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Article

Trigeminal neuralgia: bibliometric analysis of the fifty top-cited articles in the period 2000-2016.

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Abstract: Objective: To analyze the fifty top-cited articles on trigeminal neuralgia during the period 2000-2016. Methods: A bibliometric study using Harzing's *Publish or Perish* 5 software and Google Scholar as the database was performed. The term used in the search was "trigeminal neuralgia." A list was generated with the 50 top-cited articles in the period 2000-2016 and variables of interest were studied. Results: The articles received 12316 citations with a mean of 724.47 and 246.32 citations per year and per articles, respectively. The article with the highest mean number of citations/year (48.57) was published by Cruccu *et al.,* in 2010. The articles had an h index of 48 and were published in 24 scientific journals. The journals with the highest number of articles were *Neurology* and *Journal of Neurosurgery*, with 7 articles each (14%). A prevalence of North American authorship was observed (n=14; 28.0%). Original articles (n=26; 52.0%) and papers written by six authors (n=12; 24.0%) were also the most prevalent. The highest number of articles by a binomial international collaboration was from Austria-Italy (n=3; 6.00%). The most researched topics were related to updates in specific treatments for trigeminal neuralgia and neuropathic pain in general. Conclusions: The most cited article was published in 2010 in the *European Journal of Neurology*. Articles published in the years 2001 and 2002 received the highest number of citations. The most relevant scientific collaborations were observed between Italian and Austrian researchers.

Keywords: trigeminal neuralgia; publications; bibliometric analysis

INTRODUCTION.

Trigeminal neuralgia (TN) is an acute, paroxysmal, painful disorder, sometimes described as causing burning or electric-shock like[1] pain in the area innervated by the fifth cranial nerve, most commonly in the second and third branches.[2] Its annual prevalence is 4.3 individuals per hundred thousand,[3] and the mean age of occurrence is over 50 years, although cases have also been reported in younger patients. This pathology has been classified as one of the worst causes of suffering due to pain, accounting for 89% of facial pain.[4]

TN mainly affects women with a female/male ratio of 2:1.1 It occurs on the right side in 60% of the cases, 39% on the left side, and it is bilateral in 1% of cases.[4] Although the etiopathogenetic mechanisms of TN have not been fully uncovered,[5] the literature identifies neurovascular compression in the vertebrobasilar complex, evidenced in imaging studies, as the most accepted theory.[2,6]

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Diagnosis is mainly based on the personal and clinical history of the patient. Exploration must necessarily include an assessment of facial sensitivity and facial muscles, as well as the performance of cranial magnetic resonance imaging to rule out the presence of intracranial tumors. Regarding its treatment, various therapeutic strategies have been proposed and pharmacological treatment is used as a first line of action.[1,7] Surgical treatment includes multiple variants and is generally reserved for patients who do not respond positively to pharmacotherapy.[1,2,5,8,9]

The magnitude of the clinical and psychological disorders caused by TN has encouraged research and fostered publications, both of which increase every year. Taking into account that bibliometric studies have become a useful tool to asses the current and the future state of a specific field of science, and the fact that no references have been found in the literature regarding the bibliometric status of studies on TN, the present research was carried out with the aim of analyzing the 50 most cited articles on trigeminal neuralgia published during the period 2000-2016.

MATERIALS AND METHODS.

Type of study, unit of analysis and bibliometric indicators

A bibliometric analysis of the 50 top-cited articles on trigeminal neuralgia published during the period 2000-2016 was carried out. The following bibliometric indicators were studied: year of publication, total number of articles, citations, average number of citations per year, average number of citations per article, average number of citations per author, average number of citations per author and per year, average number of articles per author, h index, h5 index, g index, contemporary h index (hc), individual h index (hI), normalized hI index, AWCR index, AW index, AWCRpA index, e index, hm index, annual hI index, h amplitude, g amplitude , annual collaboration index, journals, impact factor, authors' affiliation, and article type.

The h index[10] considers the number of articles and the number of citations they receive. It consists of ordering the works of an author in decreasing fashion by virtue of the citations received for each work. At the moment in which the rank (position in the list) exceeds or equals the value of the citation, the h index is obtained. This means that the author has h works with at least h citations, *i.e.*, an author has an "h" index if he/she has "h" articles that have been cited at least "h" times. The h5 index is the h index of articles published in the last five full years.

The g index[11] is that in which the square root of the sum of the citations is the largest number in descending order of citations. The contemporary h index[10] takes into account the time of the published article and its citations. To calculate the hI[12] index, the h index is divided by the average number of co-authors that one author has. To obtain the normalized hI index,[12] the citations of each article that contribute to the h index are selected and divided by the number of co-authors of that article and the resulting h index is calculated.

The AWCR[13] index consists of the proportion of citations based on the age of the article. It measures all citations adjusted by the age of each document that the traditional h index includes. It is an average number of the citations where each document is divided by the number of years of the article and is calculated as the square root of all the citations.

The AW[14,15] index is defined as the square root of the AWCR index to allow for a comparison with the h index. It approaches the h index if the citation rate (mean) remains more or less constant over the years. The e index[15] is the square root of the sum of the citations of the articles included in the h index. The hm index[12] divides the article among the authors and takes into account the number of complete citations, and the resulting h index is calculated. The annual hI index analyzes the annual impact of the journal. The annual collaboration index was calculated as the quotient between the sum of the number of authors per article and the number of articles published.

Procedures, data collection and management, and statistical analysis

Bibliometric indicators were calculated using the Harzing's *Publish or Perish* 5 software[16] taking Google Scholar as the database; the search was carried out with the term "trigeminal neuralgia". Results were ordered in descending fashion according to the mean of citations/year. To be included in the final sample, the articles had to be accessible electronically to full text as well as having been published in journals with a double-blind peer review system.

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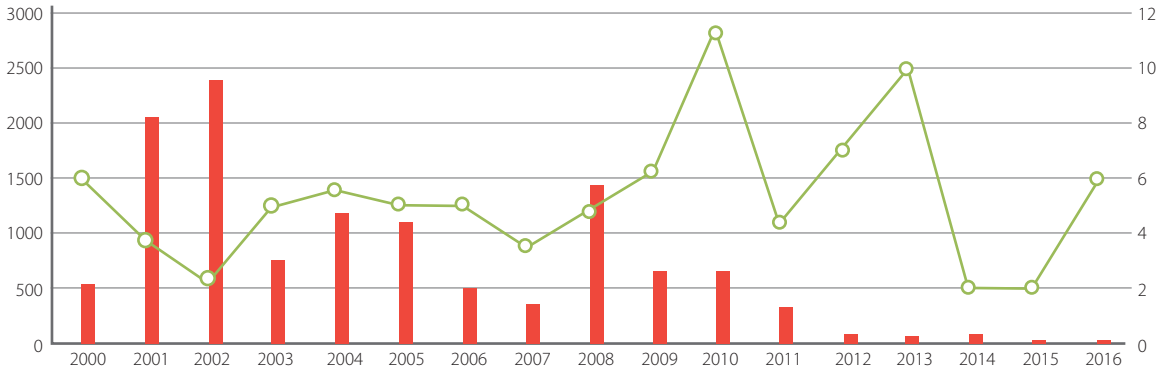
Six studies were excluded because they were book chapters. The values of the impact factor in 2 years for 2016 were obtained from the annual report of *the Journal Citation Report®* (JCR). The data obtained were exported to a database (MS Excel, Microsoft Corp., USA) in which the statistical analysis was performed.

Figure 1. Annual distribution of articles, citations and collaboration index.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Articles	2	5	8	3	4	3	2	2	6	4	3	7	1	1	1	1	1
Citations	543	2057	2411	762	1192	1105	503	353	1446	652	657	337	88	69	85	31	25
Collaboration index	6	2.8	2.25	5	5.5	5	5	3.5	4.83	6.25	11.33	4.33	7	10	2	2	6

*: In these years associations were found as institutional authors so they were taken as a single author when calculating the collaboration index.

Table 1. Annual distribution of articles, citations and collaboration index.

Indicators	Values
Articles	50
Total citations	12316
Years of publication	17
Citations/year	724.47
Citations/articles	246.32
Citations/authors	4491.35
Citations/authors/year	264.19
Articles/author	17.93
h Index	48
g Index	50
hc Index	50
hI Index	12.87
Standardized hI index	39
AWCR	1136.64
AW Index	33.71
AWCRpA	398.95
e Index	99.78
hm Index	17.93
Annual hI Index	2.29
h Coverage	100
g Coverage	100

Table 4. Distribution of articles by country.

No.	Country	n	%
1	United States	14	28.0
2	United Kingdom	9	18.0
3	France	6	12.0
4	Italy	3	6.0
5	Denmark	2	4.0
6	Israel	2	4.0
7	Germany	2	4.0
8	Austria	1	2.0
9	Turkey	1	2.0
10	Taiwan	1	2.0
11	Egypt	1	2.0
12	Switzerland	1	2.0
13	England	1	2.0
14	Netherlands	1	2.0
15	Thailand	1	2.0
16	Sweden	1	2.0
17	Australia	1	2.0
18	China	1	2.0
19	Canada	1	2.0
Total		**50**	**100**

Table 2. Positioning of articles according to citations per year.

No	Articles	Citations	Citations/year
1	Cruccu G, et al. EFNS guidelines on neuro-pathic pain assessment: revised 2009. Eur J Neurol. 2010;17(8):1010-18.	340	48.57
2	Wiffen PJ, et al. Anticonvulsant drugs for acute and chronic pain. Cochrane Database Syst Rev. 2005;3.	536	44.67
3	Cruccu G, et al. AAN-EFNS guidelines on trigem-inal neuralgia management. Eur J Neurol. 2008;15(10):1013-28.	352	39.11
4	Love S, Coakham HB. Trigeminal neuralgia: pathology and pathogenesis. Brain. 2001;124(12):2347-60.	609	38.06
5	Gronseth G, et al. Practice parameter: the diagnos-tic evaluation and treatment of trigeminal neuralgia (an evidence-based review). Report of the Quality Standards Subcommittee of the American Academy of Neurology and the European Federation of Neurological Societies. Neurology. 2008;71(15):1183-90.	332	36.89
6	Rogawski MA, Löscher W. The neurobiology of antiepileptic drugs for the treatment of nonepileptic conditions. Nature Medicine. 2004;10(7):685-92.	422	32.46
7	Serpell MG,Neuropathic Pain Study Group. Gabapentin in neuropathic pain syndromes: a randomized, double-blind, placebo-controlled trial. Pain. 2002;99(3):557-66.	434	28.93
8	Zakrzewska JM, Linskey ME. Trigeminal neuralgia. Br Med J. 2014;348(9):474.	85	28.33
9	Kanpolat Y, et al. Percutaneous controlled radiofrequency trigeminal rhizotomy for the treatment of idiopathic trigeminal neuralgia: 25-year experience with 1600 patients. Neurosurgery. 2001;48(3):524-34.	452	28.25
10	Yuan RY, et al. Botulinum toxin for diabetic neuropathic pain. A randomized double-blind crossover trial. Neurology. 2009;72(17):1473-1478.	205	25.63
11	Hall GC, et al. Epidemiology and treatment of neuropathic pain: the UK primary care perspective. Pain. 2006; 122(1):156-62.	278	25.27
12	Khedr EM, et al. Long-lasting antalgic effects of daily sessions of repetitive transcranial magnetic stimulation in central and peripheral neuropathic pain. J Neurol Neurosurg Psychiatry. 2005;76(6):833-8.	302	25.17
13	Régis J, et al. Long-term safety and efficacy of Gamma Knife surgery in classical trigeminal neuralgia: a 497-patient historical cohort study. J Neurosurg. 2016;124(4):1079-87.	25	25.00
14	Tatli M, et al. Various surgical modalities for trigeminal neuralgia: literature study of respective long-term outcomes. Acta Neurochirurgica. 2008;150(3):243-55.	219	24.33
15	Attal N, et al. Neuropathic pain: are there distinct subtypes depending on the etiology or anatomical lesion? Pain. 2008;138(2):343-53.	217	24.11
16	Lopez BC, et al. Systematic review of ablative neurosurgical techniques for the treatment of trigeminal neuralgia. Neurosurgery. 2004;54(4):973-83.	313	24.08
17	KoopmanJS, et al. Incidence of facial pain in the general population. Pain. 2009;147(1):122-7.	191	23.88
18	Jensen TS. Anticonvulsants in neuropathic pain: rationale and clinical evidence. Eur J Pain. 2002;6(SA):61-8.	355	23.67
19	Tassaneeyakul W, et al. Association between HLA-B* 1502 and carbamazepine-induced severe cutaneous adverse drug reactions in a Thai population. Epilepsia. 2010;51(5):926-30.	163	23.29
20	Lyons MK. Deep brain stimulation: current and future clinical applications. Mayo Clinic Proceedings. 2011;86(7): 662-72.	135	22.5
21	Österberg A, et al. Central pain in multiple sclerosis: prevalence and clinical characteristics. Eur J Pain. 2005;9(5):531-531.	267	22.25
22	Kondziolka D, et al. Gamma knife stereotactic radiosurgery for idiopathic trigeminal neuralgia. J Neurosurg. 2010;112(4):758-65.	154	22.00
23	Backonja MM. Use of anticonvulsants for treatment of neuropathic pain. Neurology. 2002;59(5 suppl 2):S14-S17	330	22.00
24	Kalkanis SN, et al. Microvascular decompression surgery in the United States, 1996 to 2000: mortality rates, morbidity rates, and the effects of hospital and surgeon volumes. Neurosurgery. 2003;52(6):1251-62.	300 s	21.43
25	Nurmikko TJ, Eldridge PR. Trigeminal neuralgia: pathophysiology, diagnosis and current treatment. Br J Anaesth. 2001;87(1):117-32.	340	21.25
26	Eisenberg E, et al. Lamotrigine reduces painful diabetic neuropathy. A randomized, controlled study. Neurology. 2001;57(3):505-9.	336	21.00

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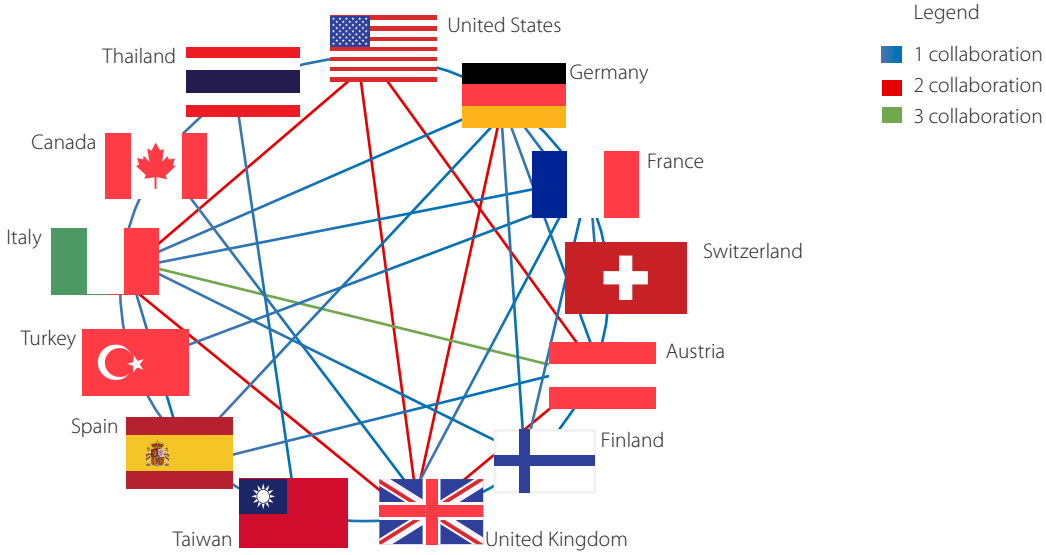
27	Régis J, et al. Prospective controlled trial of gam-ma knife surgery for essential trigeminal neuralgia. J Neurosurg. 2006; 104(6):913-24.	225	20.45
28	Maesawa S, et al. Clinical outcomes after ste-reotactic radiosurgery for idiopathic trigeminal neuralgia. J Neurosurg. 2001;94(1):14-20.	320	20.00
29	Devor M, et al. Pathophysiology of trigeminal neuralgia: the ignition hypothesis. Clin J Pain. 2002;18(1):4-13.	297	19.80
30	Lytton WW. Computer modelling of epilepsy. Nature Neurosci. 2008;9(8):626-37.	169	18.78
31	Pollock BE, et al. Stereotactic radiosurgery for idiopathic trigeminal neuralgia. J Neurosurg. 2002; 97(2):347-53.	279	18.60
32	Bennett MI, Simpson KHG. Gabapentin in the treatment of neuropathic pain. Palliative Medicine. 2004;18(1):5-11.	241	18.54
33	Sindou M, et al. Microvascular decompression for primary trigeminal neuralgia: long-term effectiveness and prognostic factors in a series of 362 consecutive patients with clear-cut neurovascular conflicts who underwent pure decompression. Journal of Neurosurgery. 2007;107(6):1144–53.	185	18.50
34	Gustin SM, et al. Different pain, different brain: thalamic anatomy in neuropathic and non-neuropathic chronicpain syndromes. J Neurosci. 2011;31(16):5956-64.	109	18.17
35	Wu CJ, et al. Botulinum toxin type A for the treatment of trigeminal neuralgia: results from a randomized, double-blind, placebo-controlled trial. Cephalalgia. 2012;32(6):443-50.	88	17.60
36	Campos-Benitez M, Kaufmann AM. Neurovascular compression findings in hemifacial spasm. J Neurosurg. 2008;109(3):416-20.	157	17.4
37	Obermann M, et al. Gray matter volume reduction reflects chronic pain in trigeminal neuralgia. Neuroimage. 2013;74(1):352-358.	69	17.
38	Burchiel KJ. A new classification for facial pain. Neurosurgery. 2003;53(5):1164-7.	236	16.86
39	Sindou M, et al. Anatomical observations during microvascular decompression for idiopathic trigeminal neuralgia (with correlations between topography of pain and site of the neurovascular conflict). Prospective study in a series of 579 patients. Acta Neurochirurgica. 2002;144(1):1-13.	252	16.80
40	Bennetto L, et al. Trigeminal neuralgia and its management. Br Med J. 2007;334(7586):201-5.	168	16.80
41	Rogers CL, et al. Gamma knife radiosurgery for tri-geminal neuralgia: the initial experience of The Barrow Neurological Institute. Int J Radiat Oncol Biol Phys. 2000;47(4):1013-9.	283	16.65
42	Freynhagen R, Bennett MI. Diagnosis and management of neuropathic pain. Br Med J. 2009;339:3002	133	16.63
43	Solaro C, et al. The prevalence of pain in multiple sclerosis. A multicenter cross-sectional study. Neurology. 2004;63(5):919-921.	216	16.6
44	Simpson DM, et al. Lamotrigine for HIV-associated painful sensory neuropathies. A placebo-controlled trial. Neurology. 2003;60(9):1508-14.	226	16.14
45	SindrupSH, Jensen TS. Pharmacotherapy of trigeminal neuralgia. Clinical Journal of Pain. 2002;18(1):22-27.	242	16.13
46	Montano N, et al. Advances in diagnosis and treatment of trigeminal neuralgia. Therapeutics and Clinical Risk Management. 2015;11:289-99.	31	15.50
47	Zakrzewska JM, McMillan R. Trigeminal neuralgia: the diagnosis and management of this excruciating and poorly understood facial pain. Postgrad Med J. 2011;87(1028):410-6.	93	15.50
48	Lefaucheur JP, et al. Motor cortex stimulation for the treatment of refractory peripheral neuropathic pain. Brain. 2009;132(6):1463-71.	123	15.38
49	Simpson DM, et al. A placebo-controlled trial of lamotrigine for painful HIV-associated neuropathy. Neurology. 2000;54(11):2115-9.	260	15.29
50	Samii M, et al. Microvascular decompression to treat hemifacial spasm: long-term results for a consecutive series of 143 patients. Neurosurgery. 2002;50(4):712–9.	222	14.80

Table 3. Distribution of articles according to journals and the impact they reach.

Journal	h5 Index	IF 2016*	Country	Articles	Citations	Mean+SD
Neurology	112	7.592	United States	7	1905	272.14 ± 59.08
J Neurosurg	66	4.059	United States	7	1345	192.14 ± 96.31
Neurosurgery	56	4.889	United States	5	1523	304.6 ± 91.31
Pain	74	5.445	United States	4	1120	280.0 ±108.95
British Medical Journal	154	20.785	England	3	386	128.67 ±41.67
Eur J Neurol	49	3.988	England	2	692	346.0 ±8.49
Brain	99	10.292	England	2	732	366.0 ±343.65
Acta Neurochirurgica	36	1.881	Austria	2	471	235.5±23.33
Clin J Pain	43	3.492	United States	2	539	269.5±38.89
Eur J Pain	42	3.019	England	2	622	346.0 ±8.49
Cochrane Database Syst Rev	148	6.124	United States	1	536	
Nature Medicine	168	29.886	United States	1	422	-
British Journal of Anaesthesia	79	6.238	United King-dom	1	340	-
J Neurol Neurosurg Psychiatry	76	7.349	England	1	302	-
Int J Radiat Oncol Biol Phys	75	5.133	United States	1	283	-
Palliative Medicine	48	4.220	England	1	241	-
Nature Reviews Neuroscience	123	28.880	United King-dom	1	169	-
Epilepsia	73	5.295	United States	1	163	-
Mayo Clinic Proceedings	71	6.686	United States	1	135	-
J Neurosci	113	5.988	United States	1	109	-
Postgrad Med J	42	1.874	England	1	93	-
Cephalalgia	44	3.609	Norway	1	88	-
Neuroimage	120	5.835	United States	1	69	-
Ther Clin Risk Manag	34	2.200	New Zealand	1	31	-
Total	-	-	-	**50**	**12316**	**246.32 ± 121.06**

***:** This indicator corresponds to the impact factor of 2 years in 2016 according to the annual report of the Journal Citation Report®.

Figure 2. Scientific collaboration networks at country level.



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RESULTS.

Table 1 shows the bibliometric indicators of the articles, which received 12316 citations with a mean of 724.47; 246.32; 4491.35 and 264.19 citations per year, by articles, by authors and by authors per year respectively, and which have an h index of 48 and a g index of 50.

The mean annual publication was 2.94±1.98. The largest number of articles was published in 2002 and 2008, (n=8, 16.00% and n=6, 12.00%, respectively). The mean number of annual citations was 724.47±711.47. The maximum value of the collaboration index was reached in 2010 and the minimum in 2014 and 2015 (11.33 and 2.0, respectively); the annual mean of this indicator was approximately of 5.28±2.52. (Figure 1)

The relationship of articles ordered in descending fashion by the mean of citations/year is shown in table 2. Citations ranged from 25 to 609; only six articles (12.00%) received fewer than 100 citations, with a mean value of 239.90±113.67. The most cited article received 340 citations with a mean of 48.57 citations per year since its publication in 2010 in the *European Journal of Neurology*.

The articles were published in 24 journals indexed in Web of Science with a mean impact factor of 7.698±7.661. *Neurology* and *Journal of Neurosurgery* were the publications with the highest number of articles, with 7 (14.0%) each. They reached mean values of citations±standard deviation of 272.14±59.08, and 192.14±96.31, respectively. Following Neurology and *Journal of Neurosurgery*, come *the journals Neurosurgery* with five articles (1523 citations and a mean of 304.6±91.31), and Pain with four articles (1120 citations and a mean of 280.0±108.95). (Table 3)

Six was the most common number of authors per paper (n=12, 24.0%). Eleven articles (22.0%) had seven authors and 10 (20.0%) had two authors. An equal number of papers were published with one, three and four authors (n=5, 10.00%). There were two articles (4.0%) with five authors. Original articles were more prevalent (n=26; 52.0%), followed by review articles (n=22; 44.0%), and short communications (n=2; 4.0%).

Figure 2 shows scientific cooperation networks at country level. The articles were published by researchers from 13 countries. The binomial Austria-Italy contributed the most articles (n=3; 6.00%) as a result of international collaboration. The most researched topics were related to the update of treatments for specific trigeminal neuralgia and for neuropathic pain in general.

DISCUSSION.

The analysis of citations is a powerful bibliometric tool that reflects the influence of an article, or a group of them, in an area of knowledge. The number of citations received by a publication is an important measure of its impact within the scientific community. The argument is that the influence of an article, in general, is directly proportional to the times it has been cited. This type of studies allows researchers to develop a monitoring system of the evolution of the thematic areas in their field and the establishment of research strategies. In addition, bibliometric studies are usually employed by journals to attract documents with a high citation potential.[17,18]

The characterization of the most cited articles helps to identify the most significant fields within the most general thematic study areas, the highly relevant contributions and their main trends.[19] Contrasting these with the different historical contexts and the processes through which the studies emerge contributes to formulating strategies for the improvement of science. In recent years, there has been an increase in the number of documents that follow this methodology in the field of health.[17,20-24] Some topics were: diabetes,[20] hypertension,[21] osteoporosis,[22] pain,[23] ameloblastoma,[24] and aortic dissection,[17] among others, but until the date this search was performed, none was found on trigeminal neuralgia, which is why the present research was conducted.

This study has the advantage of using a particular approach for determining the final top-50 articles. They were selected based on their average citations per year and not simply by the total number of citations for each document. This favors the inclusion of articles of recent publication, which have a set of particular characteristics including: being published in very high impact journals, involve the contribution of well-known and prestigious authors in the field of scientific

research, as well as being published in open access sites. The latter considerably increases their visibility and tendency to be cited very recently.

The impact factor (IF) is of great importance for both journals and authors. Being an indicator of quality, the most cited journals tend to attract more and better publications. In addition, authors able to produce high quality articles send their manuscripts to high IF journals in order to gain greater visibility.[17,26-27] The present study strengthens this idea because all the journals that contributed articles to the top list are considered of relative high impact, as they have an IF above 1.0.

Several studies show a significant direct relationship between the numerical value of IF and the total citations received by the articles.[17] This may be due to other criteria that influence the possibilities of citing studies, such as their presence in highly specialized journals and accessibility to the full-text article, which in many cases is affected by the monetary costs associated with obtaining the document.

The journals that contributed the most articles to the top-50 were *Neurology* and *Journal of Neurosurgery* (JoN). Articles are subjected to peer review processes in both journals, which guarantee their quality. Both journals allow their readers to access all their information free of charge and have high IFs (over 4.0), and both are the result of the publication of important groups of North American scientists in the field of neurology, such as: *the American Academy of Neurology* in the case of *Neurology* and, in the case of *the Journal of Neurosurgery* (JoN), *The Journal of Neurosurgery Publishing Group* (JNSPG), which belongs to the *American Association of Neurological Surgeons*. JoN is the most cited journal in neurosurgery, according to the JCR of Thomson Reuters in 2016.

All the articles were published in English. One of the main reasons for this is that English is considered the scientific language par excellence. On many occasions, despite not being the main language of the researchers, it is “borrowed" for the dissemination of their research findings and achievements.[27]

Documents with an US affiliation were the most prevalent, similar to the findings of Jifang Hui *et al.,*[28] in a study of the most cited articles in the area of orthodontics. The prevalence of articles of North American origin is mainly due to the significant funding of research projects, as well as the great community of researchers that this nation hosts. This is widely known within the scientific community, and in many occasions such an affiliation is used as a quality criterion at the moment of selecting the materials to be cited by the research community.

The prevalence of studies that focused on the updating of treatments for specific TN and neuropathic pain was noteworthy. The main characteristic of TN is the presence of pain that becomes "unbearable." This is described as one of the most severe forms of manifestation of this symptom, and it constantly generates studies aimed at updating its treatment.[29] In many occasions, there is reluctance to trying variants of treatment because there is no improvement of the symptomatology, consequently, patients begin to suffer from psychiatric disorders.[30] These factors cause disability and should be taken into account when dealing with this disease, as it significantly affects the patients’ ability to work and damages their relationships with members of their families or with the community in general.

The longer a manuscript has been published, the greater the number of citations it can reach. It is well known that an article tends to be cited one or two years after its publication date and reaches its maximum citation peak between seven and ten years after that date.[31] This may explain the lower number of articles in the last years of the study period; although taking the mean number of annual citations as a selection criterion minimized the effect of this variable.

Original studies were more prevalent, a finding that is similar to that reported by Corrales-Reyes *et al.,*[24] and Yaohong Wuet *et al.,*[33] However, it contrasts with the results reported in a study conducted on the most influential articles in the area of Urology in Turkey,[33] in which case reports were more prevalent. This in turn was similar to the findings reported by Jifang Hui *et al.,*[28] when analyzing the most cited articles in the literature in the field of orthodontics.

Although it is a bit surprising that the most cited articles tend to be reviews and meta-analyses because

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of their generalizing nature, in the subject under study, the slight prevalence of original articles is well explained. In general, the morpho-physiopathology of TN is appropriately described, so current efforts in this field of knowledge are mainly aimed at the search for improvements in neuropathic pain, as the most severe symptom of this condition. This clearly explains the tendency to cite the documents that deal with new evidence in this field.

Articles with four or more authors were more prevalent (60% of the total). The collaboration of two or more authors for the development of a study leads to the creation of work groups that tend to evolve and become true entities generating knowledge in a specific field of science.[24] As such, generation of knowledge is achieved with greater solidity and stronger foundations. All this based on the points of view and experiences of more than one person, as it is not always the case that the experience of a single researcher is in agreement with the vision of all others.

A total of 13 countries collaborated in the elaboration of the articles featuring in the top of the list. Numerous studies[34-36] show a direct relationship between the papers that involved international collaboration and the visibility achieved in the international scientific community. All of these analyses took into account their citation trend. In general, the collaboration between authors, institutions and countries contributes to the exchange of ideas and the division of tasks. This expands the possibilities of establishing new approaches and having access to the necessary resources to solve new research problems.

The strength of the study is that the Harzing's *Publish or Perish* 5 software was used[16] taking Academic Google (AG) as database. This has proved to be an effective tool to identify the most cited articles. In addition, it has a larger field of analysis than other databases in terms of the number of citations and their origins[37] for the preparation of the top-cited list.

Despite this, it is valid to raise some questions that can be considered limitations of the present research. The selected period of study may constitute a limitation for some articles that due to their prestige could have been taken into account for the top. Another important limitation is that in the methodology used for the elaboration of this type of study, the citations received by the documents are taken as a central parameter of quality for the selection, without taking into account different factors that may influence them, such as: country of origin and the journal in which it was published, among others. In addition, the effects of self-citations on the final placement or positioning of the articles were not evaluated.

It is necessary to clarify that the contribution of an article to a field of knowledge cannot be evaluated only from the point of view of the quantification of the citations it has received, other assessments would have to be made to complement these results.

CONCLUSION.

The most cited article was published in 2010 in *the European Journal of Neurology*. The articles were published in 24 scientific journals, with *Neurology* and *Journal of Neurosurgery* being the publications with the largest number of papers. There was a predominance of US authorship, as well as original articles. The articles published in the years 2001 and 2002 received the highest number of citations. The most relevant scientific collaborations were observed between Italian and Austrian researchers. The most researched topics were related to the update of treatments for specific trigeminal neuralgia and neuropathic pain in general.

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