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Impact of Otolaryngology Theses in Their Authors' Scientific Production☆

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Abstract
Introduction and objectives: The writing of a thesis has 2 main objectives: the appropriate training to be a good researcher and the publication of the first original research work. This study attempted to check this statement applied to theses in Otolaryngology by analysing the variation in the authors' publications.
Material and methods: We used the database TESEO to obtain the data relative to Otolaryngology theses in Spain published between 1993 and 2003. We found the publications of each author by using de program ''Publish or Perish'' and we analysed the variations in their work in 3 periods (prior to, around, and after thesis publication).
Results: The publications, the citations, and the parameters analysed all increased in the second and third periods (around and after) with regard to the first period. However, there were no significant differences in some of them in the first 2 periods.
Conclusions: The elaboration of a thesis in Otolaryngology increased the scientific production of its author. Almost a third of the authors did not publish any work. There was a significant increase in all the parameters studied and the bibliometric indices between the period before thesis publication and the around and after thesis periods.

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PALABRAS CLAVE
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Repercusión de la tesis doctoral en Otorrinolaringología sobre la producción científica de sus autores

Resumen
Introducción y objetivos: La elaboración de una tesis doctoral tiene dos fines principales: la formación adecuada para ser un buen investigador y la publicación de los primeros trabajos originales de investigación. Este trabajo va a intentar comprobar dicha afirmación aplicada a las tesis en Otorrinolaringología analizando las variaciones en las publicaciones de sus autores.
Material y métodos: Se obtuvieron mediante la base de datos TESEO los datos relativos a las tesis publicadas en Otorrinolaringología en España de 1993-2003. Mediante el programa Publish or Perish se averiguaron las publicaciones de cada autor y se analizaron sus variaciones en tres periodos (previo, en torno y posterior a la tesis).
Resultados: Tanto las publicaciones como las citaciones como los parámetros analizados aumentan en los periodos posterior y en torno con respecto al previo, no habiendo en algunos de ellos diferencias significativas entre los dos primeros periodos.
Conclusiones: La realización de la tesis doctoral en Otorrinolaringología hace que la producción científica de su autor aumente. Alrededor de un tercio de los autores no elabora ninguna publicación. Existe un aumento significativo en todos los parámetros estudiados y en los índices bibliométricos entre el periodo previo y el periodo en torno y posterior.

Introduction

When a university graduate wants to continue with their studies, there are several alternatives available for post-graduate study. In Spanish universities, the classic option is a doctorate programme. However, the fact that this is the most common route does not mean that the final goal (obtaining the degree of Doctor) has been adequately understood generally.

From this starting point, we have to ask questions such as ''What do we understand by Doctor?'' and ''What does obtaining a doctorate degree mean?'' As for the first question, according to the Spanish Dictionary of the Royal Academy (*Diccionario de la Real Academia de la Lengua* [*RAE*][1]) in its 22nd edition, *doctor* is used to designate those individuals who «*have completed studies for a doctorate in an establishment authorised to grant this degree*». To achieve the degree of Doctor it is necessary to follow a doctorate programme that concludes with the viva defence of the doctoral thesis.

The reply to the second question (about the meaning of the thesis) is as ambiguous as it is obvious: you obtain the title of Doctor.[2] However, this goal is qualified by the field of knowledge being considered. In areas such as experimental science and social and legal sciences, very few graduates end up defending their thesis.[2] Obtaining the degree implies that the individual is planning to become a professor («the ones who are going to stay in the faculty are the only ones who defend their theses»). That is the traditional concept in which one of the university faculties where the individual has studied recognises a candidate as an equal, and it allows the graduate to join the teaching profession (the 2nd meaning of the definition according to the RAE)[1].

Contrary to this, in the health sciences (especially in medicine), the thesis «*...constitutes an obligation rather than a conscious decision for many more*».[2] It is undertaken so as to «fit in» within the general dynamics of the department where the individual works.

In Spain, an analysis of health sciences theses has been published for various fields of knowledge such as Rehabilitation la Rheumatology,[4] Otolaryngology,[5] and Anaesthesiology.[6] These articles state that preparing a thesis in these disciplines has two main goals: appropriate training to be a researcher and the publication of the first original research papers.[3–6]

There are very few publications on the influence of a thesis in the professional or research life of doctors. A possible way of testing for this influence could be to evaluate the variation of the research-scientific activity of the doctorate by qualitative and quantitative analysis of the publications before and after obtaining this thesis degree.

The objectives of this study were to evaluate objectively the repercussion of the doctoral thesis in Otolaryngology on the scientific production of their authors, as well as the effect on the bibliometric indexes of the studies generated by them.

Methods

The TESEO database was accessed during the months of July to December 2009 (http://www.micinn.es/teseo). The following six descriptors were used as search terms: «*otorrinolaringología*» (otorhinolaryngology/otolaryngology), «*cirugía de garganta, nariz y oídos*» (ear, nose, and throat surgery), «*fisiología de la audición*» (physiology of hearing), «*fisiología del equilibrio*» (physiology of balance), «*física de la audición*» (physics of hearing),

and «*bioacústica*» (bioacoustics). The results of these 6 searches were overlaid to prevent duplications, and all the records of the theses presented from 1993 until 2003 were obtained. Each thesis record provided the following information: name of the author–doctor, director, title, university, faculty, centre where prepared (department), year of viva defence, structured thesis summary, and general descriptors.

In addition, the publications in which each thesis author appeared were found by using the Publish or Perish program (1990–2010 Tarma Software Research Pty Ltd®).[7] The search strategy included using 1 or 2 authors' surnames and the initials of their given names. We used the /or/ function and quotation marks («-») in the searches. The number of authors, whether the thesis director was one of the listed authors, the name of the journal in which the study was published, and the year of publication were recorded.

Our goal was to analyse the possible repercussions of defending the thesis on the number of articles published in national and international journals, as well as its effect on co-authorship relationships between the doctoral candidate and the thesis director. To do so, we studied the following periods: (a) the 3 years before and after the thesis (around), (b) the 3 years before the previous 3 years, and (c) the 3 years after the 3 years post-thesis. The number of publications, citations, citations/year, citations/publication, citations/author, publications/author, and bibliometric indexes (h, g, hc, hl, and hl,norm) were recorded for each of these three periods. Each of the articles found was placed into 1 of 3 subdivisions for its study, comparing the number of articles with 3 or fewer authors, those having 4–6 authors and articles with more than 6 authors.

All the data gathered was entered in Microsoft Excel® (Microsoft Office XP®) spreadsheet and statistically analysed using the SPSS 13.0 program. The information related to the publications and the bibliometric data was analysed; Friedman's *t*-test was used to evaluate the change in these parameters based on time, while Wilcoxon's test was used to show the possible «moment-to-moment» differences (correcting the *P* value with the Bonferroni method for multiple comparisons). We took *P*-values<.05/3=.016 as significant.

Results

Between 1993 and 2003, there were 254 thesis records, with a mean of 23.4 theses annually (a minimum of 17 in 1993 and a maximum of 32 in 1995) (Fig. 1). With respect to the publications prior to the thesis defence, 92.5% of the authors published 5 or fewer in national journals and 95.3% published 3 or fewer in international journals. After thesis defence, 93.3% of the authors had 14 or fewer publications in national journals and 93.3%, 6 or fewer in international ones (*P*<.0001).

As far as the thesis director being a co-author on the doctoral candidate's articles (considering both studies generated before and after the thesis together), 56.3% of the authors had no national publications together with their director (a single publication, 16.3%). Likewise, 83.7% of the authors had no publications in international journals (a single article published, 10.7%).

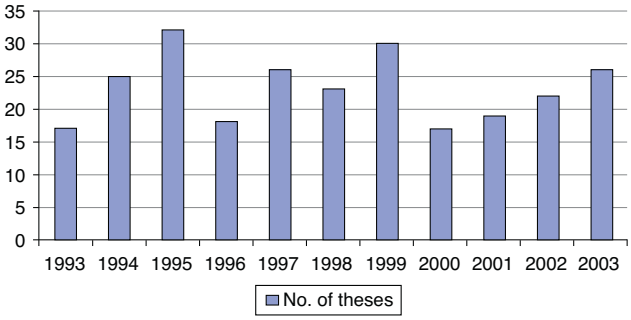

Figure 1 Diagram showing Otolaryngology theses in 1993–2003.

In terms of the publications according to periods, we saw that there are statistically significant differences between them. The period with the greatest number of publications is the 3 years around the thesis (mean of 2.3 publications/author), followed by the post-thesis period (mean, 2.1/author); the last period was the one before thesis defence (1.6/author). However, if we analyse each of the periods in a paired way, the comparison between the publications around the thesis and those made in the post-thesis period does not reach statistical significance (*P*=.081).

Analysing the citations in the three periods revealed statistically significant differences among them. The greatest number of citations appear in the period around the thesis (2.3/author), followed by the post-thesis period (2.0/author) and, finally, by the pre-thesis period (1.7/author). All the combinations showed significant differences between them (*P*<.002).

Variations in terms of citations/year and publications/author were also revealed. The period with the most was that around the thesis, followed by the post-thesis one, with the pre-thesis period in last place. The only lack of statistical significance was between the period around the thesis and the post-thesis period (*P*=.214). In citations/publication, citations/author, and authors/publication, we also found statistically significant differences between the 3 periods. The period that had the most was that around the thesis, followed by the post-thesis one and the pre-thesis period (*P*<.001).

Analysing the h-index revealed statistically significant differences between the 3 periods. The period with the highest h-index was the one around the thesis (2.3), followed by the post-thesis one (2.0), while the period with the lowest h-index was the pre-thesis period (1.7). As for the g-index, the highest values were found in the period around the thesis (2.3), then in the post-thesis (2.0) and, lastly, in the pre-thesis period (1.7). Paired analysis revealed differences between the 3. The hc-index revealed equal behaviour, with the exception of the hc-index from the post-thesis period vs the hc-index in the period around the thesis (*P*<.324).

As for the hl-index, the greatest values were seen in the period around the thesis (2.3), then in the post-thesis one (2.0) and, finally, in the pre-thesis period (1.7). Paired analysis found differences between the 3. The same trends were seen in the hl,norm-index (*P*<.001).

We analysed the number of publications with fewer than 3 authors and the number with 4–6 authors, finding statistically significant differences. The period with the most

publications was that around the thesis, followed by the post-thesis and then, in last place, the pre-thesis period. As for the number of publications with more than 6 authors, the post-thesis period had the most publications, followed by that around the thesis and, last again, the pre-thesis period (P<.001).

All of the possible pairs of numbers of authors revealed statistically significant differences, except for one: comparing the post-thesis period vs the period around the thesis in the segment of 3 or fewer authors and that of more than 6 authors (P=.872, P=.233).

Discussion

In our study, we saw great interannual variability in the number of theses defended in Otolaryngology. Although we might attempt to explain this finding with a series of potential reasons, clearly not all the possible motives would be included. Nevertheless, we are going to list a series of causes, organised as follows: *work*, *administrative*, «*setting*», *research*, *teaching*, and «*satisfaction itself*».

The *work*-related reason can be inferred from the fact that the periods of increase in thesis defence are related to situations such as the civil service examinations for healthcare posts in the public healthcare systems (period: 2001–2003) or the decrease of public employment offers (as happened in 1995 and 1996).[5]

The *administrative* reason for this variability can be found in the extinction or modification of doctoral plans (common in the last few decades). Such changes in regulations make some «lagging» doctoral candidates rush to finish their theses begun under prior legislations so as not to lose the work already carried out.[5]

Another reason is that of comparing production with other specialists in the same field who have already finished their theses. This is especially true in health care services included in clinical or teaching hospitals, in which the connection with a university makes preparing and defending a doctoral thesis «the norm» for staff there.

For a doctoral candidate to have a purely *research* vocation in a field of knowledge that coincides with a clinical medical specialty is rare. It is more normal to find specialists who either take advantage of the thesis to evaluate an issue related to their daily activity (clinical research) or attempt to obtain competitive curricula vitae (CVs) that allow them to opt for government university teaching staff positions or for chief of service positions at a health care institution. Lastly, Otolaryngology theses very occasionally serve to help the doctoral candidate to discover a strictly research preference, abandoning health care activity.[5]

Teaching inclinations are much less usual as an initial exclusive stimulus. They are normally linked to the drive to accumulate research-based publications to help to increase the possibilities of obtaining the position of university professor. Finally, another reason would be the *satisfaction itself* of learning research methodology or delving into an issue in which the specialist is especially interested.

Evaluating the actual publications revealed that their numbers changed with respect to defending the thesis. Before their thesis, 53.5% of the authors had not published any work in national journals and 87.4% had no international journal publications. In contrast, we found that 65.7% of the authors had publications in national journals and 25.2% in international journals after defending their thesis, results similar to other specialities in Spain.[3,4,6] We can therefore conclude that the thesis greatly influences the doctoral candidate's research activity, given the significant variation in overall scientific production.

In our series, we have objectively determined a fact that other authors had communicated as to the production of articles after successfully defending a thesis.[8–11] The number of doctors who, after obtaining a doctorate, do not publish any articles, not even their own thesis, is striking. In our study, this was approximately 35%. This implies that, on the one hand, the work remains unperceived by most of the scientific committee, while, on the other, the work is failing in one of the goals of a thesis (the diffusion of its results). What possible cause is there? We feel that it lies in one or more of the following 3 situations in which the successful PhDs find themselves. Firstly, they can consider that they have completed the work by defending their theses; secondly, perhaps there are adverse personal circumstances that make publishing the work findings difficult; and/or, lastly, they might «not know how» to get the most out of their thesis work.[12] Except for a new PhD's specific personal situation, these positions should not occur. At least, they should not arise in the context of a correct conception of what a doctoral thesis is and what its purpose is. This is even truer considering the support that the thesis director is supposed to represent. In summary, the thesis is the means by which a doctoral candidate has to be introduced to research methodology. In addition, it can be a way to achieve later objectives[12] such as obtaining a position at a university or at a research institution. «Coming to a halt» after a thesis is an error of concept and a waste of what was learned while preparing it; such a standstill also fosters the most common scientific policy mistakes in our setting.[13]

Insofar as articles published together with the thesis director, we can see that there are not many, generally speaking: none in national journals for 56.3% of the authors and none in international journals for 83.7%. In fact, what these results seem to indicate is that the scientific relationships normally does not increase between the candidate and the director throughout the thesis process.[14]

Analysing the number of publications based on when the thesis is defended, it turns out that more is published while the thesis is being prepared and in the period after its completion (without any differences between these 2 periods) than before preparing it (P<.001). More citations are received by articles published in the period around the thesis (a fact that is also confirmed by evaluating the indexes of citations/publication and citations/author). This leads us to think that work carried out in this stage is more interesting to the rest of the scientific community than work performed in the other 2 periods considered. However, analysing the number of citations/year revealed that there are no statistically significant differences between the period around the thesis and the one after it; this could be because fewer years are taken to evaluate this later period. This is supported by the hc-index (which gives more weight to recent publications), given that we did not find any statistically significant differences with this parameter between the period around the thesis and the post-thesis

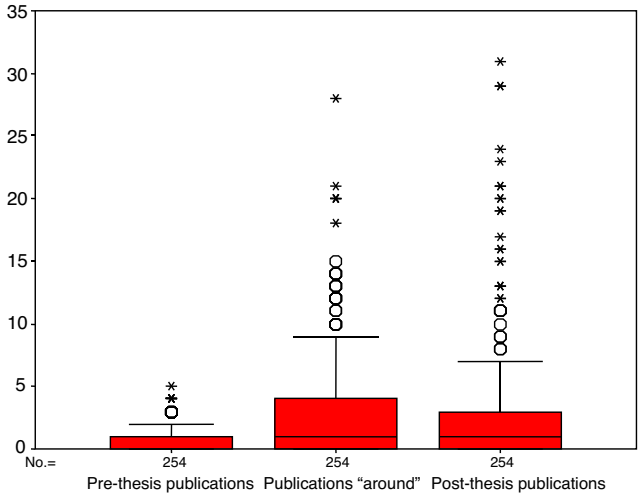

Figure 2 Comparison of thesis-related publications.

period. Everything indicates that there are specific theses that represent an increase in the quantity and quality of the authors' publications while they are being prepared. In addition, this improvement is maintained or increased in the years after the completion of the doctorate. Even though this phenomenon does not appear in all the cases, Otolaryngology theses have an overall positive effect on their authors' scientific production.

Analysing the bibliometric indexes also provided us with interesting information. The fact that the h-index is greater in the period around the thesis tells us that more articles are published and more citations are produced in this period. This coincides with previous results in other articles about this issue.[15] Something similar occurs with the g-index, even though the hc-index did not (as indicated earlier) reveal any statistically significant differences between the period around the thesis and the one after it, both having greater indexes than in the pre-thesis period.

If we compare all the indexes together, one could conclude that the fact that we chose relatively few years for the post-thesis period affected the result (as indicated earlier) that articles published in the period around the thesis have more citations than those in the post-thesis period. This would be because the indexes normalised per year tell us that there are no statistically significant differences as far as the citations the articles published in the period around the thesis receive and those published in the post-thesis period receive. What all the indexes are consistent with is that the publications from the period around the thesis and from the post-thesis period have more citations than articles published pre-thesis.

Using bibliometric indexes to discover thesis impact generates the same problems and can cause the same misgivings as when these indexes are used in selecting someone for a job position or deciding upon an award or honour.[15–21] Garfield[16] proposed his impact index in 1955. Ever since, the pros and cons of these appraisal systems (often created to evaluate the journals and not the authors themselves) have been controversial. This is reflected in the fact that, 50 years later, the prestigious journal *Nature*[18] dedicated an important space to these polemic issues. One of the most debated is Hirsch's h-index.[17,19,21,22] In our opinion, it is currently the most appropriate factor to appraise the activity and quality of a specific author's research. This is because it reduces the influence of bulging CVs on the opinion about the quality of the work carried out. However, other authors have already made proposals for improving the h-index.[15]

Lastly, other parameters analysed (authors/publication and publications/author) indicate that there are more authors for each publication in the period around the thesis (coauthors per article increase, as the hl-index and hl,norm-index confirm). Likewise, the analyses confirm that each author's publications increase in the period around the thesis and are maintained in the post-thesis period (Fig. 2).

Conclusions

Preparing a doctoral thesis in Otolaryngology brings a significant increase in articles published in national and international journals. However, defending the thesis does not result in greater co-authorship between the doctoral candidate and the thesis director. Approximately one-third of doctoral candidates make no publications after preparing the thesis.

There is a significant increase between the pre-thesis period and the period around the thesis in publications, citations, citations/year, citations/publication, citations/author, publications/author, authors/publication, and all the bibliometric indexes. This pattern continues between the period around the thesis and the post-thesis period only in citations, citations/publication, citations/author, authors/publication and the h-index, g-index, hl-index, and hl,norm-index. Only publications with between 4 and 6 authors grew in a statistically significant manner between the period around the thesis and the post-thesis period.

Conflict of Interests

The authors have no conflicts of interest to declare.

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