintessence International	02
Swedish Dental Journal	02
The European Journal of Orthodontics	02
Acta Odontologica	01



Graph 1. *Top-cited articles according to date of publication.*



Graph 2. *First authors having most articles in the top-cited list.*

Hospital (Rigshospitalet) was found to be the lead institution contributing eight articles, followed by the University of Valparaiso (n=5). The top 20 institutions are shown in the *Table 4*. The rest of the institutions had contributed to one paper each.

Field of study and study designs of the top-cited articles

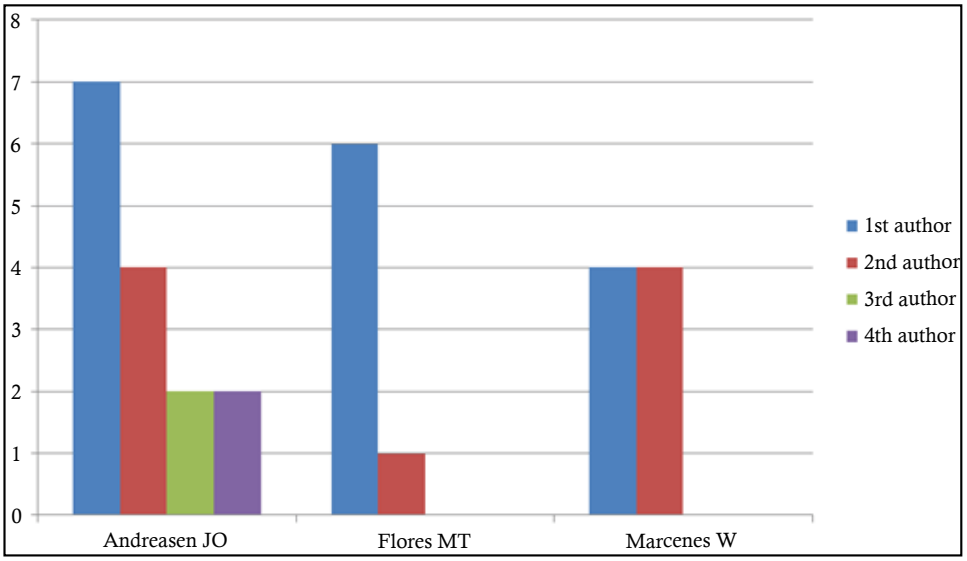
The highest number of the top-cited articles were based on epidemiology (n=40], followed by generalized dental trauma (n=15) and complications (n=12). The rest of the distribution of articles categorized according to the topic of study is depicted in the *Graph 5*. In terms of study designs, most of studies were observational along with 28 surveys *(Table 5)*.

Publisher

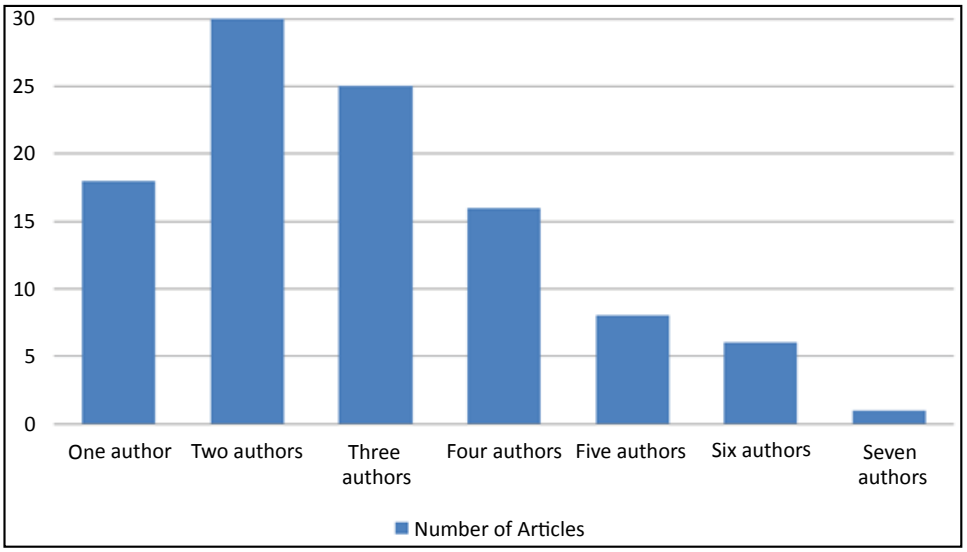
The bulk of publishing was identified to be done by the Wiley Online Library, which was responsible for publishing 76 articles out of the top 100 articles, followed by Europepmc.org and Elsevier *(Table 6)*.

Discussion

This study was under-taken in order to identify and determine those published articles in both dental and medical journals that have exerted the most influence in the field of dental trauma, as suggested by the number of citations they have received. There have been multiple studies published in literature that



Graph 3. *Collaboration of the authors of the top-cited article.*



Graph 4. *Number of authors contributing to the top-cited list.*

Table 3. *Top ten countries of the first authors of the top-cited articles.*

Country	Number of top cited papers contribued
Denmark	15
USA	14
Brazil	13
UK	11
Sweden	6
Chile	5
Turkey	5
Italy	4
Switzerland	4
Canada	3

Table 4. *Top institutions contributing to the top cited list.*

Name of Institution	Number of Citations
University Hospital (Rigshospitalet)	8
University of Valparaiso	5
Federal University of Santa Catarina	3
IADT	3
University of Oslo	3
University of São Paulo	3
Baylor College of Dentistry	2
Göteborg University	2
Jordan University of Science and Technology	2
Karolinska Institute	2
The University of Hong Kong	2
University of Alberta	2
University of Geneva	2
University of Kuopio	2
University of North Carolina	2
University of Pernambuco	2
University of Verona	2
University of Washington	2

have recognized the most cited articles in various fields of science like ophthalmology [10], general medicine [11], traumatology [12], gynecology [13], anesthesiology [14], urology [15], surgery [16], and plastic surgery [17] among many others, but very limited studies in different specialties of dentistry are present. A study determining the para-textural variables of citation classics in periodontology has been done by Neiri et al. [18]. One study by Fardi *et al.* identifies the top cited articles in endodontics [19] and another study looks at the top cited articles in dentistry [20].

Compared to the top-cited articles in endodontics, where the highest cited articles have been cited 554 times, the citation number for dental traumatology articles is lesser. This can be the result of the fact that the subject of

Table 5. *Study designs of the top-cited articles.*

Study Design	Number of Articles
Observational	42
CS survey	28
Review	13
Basic science	7
Experimental	5
Guidelines	4
Letter to the editor	1

Table 6. *Publishers of the top-cited articles.*

Publishing groups	Number of articles
Wiley Online Library	77
Elsevier	8
europepmc.org	8
Eur Orthodontic Soc	2
informahealthcare.com	2
search.ebscohost.com	2
Wiley	2
aapd.org	1
collegeofdiplomates.org	1
jada.info	1
journals.lww.com	1
nature.com	1

dental trauma is sheltered under various other domains of dentistry like endodontics, oral surgery, periodontology or even orthodontics, instead of being a separate entity. This distribution of literature can result in a lower number of citations received by the literature published exclusively in journals pertaining to dental trauma. The citation analysis of articles in endodontics also had a greater number of citation classics i.e. Sixty three (63) articles as compared to our results. Another importance difference is the year with the most cited publications, which for endodontics is 1995 and for dental traumatology in 2001. This fact demonstrates that although relevant literature regarding dental trauma had started getting published early on, a greater body of significant research in terms of number of citations these articles received, came much later, perhaps with the recognition from the scientific community regarding the importance and influence of dental trauma, its management and treatment. Most of the top cited literature in dental trauma has been published after 2000, reiterating this fact.

Denmark was identified as the country where most of the top-cited research in dental trauma originated, with the University Hospital (Rigshospitalet) as the institute which primarily acted as the research center. This was seconded by the USA, where the credit for the top-cited literature was divided among 12 different institutions.

We found that Andreason JO with the highest number of publications as the first author. Also, for four out of five articles in which Flores MT was the first author, Andreason has contributed as second, third or fourth author. So our citation analysis revealed an interesting fact regarding these top two authors collaborating closely in terms of contributing to scientific literature in dental trauma

Citation classics are those articles that have been cited more than 100 times [21] and are said to have a strong impact in research in that particular field. These articles are important because such a high number of citations imply the significant bearing on the progress, research and debate in that particular field of science [22]

Articles on epidemiology seem to be the mainstay in scientific literature on dental trauma, with observational studies making the bulk of the top-cited research. It was noted that researchers seemed particularly interested in identifying the incidence and prevalence of dental trauma in various parts of the world, as well as conducting cross-sectional surveys, both to assess the knowledge of lay people, medical and dental professionals regarding dental trauma, and to identify the different types of dental trauma cases coming to hospital settings and determining related variables. The total number of experimental studies done in dental traumatology was very few, which is in contrast to other fields in medicine. There were no clinical trials identifie , which gives an indication of the dearth in research in this particular scope in dental trauma. Also, we recognized only three articles which dealt with prevention, which is a major aspect in terms of traumatic injuries to teeth [23,24]. Hence, this citation analysis also revealed and highlighted those areas in the field of dental traumatology, where research and exploration can be made in the future.

Some limitations in performing citation analysis for a subject like dental traumatology are the paucity of journals that are dedicated to this particular field of dentistry. Dental Traumatology has the highest collection of top-cited articles, but a lot of significant literature having impact in the field of dental trauma may be scattered in various dental journals that cover other specialties like endodontic, periodontology and restorative dentistry. Therefore, it was decided to conduct the search using key terms instead of exploring specific dental journals.

The limitations of citations analysis in general are that the number of citations that articles receive is not an exact measure of the quality of the study or their level of evidence. Just looking at the number of citations that an article has received will not identify the sound methodology of the study described. There are various reasons that the number of citations for particular articles may be inflated and certain biases may be at play. Classic articles, having been published early on, may automatically receive a greater number of citations instead of articles published later. The longer the article has been published, the greater the chance that it will be cited again and again. There could also be a spontaneous impulse by authors to cite articles that have been cited many times before, in order to lend weight to their argument. This leads to new research findings being ignored for a longer time, and their impact in terms of citations received can only be seen much later. In fact, the actual impact of an article may take greater than two decades to become evident [14]. Perhaps a detailed scrutiny for each of the top cited articles in terms of quality of evidence may make the results of citation analysis more meaningful.

Some other biases that may affect the results of citation analysis can include self-citations [25,26] as well as editorial policies of some journals which demand the submitting authors to cite articles published in their journals, to inflate their impact factors. Authors may also intentionally cite

articles from journals they want to publish, in hope that it would increase the likelihood of their work being published [27]. Authors collaborating in similar areas of research may similarly preferentially cite each other's work. Also, if only the citation counts for articles are analyzed, then high impact research from book chapters and other types of publication as well as articles in languages other than English may be missing [27]. Articles published in journals that already have a high impact factor may also receive higher number of citations over time as compared to articles published in lower impact factor journals, which helps develop a 'snow-ball' effect of the number of citations received by such articles [28]. Some articles may simply be excluded because they were published too far back and hence have no electronic record [29]. Another important issue may be the availability of the articles on-line. Limited access articles that could be included in the study may be excluded and the citation results could become distorted. This is particularly the case when one uses only the ISI Web of Science to determine the number of citations. The ISI Web of Science is also not easily accessible and has a high subscription fee. In contrast, Google Scholar is freely available, and allows access to even those articles that have been published in journals not covered by the ISI Web of Science. The drawbacks of using Google Scholar is that it does not perform well for older publications and can also include some non-scholarly articles. It also is not updated as often as the ISI Web of Science. This comparison helps to highlight the importance of using two or more data bases while performing citation analysis. This methodology would ensure that all relevant articles are included for citation analysis and no literature is inadvertently excluded. These types of studies need to revised, perhaps on a yearly or five yearly basis, in order to keep track of the top-cited articles, and to identify the change in research trends in different fields of science. Citation analysis also aid in developing a data-base of relevant articles that any person interested in a particular topic or subject can access in order to be remain abreast with the top-cited literature.

Conclusions

This article provides top-cited articles in dental traumatology and identifies the different characteristics of these articles. Epidemiology remains the primary cited topic of literature on dental traumatology, suggesting that research interests emphasize the incidence and prevalence of dental trauma. Most of these highly cited papers are observational studies, surveys, review and guidelines. Only 5 papers of the top 100 most cited papers on dental trauma used experimental study design. 'Dental Traumatology' appears to be the most commonly cited journal for dental trauma.

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