

Changes in the Prosthodontic Literature 1966 to 2042

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A b s t r a c t

Purpose: To describe the growth and content of the prosthodontic literature over the last 4 decades, to make a prognosis on its probable development in the coming 4 decades and to discuss changes in the content of the *International Journal of Prosthodontics (IJP)* from its start in 1988 to 2004.

Methods: MEDLINE was searched for articles on prosthodontics published between 1966 and April 2004. All volumes of *IJP* were examined with respect to type, subject area and geographic origin of articles.

Results: Using the term "prosthodontics," the MEDLINE search produced 66,600 hits. The proportion of clinical studies increased from 1% during the first 10-year period to 13% since 2001. Articles on removable dentures decreased during the period reviewed, whereas those on implant prosthodontics increased. Randomized controlled trials were rare and often of inadequate quality. Literature reviews have become popular, but many do not follow current guidelines for systematic reviews. A marked change in geographic origin of articles in *IJP* has occurred, with a decrease in material from North America and an increase in that from Europe and Asia. The Internet and open-access publishing will probably have a great impact on the future development of the prosthodontic literature.

Conclusions: Substantial changes have occurred in the prosthodontic literature between 1966 and 2004, and they can be expected to continue with the rapid development of information technology and increased use of the Internet.

MeSH Key Words: bibliometrics; clinical trials; Medline; prosthodontics

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The prosthodontic literature is extensive. The large number of textbooks and the rapidly increasing number of articles make it virtually impossible for an individual person to absorb this enormous amount of material. During the last decade there has been increased emphasis on quality, with a focus on methodology and strength of evidence. Evidence-based medicine and dentistry aim to improve the care that is offered to patients by basing it on the best available research results. This sounds straightforward, but finding the best evidence is not easy although several articles offer guidelines.¹⁻⁴

The purpose of this article is to describe the growth and content of the prosthodontic literature during the last 4 decades and to make a prognosis on its probable development in the coming 4 decades. An account of articles published in the *International Journal of Prosthodontics*

(*IJP*) from its start in 1988 to the present time is also included.

Methods

Medline was searched for publications in the field of prosthodontics from 1966 to April 15, 2004. Six prosthodontic subject areas were included in the search: complete dentures (CD), removable partial dentures (RPD), fixed prosthodontics (FP), prosthodontics and dental implants (P+I), maxillofacial prosthetics (MP), and temporomandibular disorders (TMD). No closer perusal of the listed articles was performed. However, some recent studies of the validity of MEDLINE searches and the quality of randomized controlled trials (RCTs) and literature reviews were scrutinized.⁵⁻⁹ The type, subject area and geographic origin of articles in all volumes of *IJP* (1988 to 2003) were recorded (**Box 1**).

Box 1 Subject area, type and geographic origin of articles published in the *International Journal of Prosthodontics* (1988 to 2003)

Topic

Dental materials
Removable dentures
Fixed prosthodontics
Occlusion and temporomandibular disorders
Implants
Maxillofacial prosthetics
Other

Type of article

Methods and case reports
Reviews
Laboratory and in vitro studies
Clinical studies
Other

Geographic origin

North America
South America
Europe
Africa
Asia
Australia and New Zealand

Results

Growth and Content of the Prosthodontic Literature from the 1960s

The MEDLINE search using the term “prosthodontics” resulted in 66,600 articles (7,980 were published since 2000). Even if closer scrutiny of these publications revealed that many might be only weakly associated with prosthodontics, the number gives an impression of the abundance of written contributions related to the specialty. Adding “dental implants” to “prosthodontics,” resulted in 7,000 hits.

The prosthodontic literature expanded rapidly from the 1960s, reaching a peak in 1990 and decreasing gradually since then (Fig. 1). The reduction during the last three 5-year periods was compensated by an increase in the literature related to implant prosthodontics. The proportion of clinical studies showed a steady increase from less than 1% of all prosthodontic articles during the first two 5-year periods (1966 to 1975) to 13% during the last period examined (since 2001).

Articles in 5 of the subject areas were divided into decades starting from 1966; the last period is not a full decade (Fig. 2). Articles on removable prostheses were most numerous from 1976 to 1985, after which a substantial decrease occurred. The number of articles on implant prosthodontics was diminutive until 1985, but increased dramatically thereafter. The number on temporomandibular disorders (TMD) was very large from 1986 to 1995

Table 1 Hierarchical classification of studies according to design type (modified from Downer and others¹⁸)

Satisfactory investigations

1. Randomized controlled trials
2. Non-randomized controlled studies
3. Longitudinal experimental clinical studies
4. Longitudinal prospective studies

Less satisfactory investigations

5. Longitudinal retrospective studies

Least satisfactory investigations

6. Cross-sectional studies
7. Reports consisting only of an abstract

(4,203 articles), but diminished after that. Among the subject areas, the fewest articles were on maxillofacial prosthetics; the total number was 283 with more than a third (98) published during the period 1996 to 2004.

Limiting the search to articles in English and studies related to humans and adults (19+ years) reduced the numbers, but the rapid growth in the total dental literature was evident (Fig. 3). Within these limits, publications in prosthodontics were increasing faster than those in periodontics.

Types of Studies

Variation in the validity and quality of studies is due to many factors, but the study design is usually considered to be crucial. One example of a hierarchical classification is given in Table 1. It is generally agreed that RCTs provide the most reliable basis for evaluating the effectiveness of treatment interventions. However, the number of RCTs in prosthodontics is limited,¹⁰ and when they are available, they are often incomplete in reporting essential details of methods and conduct.⁷ Inadequate quality of RCTs is not specific to prosthodontics, but found for all dental specialties as well as in medicine, and there is no significant correlation between the quality of RCTs and the journal impact factor or the source of funding.⁶ Surprisingly, the percentage of RCTs from 1969 to 1999 was higher in dental than in medical research, 5% and 1%, respectively.⁵ This may partly be explained by the larger proportion of nonclinical fields in medical research.

The search for prosthodontics articles limited to “randomized controlled trial” resulted in 803 hits, of which the great majority (634) were published after 1996. Also, when limiting the search as mentioned above (English, human, adult), this trend persisted, with both clinical studies and RCTs increasing dramatically during the period of interest. There were more RCTs and clinical trials in implant prosthodontics than in any of the other subject areas (Fig. 4).

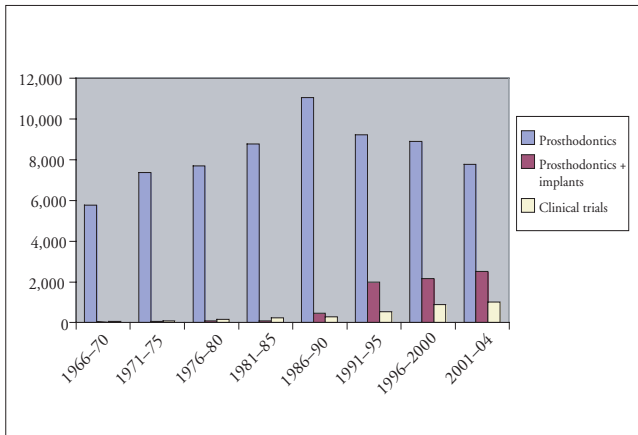


Figure 1: Number of articles on prosthodontics, prosthodontics plus dental implants and articles limited to clinical trials in prosthodontics in 5-year periods from 1966 according to a MEDLINE search in April 2004. (Note: last period is only 3.3 years.)

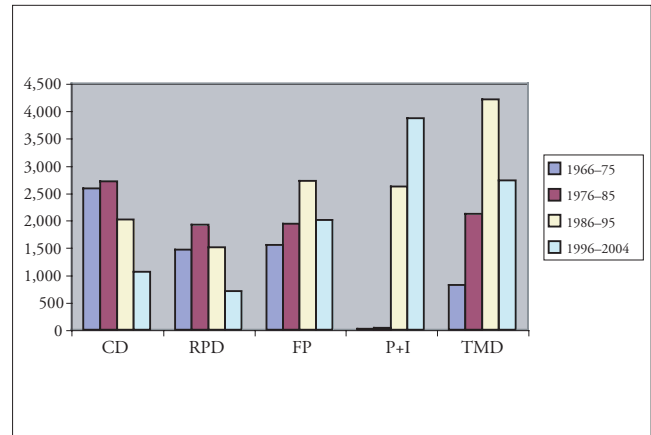


Figure 2: Number of articles in 5 prosthodontic subject areas in 10-year periods from 1966. (Note: last period is 8.3 years.) CD = complete dentures, RPD = removable partial dentures, FP = fixed prosthodontics, P+I = prosthodontics and dental implants, TMD = temporomandibular disorders.

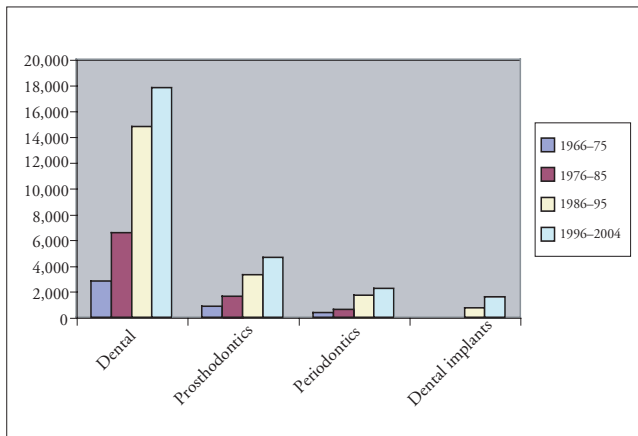


Figure 3: Distribution over time of number of hits in 4 dental subject areas when limiting the MEDLINE search to articles in English and studies of adult humans (19+ years).

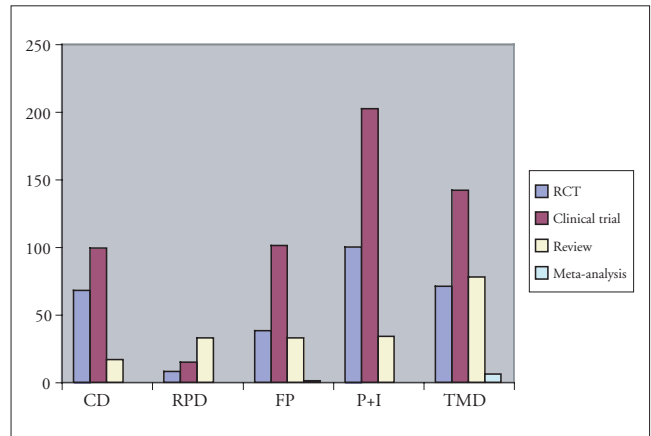


Figure 4: Number of articles published after 1966 in 5 prosthodontic subject areas by type. CD = complete dentures, RPD = removable partial dentures, FP = fixed prosthodontics, P+I = prosthodontics and dental implants, TMD = temporomandibular disorders, RCT = randomized clinical trial.

Reviews of Prosthodontic Literature

The practical impossibility of perusing huge numbers of articles has made literature reviews popular. The clinical dentist who cannot devote hours to studying often conflicting results in journal articles may appreciate a good literature review, which can offer the reader an interpretation of published results in a condensed way. One review indicated that the development of new methods and materials has complicated the treatment planning process.¹¹ A few decades ago, the prosthodontic literature usually recommended one accepted treatment for any particular condition. Today, there are many alternatives, including nontreatment. An example of such a change in treatment strategy is the shortened dental arch concept,¹² which was first met with much skepticism, but is now well documented and accepted by many dentists.¹³

Many reviews can be questioned, as the criteria for article selection are often not described and may, therefore, be author-biased. Systematic reviews have been suggested as a possibility to extract the best evidence from the literature and guidelines for their conduct have been developed.^{4,8,9} The increase in systematic reviews in dentistry is welcome, but their quality could be improved.⁹

A meta-analysis is a review in which statistical analysis is used to integrate data from independent studies. It may be of great value when properly conducted, but misleading when used inadequately.^{14,15} In a systematic review of systematic reviews⁸ of prosthodontic clinical studies with designs other than RCTs, 13 meta-analyses or systematic reviews could be included. Two pairs of reviews were identified as dealing with comparable items: longevity data for conventional fixed partial dentures (FPDs); and survival data for single-tooth implants. The pooled survival

outcomes within each pair were almost identical (approximately 90% survival of conventional FPDs after 10 years, 75% after 15 years compared with 95% survival of single-tooth implants after 4 years). The conclusion was that the conclusions of the reviews may be used as prognostic data, but not for direct comparison of treatments, as they were not based on RCTs.

An extensive review of the prosthodontic literature to the end of 2000 identified 92 RCTs covering a wide spectrum of study hypotheses, topics and issues within various domains.⁷ However, the reports were generally of poor quality in terms of methods. This indicates that there is a lack of sound evidence on a number of common procedures in the specialty, e.g., as listed by the authors: differences between impression materials, alloys, cements, occlusal adjustments, ceramics and temporization.

The situation is similar in implant dentistry. More than 220 implant brands have been identified. They are produced by about 80 manufacturers, who often claim superiority of their own products. A review¹⁶ assessing evidence for a relation between characteristics of dental implants and clinical performance concluded that the literature does not provide any clear directives regarding the alleged benefits of specific morphologic characteristics of dental implants.

A Cochrane review¹⁷ of evidence for possible differences between osseointegrated implants loaded at different times identified only 3 RCTs suitable for inclusion in the analysis. The review concluded that although it is possible to successfully load oral implants immediately after their placement in mandibles of adequate bone density and height, it is yet unknown how predictable this approach is.

A general finding in recent systematic reviews is that only a small number of published studies, including RCTs, are suitable for inclusion in analyses. Improved quality of study design and reporting of results are needed.^{8,14,16-19} Another problem is that only a small number of reviews (19%) demonstrate an attempt to identify all relevant studies.⁹

International Journal of Prosthodontics, 1988–2003

IJP was launched in 1988 to be a truly international publication presenting news — not history — of relevance to all sectors of prosthodontics. The expected dominance of contributions from the United States was balanced by the goal to ensure that at least 25% of the articles in each issue would be submitted from outside North America. This was barely achieved in the first volume in which 28 (72%) of the 39 articles came from the United States and 11 (28%) emanated from outside North America. Gradually, the dominance of North American submissions weakened, and during the last few years fewer than 15% have emanated

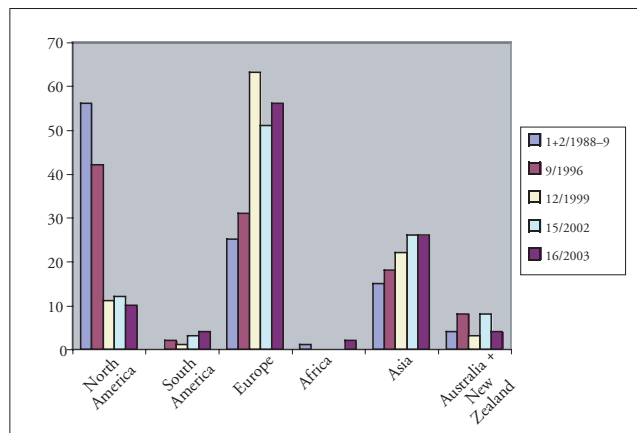


Figure 5: Geographic distribution of articles published in 5 volumes of *International Journal of Prosthodontics*.

from North America, whereas about half have been of European origin and a quarter of Asian origin (Fig. 5).

Substantial changes have occurred in subject areas and types of articles published (Table 2). The share of articles on removable prostheses has decreased in favour of investigations on fixed and implant-supported prostheses. Most evident is the marked decrease in descriptions of methods and case reports: from a third of the articles in the first 2 volumes to single reports in the last 2 volumes. Scientific material has increased over the years, and in volume 16 (2003) clinical studies became the dominant type of article. By adding the subtitle “Management of patients’ oral rehabilitative needs,” the new *IJP* editor-in-chief, Dr. Zarb, has put further emphasis on clinical research.²⁰

Textbooks

A search in the British library catalogue revealed 42 books with “prosthetic dentistry” in the title, only 4 of which were published after 1993. Books including “prosthodontics” in the title numbered 125, of which almost 40% were published in the last decade. It is obvious that prosthodontics has become the dominant term for the specialty worldwide. However, many more books would appear if other terms related to prosthodontics were added to the search, such as complete and removable partial dentures, implant-supported prostheses, etc. An example of another field of interest to prosthodontics with enormous growth potential is esthetic dentistry. The 2004 catalogue of Quintessence books and multimedia lists 76 books, of which 15 contain the word esthetics in the title and another 14 have chapters on esthetic aspects of restorative procedures.

Prognosis for Future Development of the Prosthodontic Literature

“To make a prognosis is difficult because nobody knows what will happen” (unknown thinker). Not many foresaw

Table 2 Percentage distribution of articles in the *International Journal of Prosthodontics* with respect to topic and type, in selected volumes, 1988 to 2003

	Volume (year)			
	1 (1988) + 2 (1989) ^a n = 108	9 (1996) n = 65	12 (1999) n = 65	16 (2003) n = 101
Topic				
Dental materials	35	35	22	23
Removable dentures	25	8	17	14
Fixed prosthodontics	11	25	17	27
Occlusion and TMD	11	5	8	6
Implants	5	17	22	25
Maxillofacial prosthetics	3	2	6	4
Other	9	9	8	2
Type of article				
Methods and case reports	32	11	8	1
Reviews	16	3	6	1
Laboratory and in vitro studies	33	60	46	39
Clinical studies	17	25	31	55
Other	2	2	9	5

TMD = temporomandibular disorders

^aVolumes 1 (1988) and 2 (1989) are combined as volume 1 comprised only 3 issues.

the latest stock market crash, the rapid fall of the iron curtain and the Berlin wall, the September 11 attack and other spectacular events that not even well-educated specialists prognosticated. Thirty-eight years ago, almost no one predicted the enormous development in implant dentistry with its profound influence on prosthodontics. The future is largely unpredictable, but interesting to discuss. A few people may master the art of prophesy, and Dr. George Zarb, might be one. He published his first implant-related paper in 1972,²¹ and 10 years later he helped open the eyes of North American academia to the possibilities of osseointegration by arranging the Toronto conference in 1982.²² Something equally revolutionary might occur in dentistry during the next 38 years and involve dramatic changes in the prosthodontic clinic and literature.

The Internet is changing traditional methods of disseminating information through journals and books. It has been suggested that digital publishing will change the forms of scientific communication as much as the art of printing did. Many journals are already available online in addition to the paper version, but some people believe that electronic journals will gradually replace printed ones. The number of journals that present their material free and in full-text format is also growing. This sounds attractive, but may also entail problems and risks, such as a weakening of the peer review system due to the striving for more rapid publication. Another risk is publishers' aspiration to publish articles that will attract attention in the mass media rather than in the scientific community.

Some librarians and researchers have created a network because they consider that the publishing system is no

longer working satisfactorily.²³ One reason for the dysfunction is the dramatic increase in the price of scientific journals, which has resulted in barriers that restrict access to information. These barriers have led to the initiation of new forms of publishing, evaluation and financing, such as open e-print archives and open-access journals. This concept is growing rapidly and several research-funding organizations support open-access publishing. In March 2004, representatives from not-for-profit medical and scientific societies and publishers in the United States announced their commitment to providing free access and wide dissemination of published research findings.²⁴ The declaration was signed by 48 not-for-profit publishers, over 600,000 scientists and clinicians and more than 380 journals. It is said to provide the "middle ground" in the heated debate between those who advocate immediate unfettered online access to medical and scientific research findings and advocates of the current journal publishing system.

Discussion

Available electronic databases, such as MEDLINE with worldwide coverage of dental and medical scientific journals, offer extensive lists of publications to anyone searching specific areas of research. However, the lists must be further selected according to strict criteria for practicable assessment and analysis.^{1,15,18}

All studies labelled RCT may not be of adequate quality either for study design or reporting of results. It may be of some comfort to prosthodontists that most RCTs in all fields of dentistry as well as in medicine demonstrate poor

quality in the reporting of methodology and trial conduct.⁶ Practically all systematic reviews have concluded that there is a need for better planning and design of studies and stricter presentation of results according to current recommendations.^{6,7,9,16-19}

As in other areas of prosthodontics, many questions remain to be answered through proper research on implant-supported prostheses. This dilemma has been commented on in the following way: "If prospective, controlled clinical trials are required to answer these questions, they will never be answered; the questions are too many, too complex, and maybe too expensive to answer in this way."²⁵ This may seem somewhat pessimistic, but it is probably a realistic view, and we may need to rely not only on RCTs, but also on a careful analysis of other types of studies.⁸

Electronic publishing and free access to scientific results will undoubtedly continue to develop rapidly and also have an important influence on the prosthodontic literature. Even if the forms change, we can hope that the quality of published materials will improve. There is an abundance of topics for investigation, as so many everyday clinical procedures lack strong evidence. A conference in Toronto in November 2002 on biological and social interfaces in prosthodontics, organized by Drs. Zarb, MacEntee and Anderson, identified a great number of issues representing what we do not know but would be important to know.²⁶ Research strategies for finding out what we need to know were also proposed. Therefore, people associated with prosthodontics will have an interesting future in research, and publishing the results may become an exciting adventure in the rapidly changing world of scientific communication. ♦



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References

- Anderson JD. Need for evidence-based practice in prosthodontics. *J Prosthet Dent* 2000; 83(1):58-65.
- Anderson JD, Zarb GA. Evidence-based dentistry: prognosis. *J Prosthet Dent* 2000; 83(5):495-500.
- Esposito M, Worthington HV, Coulthard P. In search of truth: the role of systematic reviews and meta-analyses for assessing the effectiveness of rehabilitation with oral implants. *Clin Implant Dent Relat Res* 2001; 3(2):62-78.
- Needleman I. Is this good research? Look for CONSORT and QUORUM. *Evid Based Dent* 2000; 2(3):61-2.
- Sjogren P, Halling A. Trends in dental and medical research and relevance of randomised controlled trials to common activities in general dentistry. *Acta Odontol Scand* 2000; 58(6):260-4.
- Sjogren P, Halling A. Quality of reporting randomised clinical trials in dental and medical research. *Br Dent J* 2002; 192(2):100-3.
- Jokstad A, Esposito M, Coulthard P, Worthington HV. The reporting of randomised controlled trials in prosthodontics. *Int J Prosthodont* 2002; 15(3):230-42.
- Creugers NHJ, Kreulen CM. Systematic review of 10 years of systematic reviews in prosthodontics. *Int J Prosthodont* 2003; 16(2):123-7.
- Glenny AM, Esposito M, Coulthard P, Worthington HV. The assessment of systematic reviews in dentistry. *Eur J Oral Sci* 2003; 111(2):85-92.
- Dumbrigue HB, Jones JS, Esquivel JF. Developing a register for randomised controlled trials in prosthodontics: results of a search from prosthodontic journals published in the United States. *J Prosthet Dent* 1999; 82(6):699-703.
- Rich B, Goldstein GR. New paradigms in prosthodontic treatment planning: a literature review. *J Prosthet Dent* 2002; 88(2):208-14.
- Kayser AF. Shortened dental arches and oral function. *J Oral Rehabil* 1981; 8(5):457-62.
- Sarita PT, Witter DJ, Kreulen CM, Matee MI, van't Hof MA, Creugers NH. Decayed/missing/filled teeth and shortened dental arches in Tanzanian adults. *Int J Prosthodont* 2004; 17(2):224-30.
- Kreulen CM, Creugers NHJ, Meijering AC. Meta-analysis of anterior veneer restorations in clinical studies. *J Dent* 1998; 26(4):345-53.
- Jokstad A. Evidenced-based medicine applied to fixed prosthodontics. In: Carlsson S, Nilner K, Dahl BL, editors. A textbook of fixed prosthodontics. The Scandinavian approach. Stockholm: Gothia; 2000. p. 330-49.
- Jokstad A, Braegger U, Brunski JB, Carr AB, Naert I, Wennerberg A. Quality of dental implants. *Int Dent J* 2003; 53(6 Suppl 2):409-43.
- Esposito M, Worthington HV, Coulthard P. Interventions for replacing missing teeth: different times for loading dental implants. In: The Cochrane Library, Chichester, UK: John Wiley & Sons Ltd.; 2003; issue 4.
- Downer MC, Azli NA, Bedi R, Moles DR, Setchell DJ. How long do routine dental restorations last? A systematic review. *Br Dent J* 1999; 187(8):432-9.
- Creugers NHJ, Kreulen CM, Snoek PA, de Kanter RJ. A systematic review of single-tooth restorations supported by implants. *J Dent* 2000; 28(4):209-17.
- Zarb GA. Toward a new direction for the IJP. *Int J Prosthodont* 2004; 17(2):129-30.
- Zarb GA, Melcher AH, Smith DC. Cementation of dental implants: rationale and preliminary observation. *J Can Dent Assoc* 1972; 38(9):328-32.
- Zarb GA. Introduction to osseointegration in clinical dentistry. *J Prosthet Dent* 1983; 49(6):824.
- Scientific communication. Lund, Sweden: Swedish Resource Centre for Scientific Communication. Available from: URL: www.sciecom.org. (Accessed March 28, 2005)
- Washington DC. Principles for Free Access to Science. Bethesda: United States. Available from: URL: www.dcprinciples.org. (Accessed March 28, 2005)
- Taylor TD. Research directions in implant prosthodontics. *Int J Prosthodont* 2000; 13(4):270-1.
- Zarb GA, MacEntee M, Anderson JD, editors. On biological and social interfaces in prosthodontics. *Int J Prosthodont* 2003; 16(Spec Suppl):7-90.