Scientific composition and review of manuscripts for publication in peer-reviewed dental journals

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This article provides an extensive tutorial for writers and reviewers involved with the preparation and evaluation of manuscripts submitted for publication in dental journals. The contents were compiled from the Instructions for Authors printed in various peer-reviewed dental journals and from feedback from 10 workshops conducted for the Editorial Review Board of the *Journal of Prosthetic Dentistry.* The 10 major sections of a scientific manuscript are reviewed in detail in terms of content, format, and common errors; examples of good content are provided. The review process is described, and instructions on conducting fair and expeditious manuscript evaluations are provided for reviewers. In addition, a number of special topics are addressed, including potential conflicts of interest for an author, institutional review of experiments that involve human subjects or animals, and the reproduction of photographs and other images in color versus black and white. In summary, this article presents key guidelines to ensure compliance with the principles of sound scientific writing and the expeditious review of manuscripts prepared for publication in peer-reviewed dental journals. (J Prosthet Dent 2003; 89:201-18.)

Scientists have a strong penchant for testing and collecting data in the laboratory, yet the vast majority of that information is never reported publicly. According to current estimates, only about 5% of all scientific information is formally printed in peer-reviewed publications.[1] One reason for this limited dispersal is that some information may be scientifically flawed or technically incomplete. The most prevalent reason, however, appears to be that many scientists have difficulty writing effectively or understanding the submission and review process for peer-reviewed journals.

Reviewing and writing are different faces of the same coin: the manuscript. Understanding the process from either point of view provides invaluable insight into the other. The objective of this article is to provide a detailed set of guidelines for writers and reviewers to facilitate their work. The guidelines were compiled from the Instructions for Authors printed in various peer-reviewed dental journals (Table I), as well as feedback from 10 workshops conducted for the Editorial Review Board of the *Journal of Prosthetic Dentistry.*

OVERVIEW OF MANUSCRIPT DEVELOPMENT

Manuscript categories

Most journals include a wide range of published material. The specific manuscript categories established by the *Journal of Prosthetic Dentistry* are listed in Table II. A more general range of categories is listed below, with a brief explanation of each. The most common manuscripts are laboratory or clinical research investigations. Research manuscripts receive the most attention in the remainder of this article.

Clinical research investigation (and meta-analysis). Investigator-initiated clinical research that includes an objective that can be presented as a testable hypothesis. Typically, a clinical research investigation tests the safety and efficacy of a product, treatment, or clinical procedure.

Laboratory research investigation. Investigator-initiated laboratory research that includes an objective that can be presented as a testable hypothesis.

Epidemiologic research investigation. Investigator-initiated epidemiologic research that includes an objective that can be stated as a testable hypothesis. The work is generally focused on a target population of patients, patient outcomes, diseases, patterns of health care problems, or other indicators of patient trends.

Review article. Well-formulated review of procedures, materials, techniques, or clinical problems. The review is not just a summary of past studies, but a critical review of their results and possible limitations. The review should be unbiased and detailed enough to support all statements of fact with scientific evidence.

Clinical report. A record of the procedures performed in a challenging treatment plan and the immediate outcomes for a single patient or limited group of patients. As one article, a clinical report has restricted value. However, it is possible to glean early trends from a group of similar reports.

Dental procedure or technique. Description of a new or modified technique that has the potential to save time, increase accuracy, avoid routine problems, or provide better clinical results than the standard tech-

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Table I. Comparison of features of 18 well-known dental journals

Journal abbreviation (publisher or journal website)	Requirements for Structured Abstracts							Limit on authors	Citation method	1998 SIF*
	Objective	Introduction	Material and methods	Results	Conclusion	Significance	Words			
J Prosthet Dent www.us.elsevierhealth.com	XXX	XXX	XXX	XXX	XXX	XXX	<250	≤4	Vancouver style	0.829
J Dent Res jdr.iadrjournals.org	XXX	XXX	XXX	XXX	XXX	—	~150	None	~Vancouver style	4.060
Dent Mater www.us.elsevierhealth.com	XXX	—	XXX	XXX	—	XXX	<250	None	~Vancouver style	1.434
Am J Dent www.amjdent.com	XXX	—	XXX	XXX	—	XXX	None	None	Vancouver style	1.135
J Dent www.us.elsevierhealth.com	XXX	—	XXX	XXX	XXX	—	<250	None	Vancouver style	1.104
J Am Dent Assoc www.ada.org	XXX	—	XXX	XXX	XXX	XXX	<240	None	Vancouver style	—
J Biomed Mater Res www3.interscience.wiley.com	(XX)	—	(XX)	(XX)	(XX)	—	<200	None	Vancouver style	1.755
Quintessence Int www.quintpub.com	XXX	—	XXX	XXX	XXX	—	<250	None	Vancouver style	—
Oper Dent www2.iusd.iupui.edu/jopdent/	(XX)	—	(XX)	(XX)	(XX)	—	None	None	Special style	0.972
J Esthet Restor Dent www.bcdecker.com	XXX	XXX	XXX	XXX	XXX	XXX	<250	None	Vancouver style	—
Crit Rev Oral Biol Med crobm.iadrjournals.org	(XX)	—	(XX)	(XX)	(XX)	—	<250	None	~Vancouver style	2.478
J Adhes Dent www.quintpub.com/	XXX	—	XXX	XXX	XXX	—	<250	None	Vancouver style	—
Clin Oral Investig link.springer.de	XXX	—	XXX	XXX	XXX	—	<200	None	~Vancouver style	—
J Prosthodont www2.jprosthodontics.org	XXX	—	XXX	XXX	XXX	—	<350	None	~Vancouver style	—
Eur J Oral Sci www.blackwellmunksgaard.com	(XX)	—	(XX)	(XX)	(XX)	—	<200	None	Vancouver style	1.283
J Endod www.jendodon.com	(XX)	—	(XX)	(XX)	(XX)	—	<150	None	Index Medicus	0.731
Biomaterials www.elsevier.com/locate/biomaterials	—	—	—	—	—	—	<200	None	Vancouver style	1.817
Caries Res content.karger.com	—	—	—	—	—	—	~150	None	~Vancouver style	1.283

XXX, Required in abstract; (*XX*), implied as necessary for abstract; *~Vancouver style,* approximates Vancouver style for reference citation but does not follow exactly.

*ISI scientific impact factor (ranging from 0.000 to approximately 90.000) as published for 1998. Journals that do not have sufficient publication history or that are infrequently cited may not be included in the determination of an SIF.

nique(s). References should be used to support statements of fact but otherwise are not expected unless the author is trying to standardize the procedure.

Educational technique. Review of new or novel teaching strategies, programs, or topics in undergraduate, graduate, or continuing dental education that deserve public dissemination.

The writer-reviewer relationship

Many authors have composed only a few manuscripts. In spite of such limited experience, each author imagines his/her submission as "finished." Reviewers in the service of a peer-reviewed journal may not agree. If not carefully phrased, many of the comments made by

Table II. Types of articles accepted by the *Journal of Prosthetic Dentistry*

Research/clinical science article
No longer than 10-12 pages and accompanied by no more than 12 high-quality illustrations.
Structured abstract provides adequate overview of study and actual results.
Research problem is explained completely and accurately. Relevant literature is summarized, and any bias in previous studies is identified. Research objective is clearly stated at the end of the Introduction.
Research method and materials are fully described so that others can duplicate the experiment and judge its validity.
Results are reported accurately and briefly.
Findings are discussed in relation to the research hypothesis, to previously published results, and to generally accepted standards.
Limitations of the study are identified.
Conclusions are drawn within the limitations of the study.
Clinical report
No longer than 4-5 pages and accompanied by no more than 8 high-quality illustrations.
Nonstructured abstract briefly summarizes a patient treatment challenge and the methods employed to resolve it.
Literature relevant to the problem is summarized in the Introduction.
Particular problem and the author's approach to it are described in detail. Alternate methods are identified, and a rationale is provided for selection of the chosen treatment.
Advantages and disadvantages of the chosen treatment are described.
Dental technique article
No longer than 4-5 pages and accompanied by no more than 8 high-quality illustrations.
Nonstructured abstract briefly summarizes the proposed technique.
Relevant literature, including reports on standard methods and protocols, is summarized in the Introduction.
New or improved technique is presented in a numbered, step-by-step format.
Advantages and disadvantages of the technique are identified, and alternate situations in which it may be applied are described.
Literature review
Accurate and critical review of published research on a particular area of interest in dentistry.
Thorough documentation is provided through the citation of references.
Tips from our readers
Limited to 2 authors, 250 words, and 2 high-quality illustrations.
Helpful or time-saving procedure is briefly described.

reviewers may be interpreted as extreme criticism, no matter how justified or thoughtful these comments may be. Reviewers should see their task as trying to help authors become better scientific writers. Authors who are convinced that reviewers are on their side are likely to respond quickly and positively to any review.

In a similar manner, authors should think of reviewers as well-meaning and helpful. The writer-reviewer relationship will remain fruitful if authors respond to constructive criticism in a dedicated way. Moreover, authors can show respect to the reviewers in advance by carefully reading and following the guidelines published in the target journal's Instructions for Authors section. Compliance with these guidelines can greatly facilitate the review process.

General recommendations for writers

Although most articles submitted to dental journals have some stated clinical significance, it may be so low as to not justify publication of the article. It is common for editors to ask, "What is the relative importance (scientific and clinical) of this manuscript on a scale from 1 to 10?" A quote attributed to Will Rogers,[2] "There is nothing worse, than doing something well, which never should have been done." The fact that research has been conducted does not guarantee that it has any underlying importance. Make sure that the opposite is true of your work before you begin manuscript development in earnest.

The following 3 components should be part of any plan for writing an article: (1) an outline, (2) figures and tables, and (3) a writing schedule. When all components receive adequate attention, most authors can complete the first draft of a manuscript relatively quickly.

Outline. Prepare a 1-page outline (30 to 40 lines of organized material) that will serve as the framework for the draft. This outline should include all components deemed important in the submission guidelines of the target journal.

Illustrations and tables. Compose key figures and tables (which should concisely present information but not directly duplicate the text) before you start writing. These elements may evolve during the writing process and others may be added, but you need the initial figures and tables to focus your efforts.

Writing schedule. Estimate the amount of time that it will take to write the manuscript, and set a deadline for completing the process. Generally, a manuscript draft can be completed in 1 day. If you allow yourself 2 to 3 days, make sure that you isolate times of 1 hour or more

and determine what you expect to accomplish during those periods. Otherwise, the process will be terribly inefficient, and you may find yourself abandoning it out of frustration.

Where to start. Generally, the order of composition should follow the standard organization of the manuscript: title and authors, abstract, introduction, material and methods, results, discussion, summary and conclusions, acknowledgments, references, and figures and tables. The exceptions are that you should start with the key figures and tables already composed, and you may find it easier to write the abstract after the rest of the draft is complete. An alternative approach is to create a presentation of the findings first, then work to fill out the rest of the outline.

Instructions for authors. Although each journal has slightly different Instructions for Authors, some basic principles apply across the field. Unless your target journal indicates otherwise, consult the American Medical Association guidelines for style, use passive rather than active voice, avoid the use of first person, describe teeth by name rather than number, and spell out numbers that begin a sentence. Always support statements of fact with evidence-based references. Carefully review any formatting guidelines provided by the target journal, particularly those related to references. For maximum efficiency, keep a copy of the Instructions for Authors handy while you compose the manuscript. Although your initial aim might be simply to get words on paper, your final draft should fully comply with all instructions and requirements outlined by the target journal.

Writing the first draft. Create an electronic version of your outline. Expand each line of your notes into a full paragraph. As stated above, it is often better to write the abstract last. At the end of this process, you will have completed Draft 1. Most manuscripts go through 3 drafts before submission.

Revising your drafts. Distribute Draft 1 to your coauthors for comments; incorporate their suggestions and edits to create Draft 2. Distribute Draft 2 to your coauthors and to at least 1 other individual not involved in the project; incorporate their suggestions and edits to create Draft 3. Pay particular attention to the comments of the uninvolved individual, because that person should indicate how easily a layperson would understand the subject, experiment, and clinical meaning. If English is not your native language but your target journal is published in English, ask or employ someone with expertise in English and scientific writing to assist you with Drafts 2 and 3. Both you and the expert should review recently published articles in the target journal to ensure that your work meets the content and formatting standards.

Submitting the manuscript. Follow the Instructions for Authors in the target journal. Typically, multiple copies of the manuscript with figures and tables are required, along with these supplementary materials: a copyright statement that transfers publication rights to the publisher; a statement that discloses whether illustrations have been modified in any way; a statement that discloses any author interest in or affiliation with a manufacturer or specific product; permission statements for direct quotations, tables, and illustrations that previously appeared in copyrighted material; and statements of permission from persons who can be identified in illustrations that accompany the article. Most journals insist that both hard copy and electronic versions of the primary manuscript materials be submitted. Be sure to include a cover letter that documents the date of submission. If important figures have been made into photographic prints, protect the prints with stiff backing and mark the mailing envelope to prevent damage. If the manuscript refers to references "in press," include accepted copies of the references in question with your submission.

MAJOR COMPONENTS OF A RESEARCH MANUSCRIPT

There is a standard litany of components that are part of all published dental research articles. Although these are very similar from journal to journal, it is important that authors and reviewers check specific journal guidelines in advance. These guidelines are provided to ensure standardization of the peer-review process and the expeditious processing of manuscripts. Failure to follow the guidelines generally results in frustration for reviewers and authors, as well as delays in the review and publication process; it also may result in rejection of the manuscript.

Title

The title of a manuscript should be as revealing and precise as possible. There are 2 purposes here: First, the reader should be able to quickly discern the content of the article from the title. Second, the title should be as useful as possible for electronic database searches. Databases such as PubMed rely on text in the title and abstract to locate information. Titles that include both common words and specific details are recommended. Generally, editors do not restrict title length unless an excessive number of words (>25-30) is used; most good titles are 10 to 15 words long.

Ask a simple question about the title: Does it tell the reader which materials, tests, and time spans were involved in the experiment? If not, rewrite the title as needed to be more precise. Be sure to use the terminology recommended or approved by the target journal. For example, the *Journal of Prosthetic Dentistry* insists that authors consult and comply with the most recent edition of the *Glossary of Prosthodontic Terms.* Here, examples of weak titles are followed by improved revisions.

Original title: Mechanical properties of dental cements

Improved revision: Biaxial flexural strengths of 2 resin-modified glass ionomer versus 2 composite dental cements

The revised title specifies which tests and materials were used, but it also includes the general term "dental cements" for broad-based searching with online search engines.

Original title: Do composites completely polymerize in 1 cycle?

Improved revision: Degree of polymerization of 4 hybrid composites as a function of depth for a 20-second polymerization cycle with visible light

The original title is phrased as a question. Although this form may be acceptable for some journals, it limits the necessary presentation of detailed information in the title. The revised title indicates that degree of polymerization, not hardness or some other property, was measured. It also indicates the general class of composites tested, defines the length of polymerization, and specifies the type of polymerizing light used.

Original title: Literature review of glass-ionomer cement

Improved revision: Literature review of dental applications of glass-ionomer cement from 1980 to 2000

The revised title defines the limits of the review by clearly indicating that the primary focus is applications, not product properties or chemistry, for example.

Abstract

The abstract is what is published on MEDLINE. It should be brief but include enough information about the materials and experimental design that a reader searching the literature would be able to judge the article's validity and scientific merit. Most dental journals require a structured abstract for research and clinical science articles (Table I). The following abstract, fabricated as an example for a dental materials investigation of flowable composite, demonstrates the key features of good style. Note that some journals do not allow the use of abbreviations in the abstract.

Statement of problem. Compared with hybrid composites, flowable composites may have a lower degree of conversion (DC) from the unpolymerized to the polymerized state because of the use of pigments for coloration.
Purpose. The DCs of 3 representative contemporary flowable composite products were compared with each other and with the 1999 International Standards Organization (ISO) standard that requires at least 50% DC of a standardized specimen at 1.5-mm depth for a 20-second cycle of visible light-polymerization.
Material and methods. The DC of ISO standardized specimens fabricated from 3 flowable composites (AeliteFlow [AF], Flow-It [FI], and Filtek Flow [FF]) was tested with a Fourier Transform Infrared (FTIR) spectrophotometer. DC (as percent conversion) was measured as the ratio of integrated peak areas for the carbon-carbon double-bond peak before and after polymerization versus an internal control peak for carbon-oxygen double bonds. FTIR scans (n = 5 per composite specimen group) were run on the undersurface of ISO standardized discs, each 1.5 mm thick, after a 20-second polymerization cycle (intensity~600 mW/cm^2). One-way analysis of variance was used to compare percent DC among products ($P<.05$); the results also were compared with the ISO standard.
Results. DC values were as follows: AF = 49% ± 5%, FI = 48% ± 4%, and FF = 45% ± 7%. There were no significant differences among the flowable composites tested, and none met the ISO standard.
Conclusion. Within the limitations of this study, the flowable composites tested at a thickness of 1.5 mm did not display adequate DC to meet the ISO standard.
Clinical implications. For the materials and polymerization unit tested at 20-second light-polymerization cycles, 1.5-mm-thick specimens of flowable composite were underpolymerized.

The Purpose section clearly states the number of items tested and the method involved. The Material and Methods section describes the experimental testing and how the results were evaluated. The Results section provides specific data with standard deviations and expressions of the statistical analysis. The Conclusion section focuses on the significant results of this experiment only. The Clinical Implications section contains a clear interpretation of the impact of the results on clinical practice.

Introduction

Your goals for the Introduction section are as follow: (1) to identify the global area of research and produce some justification for the current effort, (2) to quickly "funnel" the topic down to the specific focus of the research while reviewing all pertinent literature that documents work in the area, and (3) to state the objective of the research in a clear and precise manner. ("Funnel" concept by James Bader, DDS, MPH, written communication, December 2, 2002.)

Justify your research. There are an infinite number of possible research topics. You must establish why your particular research is important to the general population. In many situations, the choice of topic can be justified with quotations of national priorities, task force decisions, economic impacts, or numbers of affected individuals.

Funnel the global topic to a specific interest. Do not waste time quoting extensive literature that is not directly related or of immediate interest to the current problem. Move quickly from the global problem to the

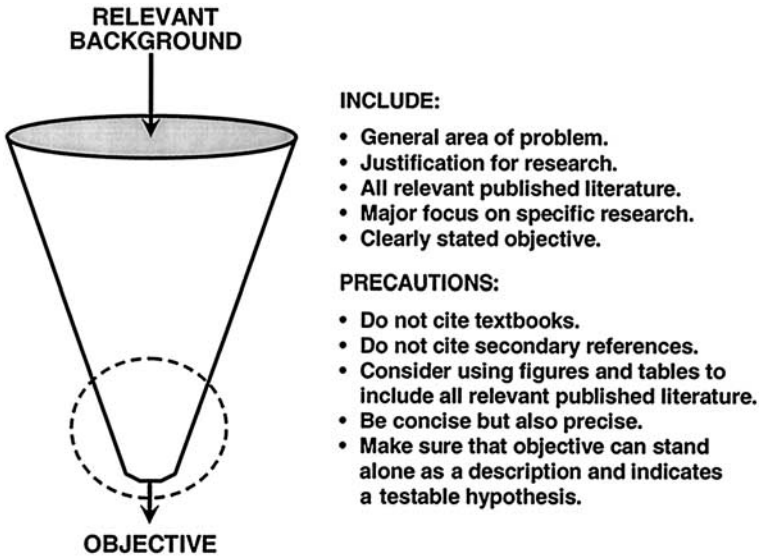


Fig. 1. Example of quickly funneling down comments in Introduction from global problem area to specific research problem of interest.

specific problem at the heart of your research (Fig. 1). Once you have transitioned to the specific problem, focus your energies on summarizing the pertinent literature. If a sizable number of references relate to the specific topic, then find creative ways to succinctly summarize the content. If necessary, organize the references into tables or place some of the content in an illustration. A good rule of thumb for the Introduction is to limit this section to no more than 2 pages (4-6 well-formed paragraphs).

A common error is the exclusion of key literature from the Introduction in favor of the Discussion section. This is unacceptable. All information should be presented in the Introduction to establish the background for the research objective. Pertinent literature may be referenced again later for a comparison of results.

State the research objective. The last statement in the Introduction section should be the research objective, which can be formulated as a simple sentence or a hypothesis. This statement essentially should be identical to the Purpose statement in the abstract. Be sure to state the number and type of items tested, the test methods used, and the key comparisons made. It is not sufficient to say that you "characterized" or "investigated" something; provide details. It also is not acceptable to say that tests were conducted without stating the standard or criteria by which the results were measured. Were the results compared with an ADA or ISO standard? Is a minimum value generally accepted by the profession? Has a target value been proposed as good or passable? Readers should be able to deduce the research methods from the objective statement. Examples of strong objective statements are provided here.

Example 1: In this study the short-term color stability of 3 new, small-particle versions of resin-modified glass ionomers was measured. A weatherometer was used to induce changes, which were recorded with a colorimeter.

Example 2: The objective of this research was to determine whether microprotection occurs with 2 new minihybrid composites designed to prevent food-bolus abrasion. Their resistance was measured with the Leinfelder wear apparatus for a simulated 3-year test cycle.

Example 3: This investigation examined the quantity and rate of absorption of Ca uptake by testing circulating Ca levels in the blood of human volunteers who had swallowed powdered samples of glass ionomer.

Material and Methods

Describe all experimental activities in the Material and Methods section. Because the details can be quite complex, it is customary to provide the reader with a short introductory paragraph that summarizes the information to come. A flowchart may prove helpful as well. A common error associated with Material and Methods is the inclusion of subheadings, which are almost always unnecessary and take up valuable space. Unless there is special justification for the use of subheadings, exclude them. In an extremely complicated or lengthy article (such as this one), subheadings help readers mark their place in the manuscript.

A special note on terminology: The terms *sample* and *specimen* are easy to confuse, but the distinction is important. *Sample* refers to the entire collection of objects or subjects; this term will be needed only once or twice in the typical manuscript. A *specimen* is the individual test unit. Even when all members of a group are mentioned, the proper term is *specimen*.

Adequate detail. Do not assume too much knowledge on the part of the reviewer or reader. The best approach, in fact, is to presume nothing. Provide enough detail that someone not skilled in the research area could follow your directions and repeat the experiment. Make sure that all details are documented either within the manuscript or in easily accessible published literature that will be available for a long time.

Materials used. Completely describe all materials. Provide the exact name of the product or raw material (Eugenol, CP 99.99%, for example), as well as the manufacturer's name and location (Mallinckrodt; Philadelphia, Pa.). Be sure to detail the purity, batch number, and expiration date. Do not say that "the manufacturer's directions were followed," because you cannot assume that the direction sheets or special technical bulletins will always be available and remain unchanged. Document the exact procedures that were implemented. You may wish to place descriptive information about the materials tested, including the manufacturers' directions for handling and manipulating them, in a table for easy reference.

Test methods or procedures. Describe the methods, procedures, and equipment in detail. This information should include the normal standards and controls for the procedures, the calibration procedures used to ensure standardization, and the reported precision and accuracy of all instruments. If you followed a standard or protocol, reference it and summarize the key details. Example: "Three-point flexure tests were conducted in accordance with ADA Specification #25, which requires that a $2 \times 2 \times 25$-mm beam be tested across a 20-mm support span and bent exactly in the middle of the beam." Always document the loading conditions, crosshead speed, and load cell range. The omission of important information could make it difficult for readers to interpret the experiment or results.

Temperature, humidity, pH, and time. Be explicit in regard to these subjects. Tell readers what temperature and relative humidity were used, how long the tests took, when the specimens were first tested, how often the water was changed, whether the water was deionized and distilled, what pH was used, how often the effect of dissolved carbon dioxide on acidity was checked, what volume of water was used in proportion to the volume of the sample, and so on.

Specimen preparation for microscopy. If microscopy was included in the experiment, inform readers of the equipment operation, whether the specimen was coated, what microscope type and accelerating voltage were used, what working magnifications were chosen, and what special precautions were taken to avoid artifact production in the high vacuum of the specimen chamber. For light and transmission microscopy, provide information about special stains used to reveal structural information and about instrumental conditions (such as contrast or brightness of the image) that may affect interpretation of the results.

Statistical design and analysis. At the end of the Material and Methods section, describe the statistical design and analysis. The design details should include planned comparisons, any power analysis performed to determine the number of specimens needed in each group, and the key hypotheses tested. The analysis details should include the specific statistical tests performed, level of significance established, and justifications for these particular choices. Some experiments involve computer models (such as finite element analysis) that have no associated variance. In this case, describe the models carefully and disclose all assumptions, boundary conditions, and parameter choices. Information about the computer hardware generally is not necessary.

Results

The shortest section of any manuscript should be Results. Present the facts without discussing them or editorializing. List the results in an order that matches the research objectives at the end of the Introduction and the description of testing in the Material and Methods section; do not start with results for the third objective, even if those results proved most interesting. Highlight the most important outcomes in the text, and make reference to figures or tables that contain the complete results as well as the statistical analyses. If no statistically significant differences were found, do not state that certain trends were apparent or that numerical differences were identified.

Use of figures and tables. Carefully decide the minimum number of tables and figures needed to clearly present the results. Do not make separate tables for every point that might be of interest. It is advisable to collate the results in a single table with logical sections that can be identified easily by readers. This saves space and permits readers to compare all results in one place, at one time. Never assume that related tables or figures will appear side-by-side in the printed publication. They may, in fact, be distributed across several pages to accommodate the layout templates used by the publisher.

Results versus experimental data. In most situations, it is appropriate to report only a summary of the experimental group values (mean values and standard deviations); individual data values are not needed. For example, do not provide a table listing of 10 specimens, their dimensions, and their calculated strengths. Instead, report the mean values and standard deviations for the groups, along with statistical comparisons (Table III).

Discussion

If fully developed, the Discussion may be the longest portion of the manuscript. This section should include

Table III, A. Example of unnecessary experimental results

Group	No.	Failure (kg)	Shear bond strength (MPa)
A	1	1.25	21.531
	2	1.73	29.825
	3	1.16	19.950
B	1	1.02	17.542
	2	1.16	20.054
	3	0.98	16.922

Raw data, such as values for individual samples, rarely need to be reported. Values reported should be reduced to the least number of significant digits (generally 3).

Table III, B. Example of necessary experimental results

Group	n =	Shear bond strength (MPa)
A	3	23.8 ± 5.3
B	3	18.8 ± 1.8

Summary of results for groups should be reported and statistically compared. Values reported should be reduced to the least number of significant digits (generally 3).
Not statistically different, P>.05.

references to the literature originally described in the Introduction, as well as evaluations and interpretations of the results. The Discussion may include supportive figures and tables not used elsewhere in the manuscript.

The Discussion section should comprise 5 major points: (1) a critical analysis of the experimental design, including any limitations of the study, data, or assumptions; (2) a comparison of the results to those reported in the existing evidence-based literature; (3) an interpretation of the results in terms of structure-property relationships and underlying mechanisms; (4) a definition of the clinical meaning of the results; and (5) a suggestion of future work or experiments that could build on the current results.

Analysis of experimental design. A common error is to ignore the frailties or potential problems in the current experiment and any impact these problems may have had on the outcomes. Ask yourself: Now that the experiment is over, what might have been done differently? What aspects of the design were problematic? Did the equipment work as expected? Were the results affected by uncontrolled factors? It is a strength, not a weakness, to point out the limitations of the study, any factors that may affect the interpretation of results, and considerations for future experiments.

Comparison of current and previously published results. Any literature associated with or of interest to the current presentation should first be cited in the Introduction and then mentioned in the Discussion as appropriate. Point out congruities and discrepancies between the current results and those published previously. Speculate on reasons for these similarities or differences. Could they be attributed to the experimental design, to advancements in product formulation, or to other factors? Be sure to note whether your results support or contradict generally held beliefs or principles.

Structure-property relationships. The composition of any materials or components involved in the experiment should be described in the Material and Methods section. Use that information in the Discussion to connect the results to the composition. This structure-property analysis is a key part of any scientific report; without it, the results are simply a product test without understanding. Be careful not to introduce secondary results in the Discussion to support the primary results. For example, it would be improper to refer *for the first time* to a scanning electron microscopy picture of a failed specimen surface to explain the structure-property supposition. All results must be presented initially in the Results section.

Clinical meaning. Regardless of whether the experiments were basic or applied, suggest the clinical meaning of the results. Why are the results important? How do they differ from currently accepted standards? How might they affect patient care or choice of treatment? Be specific, and include precautions. Results are often exciting but not as global in application as one would like. If you examined a very carefully controlled situation, preface your interpretations with phrases such as "within the limitations of this experiment" or "for populations similar to the one tested here." Opinions and generalizations are not acceptable unless they can be supported by the data.

Suggestions for future research. State what new directions for future experiments are indicated by the current results. What should be done next? Do not be afraid to suggest possible avenues of investigation; if the research is of special interest to you, there will be time to pursue it while your article awaits publication. Consider this an opportunity to convince others of the importance of the subject area and the need to investigate it further.

Conclusions or Summary

If your target journal requires a Conclusions section, limit it to statements that are substantiated by the statistical analyses and results of the present experiment. Do not include commentary or conjecture in the Conclusions, and do not mention the results of other studies.

It is prudent to begin with a precautionary statement or phrase that indicates the general limitations of the value of the work. Example: "Within the limitations of this study, the following conclusions were drawn." Be cautious about the generalizability of the conclusions. If you studied the longevity of implants in 40- to 60-year-old white men living in a rural culture, do not assume that equivalent results would be obtained for a similarly aged multicultural group of men and women in an intercity environment. If you studied retired people in

rural North Carolina, do not assume that the same results would be found for citizens of the California coast. If you studied caries activity for a fluoridated community in Maine, do not assume similar outcomes for a nonfluoridated community in Texas. Conclusions should be limited to the population and conditions of the study at hand. Finally, state only major conclusions at this point; do not reiterate small points from the results. The typical Conclusions statement will list 1 to 3 items of major importance and relate them to the initial research objective(s) or hypothesis(es). A Summary section is slightly different, in that it comprises a brief review of the research objective(s) materials, and methods, as well as the most important results.

Acknowledgments

Consider acknowledging the following groups at the end of your manuscript: (1) companies or corporations that donated materials or services for your research, (2) companies or institutions that provided grants/contracts in support of your research, (3) persons who provided statistical services or made other contributions to the preparation of the manuscript but received no compensation, and (4) mentors or advisors who provided organizational input or review free of charge. Succinctly acknowledge each contribution.

> *Example:* We thank 3M-ESPE, Kerr, and Dentsply for providing test materials; Dentsply for providing a small research contract; and UNC 3998 for assuming some of the research expenses. Dr John Smith performed all of the statistical analyses.

References

The list of cited literature (references) should represent the major published information, reflect recent contributions (do not skip the previous few years), reflect differences of opinion, and include only those key studies necessary to document points within the manuscript. For a typical manuscript (8-10 published pages), the reference list is normally 10 to 30 items long. References should be selected in accordance with 4 major rules: (1) use public information and cite original sources, (2) select appropriate examples, (3) distinguish results from opinion, and (4) properly document publication information.

Use public information and cite original sources. Do not cite unpublished manuscripts. If readers cannot access a document publicly, then it should not be used for support. The following items are unacceptable: submitted but unpublished manuscripts; internal documents that are not accessible through libraries; and information presented at meetings, symposiums, or conferences but not published in detailed abstracts or peer-reviewed conference proceedings.

Several other types of sources should be used sparingly, if at all. First, avoid citing abstracts from meetings or conferences; most are not strongly refereed. (Good meeting abstracts will be published as full-length articles.) Note that many journals, including the *Journal of Prosthetic Dentistry*, flatly reject the citation of abstracts unless full-length follow-up studies also are cited. Second, if your target journal is published in English, cite foreign-language references only when the original article has been translated into English. (Some journals accept foreign-language references when only the abstract is available in English). Third, cite theses and other unique documents only if public access to them exists. Most theses are copyrighted and retained by the University of Michigan Copyright Service; loaned copies are available on request. Finally, technical bulletins should be referenced only if they have been publicly distributed and the date or number of the document is available.

Always cite the original (primary) reference, not a secondary reference that simply acknowledges the original source. For example, if a particular statement in a book is referenced to an article published 20 years earlier, find the original reference and cite it; do not cite the book. If an author in one journal article refers to information in another journal, cite the journal that originally published the information. Be sure to actually read the original source.

Select appropriate examples. Recognize 1 or 2 key examples of the work under discussion, but do not list every citation available. Avoid excessive acknowledgment of your own published papers.

Distinguish results from opinion. Draw a clear distinction between published opinion (comments or discussion) and actual results. To document previously published results that statistically support a point in your own manuscript, cite the article in which the results first appeared, and report them in adequate detail. If you are referencing an author's opinions, overtly say so.

> *Example (results)*: Bayne et al[21] demonstrated that the number of published articles was significantly greater in 2003 (n = 770) than in 2000 (n = 650) ($P \leq .05$).

> *Example (opinion)*: Bayne[21] proposed that the number of articles published in 2003 was a direct result of the increased emphasis on publish-or-perish philosophy in dental schools.

Properly document publication information. Throughout the 220+ major dental journals, there are numerous styles of reporting references to the literature. The style generally is chosen by the editor or publisher of each journal. Since the early 1990s, there has been a strong push toward universal reporting of references. An international conference of editors and publishers is constantly considering styles for all aspects of publishing across all disciplines of science; their goals are precision and efficiency. Currently, the most widely accepted method for reporting scientific references is Vancouver style. The Vancouver method is precise and concise. It

attempts to eliminate unnecessary punctuation and journal information, which helps publishers meet their ever-present goal of space conservation.

To comply with Vancouver style, follow these rules: Cite all authors by last name followed by first and middle initials without periods. Separate each author entry with commas; do not use the term "and" before the last author's name. End the author listing with a period. Cite the title of the article in sentence style: Capitalize the first word, and use lowercase letters for all other words thereafter, unless the title contains a proper noun or 2 or more phrases separated by periods. Cite the journal name in italics, using the accepted abbreviation. (Note that the *Journal of Prosthetic Dentistry* modifies this style by eliminating the italics.) List the year, volume, and pages of publication without spacing; separate the year and volume with a semi-colon and the volume and page numbers with a colon. Do not include the issue number or date unless the page numbers do not run continuously across volumes within a year. Report the inclusive page numbers in shortened form, without repeating numbers common to each end of the span (124-6 instead of 124-126, for example). Conclude the citation with a period.

Example: Bayne SC, Thompson JY, Swift EJ. Literature review of dental materials for the years 2002-2003. *Am J Dent* 2003;15:126-35.

To document Internet-based information, provide the author or source name, the title of the specific page or document, the URL, and the date on which you accessed the site. A major responsibility of authors is to cite the literature without errors. This is vastly easier today than just a few years ago because of digital access to PubMed. Look up each citation as part of your proofreading exercises; otherwise a tainted reference list will become part of the record. Errors in the reference section may suggest that you also introduced errors in the main research report.

Tables and illustrations (figures)

In any manuscript, one major effort is the production of quality tables and figures. They take time to compose and perfect, which means that at least 50% of the overall effort that you expend on your manuscript may be devoted to figures and tables.

Captions (table titles and figure legends). Every table and figure requires a well-composed caption that is simple, succinct, and focused. Table titles should be relatively short but revealing. Present any explanatory information in footnotes to the table.

Bad examples
Table #. Products
Table #. List of results for 3 composites tested versus controls at 1 day for wear testing in the laboratory
Table #. Wear results

Good examples
Table #. Implant names, types, dimensions, and manufacturers
Table #. Summary of manufacturer information on products tested
Table #. Summary of wear results for all systems and all recalls
Table #. Wear simulator results* for hybrid versus microhybrid composites
(An asterisked footnote would include information about wear testing, such as the number of cycles, measurement units, etc.)

Figure legends should contain a title and explanatory information about the key parts, abbreviations, magnification, or other features of the illustration, graph, or chart.

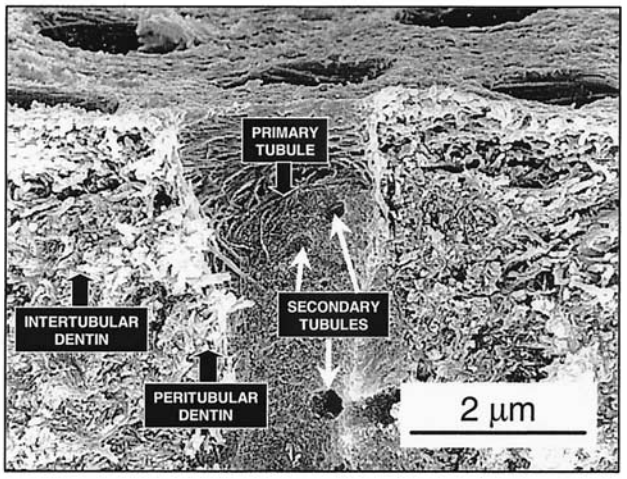
Bad examples
Fig. #. Schematic of wear results.
Fig. #. Plot of predicted and observed pain responses.
Fig. #. Results from 1-day experiments.

Good examples
Fig. #. SEM image of surface roughness of new microhybrid composites after 0.5-μm diamond polish finishing. **A**, Micro-Shine. **B**, Ultra-Gloss. **C**, Reflect. (Images are representative of 10 areas randomly selected for inspection. All images were rated at original magnification $\times$5000. *Magnification bars* in images represent 2 μm.) *F,* Filler particle; *M,* resin matrix; *P,* porosity; *W,* wear tracks of polishing paste.
Fig. #. Histogram of amount of measured protein at 1 day, 1 week, and 1 month for 4 treatments. (Baseline measurements are indicated with *dotted line* across bottom of diagram. Clinical acceptable target level is shown with *solid line* across middle of diagram.)
Fig. #. Correlation of hybrid layer thickness and sealing ability of dentin bonding systems. Hybrid layers were measured as average widths of interfaces as seen in SEM at original magnification $\times$1000. Sealing ability was rated from 1 to 5 in microleakage experiments.

A variety of figure types may be included in the same manuscript. These may include the following: (1) a schematic created to focus the reader on the problem; (2) a flowchart of the overall experiment; (3) photographs of the equipment used; (4) line drawings of key events expected in the experiment; (5) graphs or histograms of the results; (6) SEM, transmission electron microscope, or light microscope images of the specimens before and after testing; and (7) correlations of the current results to other published results. Consider the suggestions below.

Photographs and other images. All images must be faithfully and truthfully presented. Do not photo-retouch or digitally modify specimen images unless you provide an explicit disclosure of what was modified. Color-balance related illustrations so that they have the

Legend. Representative SEM photograph of partially dissolved polycarboxylate cement showing porosity and new appearance of new crystals in microstructure. Original magnification = 2000×. (Compliments of Stephen C. Bayne, University of North Carolina)



Legend. Freeze-fractured surface of human dentin showing primary and secondary tubules and mixture of collagen fibrils and hydroxyapatite within inter-tubular dentin. Bottom of picture is toward dental pulp. (Compliments of Dr Jorge Perdigao, University of Minnesota School of Dentistry. Original photograph reprinted with permission of Mosby from Craig, Restorative Dental Materials, 2002, p. 398.)

Fig. 2. Examples of inadequate (*top*) and adequate (*bottom*) figure labeling. Figure legend may contain description of the events, but these should be clearly marked within figure with full text labels whenever possible and with proper internal references to magnification. Publisher may reprint figure at different size than planned, effectively changing original magnification.

same or very similar hue, chroma, and value. Number illustrations to facilitate good relationships among them, as well as between them and the text, when the manuscript is published. If several illustrations are related and referenced close together in the text, consider grouping them under one number (Figure 7, parts A-C, for example). Submit all related illustrations in the same size.

Images should always contain magnification markers. Do not simply state the magnification as a number in the legend, as this number probably will not correspond to the magnification of the final printed image. You may supply a photograph at original magnification ×100, for example, but its size could be increased or decreased to fit the layout of the journal; the effective magnification would thereby be altered. Include a magnification bar in the figure with a label, such as 20 μm, or state in the legend that the magnification bar represents 20 μm.

All images benefit from labels and arrows that lead the reader to the most important aspects (Fig. 2). Do not state in the legend that the reader should focus on the interface and then assume that it will be obvious; mark the interface with an arrow or label. When adding labels to the figure, try to provide maximum contrast: Use white labels on dark backgrounds and vice versa. Write out a label if it is only 1 short word. Use abbreviations when the labels must be kept small to avoid interference with the overall image details.

Line drawings. Remember that many readers may not be familiar with the scale that you have chosen to represent your image. Lead readers to the important points. If you show a test zone on a specialized piece of equipment with a specimen in place, it might be helpful to show a schematic of the overall equipment with the test zone circled and connected by an arrow to the magnified view of interest. Generally, line drawings are selected in preference to photographs to hide or eliminate distracting details. Line graphs should be artistically similar to a photograph but not overly complicated; otherwise, you have not eliminated the distractions. Figure 3 is an example of a good line drawing.

Graphs and histograms. Most computer programs that produce graphs want to assign them a title. Remember that the title for each of your graphs will be part of the caption, separate from the graph itself. Leave blank any space provided by the computer program for a title.

Acronyms or abbreviations commonly are used within graphs to identify lines, bars, or curves that represent various products or treatments. If abbreviations are truly necessary, use simple forms that can be decoded by the reader easily; include the codes in the figure or legend.

Graphs have axes (x, y, and z) that should be carefully labeled. The standard convention is to create labels that are short, capitalized, and bolded and that include properly abbreviated *System Internationale* equivalent units in parentheses or brackets. Each axis should include 4 to 5 ticks or numeric labels precise enough for readers to extract the data values to about 5% of the actual values by looking at the scales involved. Some examples of acceptable schemes follow.

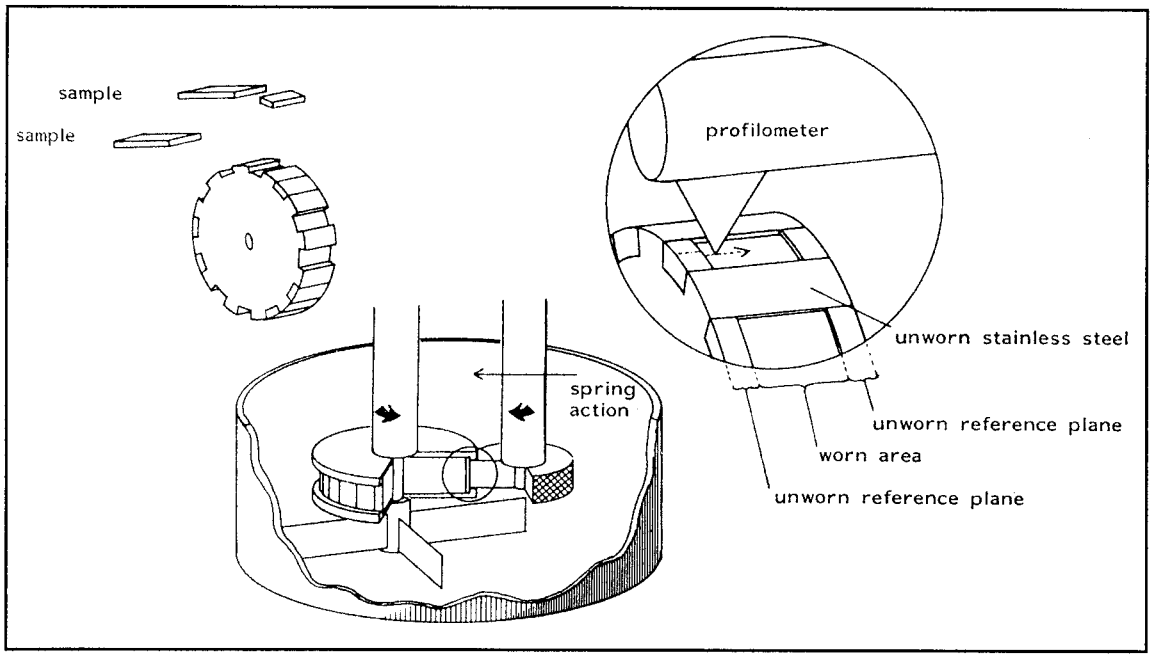


Fig. 3. Example of good line drawing. Although photographs are important, line drawings generally can be composed to show details and relationships of apparatus or event more clearly. Main item and various important magnifications should be shown with adequate labeling to clearly indicate main effects to reader. (Image reprinted with permission of Mosby from Pallav P, Davidson CL, de Gee AJ. J Prosthet Dent 1988;59:426-9.)

WEAR (μm): Indicate 100, 150, 200, 250, 300, 350, and 400 μm with ticks but label only 100, 200, 300, and 400 μm.
TIME (days): Indicate 1, 5, 10, 15, 20, 25, and 30 days with ticks but label only 10, 20, and 30 days.
CONCENTRATION (μg/mL): Indicate 1, 10, 100, and 1000 μg/mL with ticks and label all.

If axes are foreshortened to represent only the outmost range, be sure to include slash marks on the scale (—//—). The intent is to emphasize small differences, but this can be very deceiving. Two adjacent bars in a histogram can look like they are different by a 2-fold factor when, in fact, careful inspection of the scale reveals that they are only 5% different (Fig. 4).

Carefully composed graphs or histograms can support the presentation of about 10 items. Beyond that complexity, you should divide the information into separate figures.

Within graphs, connect points and label the curve. Use linear interpolation without extrapolation unless there is a specific justification for doing otherwise. Do not try to indicate a trend with small data-point triangles, squares, or circles. Too many times, these are either not readable in the final published manuscript or require special effort by readers. Report the points, but connect them, and label the line so that it can be conveniently identified by the reader.

Graphs should be constructed in accordance with these simple rules: The main variable of measurement should be on the vertical (y) axis. Time, cycles, or experimental conditions should be reported on the horizontal (x) axis. If you compare 2 independent variables such as temperature and polymerization time, plot the one of major interest on the vertical axis. If 2 y-axes (left and right) are needed, use careful labeling to eliminate possible confusion of the cross-over data.

Histograms should be constructed in accordance with these simple rules: Most readers expect to see vertical histograms. Label the groups on the x-axis and the results on the y-axis. If there are too many bars to clearly report the information, consider reversing the presentation so that the labels are printed on single lines on the y-axis and the data are reported horizontally.

Tables versus graphs. Do not repeat the presentation of results in graphs and tables that contain identical information. Tables can report results (means $\pm$ standard deviations) and statistical differences more carefully than most figures. When a substantial amount of data is involved, however, it may take considerable time to design a clean and uncluttered table. Graphs may be less precise, but they have the potential to make points with greater impact. There are advantages and disadvantages to both forms.

As alluded to previously, table creation can be quite complicated. Consider the following situation: Three groups of materials (A, B, and C) were compared at 3 different times (1 day, 1 week, and 1 month) for 2 properties (wear and strength). What is the best method

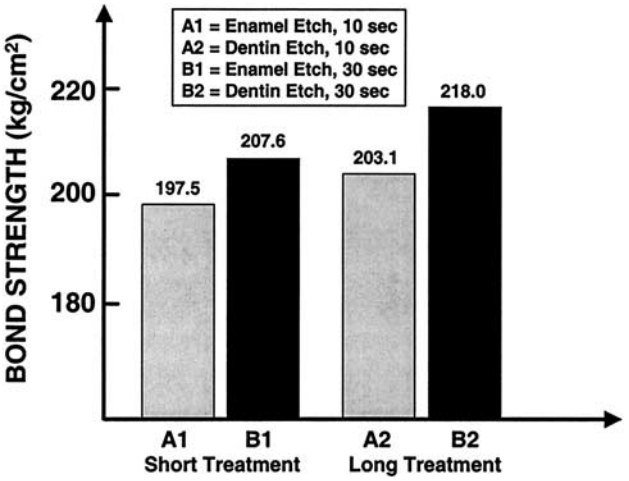


Fig. 4. Example of poorly planned figure. Y-axis scale is collapsed to small range to amplify minor differences between results of 4 groups. Group values reported above each column are unnecessary and reported to 4 rather than 3 significant digits. X-axis includes codes for groups when labels should be reported directly below each column. Required statistical information, including standard deviations, is not reported; it most likely would show that there were no significant differences among treatments ($P>.05$). Y-axis label is in metric (kg/cm^2) rather than SI units (MPa) and does not indicate specific type of bond strength test used (shear bond strength, for example).

of presenting these results? You could create several tables or 1 table with 3 sections. You could construct a table like an outline with all the variables, or a table with the dependent variables on the left-hand side as rows and the results as columns. The statistical analysis could be reported in one of these tables or on its own.

A general suggestion: List the main variables (major groups and major effects) as row headings, and report the test results in columns. If possible, keep all information in a single table so that readers can make comparisons without having to flip pages (Table IV).

Table IV. Example of combining related tables into a single table*

Table A. Surface treatment effects on bond strength and microleakage before thermal cycling

Before Thermal Cycling: Treatment Group	Strength (MPa)	Microleakage Score (1-3)
Smooth surface	22 ± 4	1.6 ± 0.3
Diamond bur-roughened	18 ± 5	1.8 ± 0.2
Air-particle abraded	27 ± 4	0.8 ± 0.5

Table B. Surface treatment effects on bond strength and microleakage after thermal cycling

After 10,000 Thermal Cycles: Treatment Group	Strength (MPa)	Microleakage Score (1-3)
Smooth surface	18 ± 5	2.3 ± 0.3
Diamond bur-roughened	14 ± 6	1.6 ± 0.3
Air-particle abraded	22 ± 5	0.6 ± 0.7

Table AB. Surface treatment effects on bond strength and microleakage before and after thermal cycling

Treatment Group 10,000 Thermal Cycles	Strength (MPa) Before	Strength (MPa) After	Microleakage Score (1-3) Before	Microleakage Score (1-3) After
Smooth surface	22 ± 4	18 ± 5	1.6 ± 0.3	2.3 ± 0.3
Diamond bur-roughened	18 ± 5	14 ± 6	1.8 ± 0.2	1.6 ± 0.3
Air-particle abraded	27 ± 4	22 ± 5	0.8 ± 0.5	0.6 ± 0.7

*Data are supplied for the purpose of examples only and do not indicate actual performance. Statistical information was not added to these tables but normally would be present.

THE REVIEW PROCESS

Scientific journals have a dedicated staff of reviewers who are experts in various content areas. New reviewers tend to provide brief comments and harsh ratings; those who have been on staff for extended periods tend to think that anything can be revised to become publishable.

Most editors require that manuscript submissions be reviewed by at least 2 people. If the returned comments and recommendations are very different, another reviewer might be enlisted as an adjudicator. One might argue that enlisting more reviewers would improve the scientific review process, but it would be just as likely to make things more complicated. As the number of reviewers increases, so do the chances that one of the reviewers will be quite contrary to the rest. Under special circumstances, the journal editor may serve as a second or third reviewer.

Most journals now use some form of electronic manuscript submission and review. Some systems involve only e-mail tools, whereas others use dedicated software on protected Internet sites to distribute manuscripts, collect reviews, and manage the publication process. To a large extent, the sophistication of the electronic process is driven by the workload of the journal.

Review guidelines

Journal editors feel compelled to guide the review process in terms of the details required in each manuscript and the comments desired from each reviewer. This guidance generally occurs by means of a "reviewer's form" that is sent along with the manuscript. Unfortunately, the style and detail of reviewer forms can vary considerably. A simple form may request only a global assessment of the manuscript (acceptable as submitted, needs minor revision, needs major revision, or merits rejection); a few comments; and the reviewer's dated signature.

A complex (and more worthwhile) form generally requests not only the same core information as the simple form, but also detailed information about each section of the manuscript. Twenty to 40 questions may be

proposed to guide an evaluation of the manuscript's merit. Questions related to the Material and Methods section, for example, might include the following: Does the experimental design include sufficient controls? Did the authors choose appropriate statistical tests for analysis of the data? Such questions are designed to elicit commentary from the reviewers that will, by virtue of its specificity, provide excellent guidance for authors who will be asked to revise their work.

General recommendations for reviewers

Review requests. You will receive a cover letter or an e-mail asking whether you can review an enclosed manuscript within a specific period of time (usually 2 weeks). Quickly review the manuscript to determine its length and complexity. Decide whether your schedule can accommodate the necessary review; if it cannot, return the manuscript to the editor immediately so that it can be assigned to someone else with minimal delay.

Reviewer guidelines and forms. Most journals provide their reviewers with a rating/comment form and guidelines for the evaluation process. Familiarize yourself with the guidelines, particularly those that relate to expected content in each section of the manuscript. You may find it helpful to create a checklist of important items (if such a list is not provided).

Creating and organizing appropriate commentary. Specific rather than general comments are needed to adequately guide authors in their revision efforts. For example, do not simply say, "This manuscript is missing a key reference." Provide the exact reference, with at least the lead author's name, the journal, and the year and pages of publication. If you want to know the exact number of samples/specimens tested, pointedly request that information. Do not vaguely say that the authors need to provide more details about the experiment.

In general, the order of your comments should mimic the order of the manuscript text. Organize notations under the groupings of Title, Abstract, Introduction, etc. As often as possible, tie specific recommendations to the text by quoting a key phrase or identifying the section and paragraph number in question. Do not make reference to page numbers, as these may change with subsequent reformatting of the text. This approach will produce a discrete list of comments that the editor and author can work from to make necessary changes. Always maintain a respectful tone. If changes are mandatory, preface your comments with "It is strongly suggested that...." If changes are warranted but not absolutely necessary, preface your comments with "I suggest that..." or "The text might benefit from...."

Fostering the right state of mind. Before you begin a review, be sure that you are in an appropriate environment and state of mind. Do not review a manuscript after a major disappointment, a bad day in the clinic, a frustrating discussion with your spouse, or another emotional challenge that may cultivate bias or negate your critical effectiveness. The challenge is to enumerate suggestions for improvements without losing interest in the process. Pick a time during which you can complete the review in a single sitting. If your review is interrupted, you will return to it feeling as if you must start all over again. If you need 1 to 2 hours to complete a review, find the time. Feeling rushed or stressed may cause you to overreact to imperfections in the submission.

Reviewing versus editing. Editing is the responsibility of the editorial office staff and/or the publisher. Reviewers should evaluate the quality and quantity of the content material provided for publication and provide feedback to the editor, not rewrite what is deemed unsatisfactory text. That being said, a variety of textual problems may hinder your ability to read and interpret the manuscript. These include the following:

- Lack of compliance with the Instructions for Authors: If the infractions are minor, refer the authors to the journal's published guidelines and ask that they *fully* comply with all requests made therein. If the infractions are major and show a total disregard for journal standards, consider returning the manuscript to the editor with a note that it does not merit review.
- Language usage: Many authors are not native English speakers. Some employ technical editors, but others forge ahead with their own limited abilities. In both situations, the manuscript may be very difficult to interpret. See if you can make enough sense of the manuscript to determine whether it merits review and then revision efforts. If the text is virtually incomprehensible, return it to the editor with a note that, unless the authors obtain the services of an expert in English and scientific writing, the manuscript should be rejected outright.
- Misspellings: There is no excuse for misspellings. All authors, and perhaps even a colleague not involved with the project, should have reviewed the manuscript before submission. Moreover, today most manuscripts are created electronically, with the aid of word-processing programs that have spell-check features. Regardless, the occasional misspelling may creep in. Point it out to the authors, but do not let it break your concentration.
- Missed literature: It is common for authors to miss some references pertinent to their research topic. If a critical part of the literature is missing, provide the citation information and suggest that the authors consult the source. If most of the literature is missing, provide a few examples and note that the authors have done a poor job of reviewing the literature.
- Errors in data reporting: One famous graph published in a 1980s manuscript was an x-y plot with no

labels on the axes, no numbers on the hash marks, a line with 3 segments that connected only 2 points, and an incomplete legend. These errors cannot be blamed on the publisher or printer; they should have been caught by the authors, reviewers, and editor. Although a review of tables, charts, and graphs can be very time-consuming and tedious, it is important that you verify the validity and completeness of the data.

Making an overall recommendation. The bottom line for any review is a judgment of whether the manuscript should be accepted for publication (and under what conditions) or rejected. Carefully consider the wording of your recommendation. If you overemphasize relatively minor problems and fail to recognize the strengths of a generally good manuscript, the authors may be discouraged from submitting a revision. Conversely, if you downplay potentially serious flaws or problems in a mediocre manuscript in an attempt to spare the authors' feelings, they may underestimate the extent of necessary revisions and assume that publication is guaranteed. Both situations can create serious problems for the journal editor and his/her staff. In general, the vast majority of new submissions should be returned with a recommendation to "revise and resubmit for further evaluation," with no promise of publication. No matter how uncomfortable it may make you feel, outright rejection of an irredeemable manuscript should always be an option.

The reviewer's goals. Always remember that you are an advocate for both the journal and the authors-at the same time. Say this to yourself before you start, and constantly remind yourself of your responsibilities throughout the review process.

Advocate for the journal: The editor trusts you to provide an unbiased and in-depth critique of the quality and quantity of the submitted material. You may not like some of the associated tasks, but they must be completed nonetheless.

Advocate for the authors: If the manuscript shows true promise, you should report everything possible to help the authors improve the manuscript so that it meets publication standards. This is not always an easy task. Manuscripts that are fraught with problems are burdensome to review. It is not uncommon for negative reviews to comprise 2 to 4 pages of single-spaced comments. However, if you can effectively guide (and educate) the authors, you can help them make the revisions necessary for publication without any wasted effort. Be precise, helpful, kind, and encouraging.

Expeditious reviews

Most reviewers routinely take 2 to 4 hours to complete a single review. We believe, however, that a regular review need not take more than 1 to 2 hours. Consider the following guidelines for expeditious manuscript reviews.

To conduct an efficient and effective review, you must not duplicate time or effort. Isolate yourself with your computer and the manuscript. The best starting point is a template that contains space for comments on all the critical sections of the manuscript: General, Title, Abstract, Introduction, Material and Methods, Results, Discussion, Summary/Conclusions, Acknowledgements, References, and Figures and Tables. Familiarity with the general requirements for these sections (as outlined by the editor and the Instructions for Authors) will be of great help.

Quickly skim the manuscript to get a general sense of the article. Then begin a more focused read, typing comments into the computer as you go from section to section. Do not worry about criticizing something at the onset that you might discover later is not a problem; make all your notes as you read. If the journal editor has provided you with an electronic copy of the manuscript, there is no need to describe a specific part of the text or problem at length; simply cut and paste the relevant text into your comment form and then succinctly identify the flaw. Examples are provided below.

Material and Methods, paragraph 2: "When the experiment was initiated...." This sentence does not provide details about the load levels, number of cycles, or method of terminating the experiment.

Results, paragraph 4: Comments about the statistical results duplicate the information contained in Table V and should be eliminated.

Discussion, paragraph 3: This important background information should be moved to the Introduction. Paragraph 6: This information duplicates the Results section. The Discussion section should be used to interpret the results.

By the time you finish collecting your comments, you will have compiled a neat list of advice for both the editor and the authors. Another option (if the journal editor approves of the practice) is to embed your questions, comments, requests, and recommendations directly in an electronic copy of the manuscript file, with each notation placed immediately after the text it concerns. Some authors report that embedded commentary facilitates the revision process.

In most situations, you will be able to finish your evaluation in about 40 to 60 minutes. Read and edit your comments. Rank the manuscript on the reviewer's form. You are done. After a few of these expeditious yet thorough reviews, you will become accustomed to replaying the same questions in your mind, and you will develop a repertoire of concise statements about common manuscript problems.

The key to this process is to choose a time of the day and place that will allow you to complete the review without interruptions. If there is a break in the process,

Table V. Useful online resources for writers and reviewers

Source	URL
Online databases	
National Library of Medicine's PubMed	www3.ncbi.nlm.nih.gov/entrez/query.fcgi
United States Patent and Trademark Office	www.uspto.gov
Biomaterials Properties Database	www.lib.umich.edu/dentlib/Dental_tables/intro.html
Web of Science*	isi6.isiknowledge.com/portal.cgi
Online dental dictionaries or glossaries	
Glossary of Prosthodontic Terms*	www.us.elsevierhealth.com/prosdent (click "Glossary")
Medical dictionary	cancerweb.ncl.ac.uk/omd/
Hyperlinked list of medical dictionaries and glossaries	www.4woman.org/nwhic/references/dictionary.htm
Journal titles and abbreviations	www.ncbi.nlm.nih.gov/entrez/journals/loftext_noprov.html
Hyperlinked list of online Instructions for Authors by journal	www.mco.edu/lib/instr/libinsta.html

*Requires ID/PW.

then you might as well start all over again. Be organized and efficient. You will enjoy reviewing much more if you consider it an exposure to the variety of ongoing research rather than a tedious task that competes with your other responsibilities. Have fun.

Reviewer resources

Numerous online resources allow reviewers to check references, confirm journal title abbreviations, access database records, and review Instructions for Authors. Some of the key resources and their URLs are listed in Table V.

SPECIAL TOPICS

Numerous special topics arise during manuscript composition and evaluation. Although many journals have not dealt with these topics in an official manner, they impact the publication process in important ways.

Number and order of authors

Many journals limit the number of authors to 4 unless special justification for a larger number is provided at the time of submission. The person who writes the manuscript generally is deemed the first author. Other authors are included if they make a key contribution to the project-that is, one critical to its completion. Many times the order is modified so that the name of the principal investigator comes first, regardless of who authored the manuscript. In Europe, the mentor's name traditionally is placed first, whereas in North America, the opposite is true: the mentor is listed last. Currently, the most prevalent sequence is as follows: the main investigator first, the mentor second or last, and the other investigators in the order of their relative contributions.

Conflicts of interest

Hidden to many reviewers is the fact that authors may have conflicts of interest-financial, institutional, or personal. This is not a bad thing. However, it is important that authors make an open declaration of any conflicts of interest. You can own a company and publish a scientific article. You can be a consultant to a company and do research on its products. You can be paid from a grant that funds research on the product or technology under review. If an investigator has any link to the research being conducted, he/she must disclose it so that reviewers and readers can make a personal judgment about whether the link is problematic and whether the interpretation of the results therefore should be tempered.

Compliance with human subject and animal regulations

In the United States, a formal system of subject reviews and project audits regulates the participation of human subjects and animals in research. Because of the large number of individuals involved in government-sponsored research activities (through the National Institutes of Health and the National Science Foundation, for example), a governmental set of rules has become the de facto standard for all activities. Research that does not adhere to these rules (perhaps because it was conducted outside the United States) is problematic. The reviewers, editor, and publisher have a responsibility to enforce the system as follows.

Institutional review board. Each institution (whether public or private) must have an institutional review board (IRB) or an arrangement with an existing IRB to review all proposals that involve human subjects. Additionally, all investigators must be trained annually in human subjects procedures for the approved clinical trial activity to be conducted in a bona fide way. The challenge for editors is to establish that the authors of a particular manuscript complied with all appropriate procedures.

Animal protection. Similarly, for all investigations that involve vertebrate animals, the institution must follow federal guidelines and give research authorization to only trained and compliant individuals. The challenge

for editors is to establish that the authors of a particular manuscript complied with all appropriate procedures.

Lack of institutional review. If the authors of a particular manuscript either have not complied or will not testify that they have complied with human subject or vertebrate animal protection procedures, most US journals will refuse to publish the manuscript, regardless of whether it otherwise would be accepted.

Proof of institutional review. To ensure that readers are well-informed, the authors must state in the Material and Methods section that they complied with all relevant regulations. It is appropriate to state the name of the IRB that reviewed the protocol and regulated the activity and to indicate the dates of the project. This information allows readers to double check the authors' compliance, if necessary.

Copyright Transfers and Double-Publication

When presenting an original article for consideration, authors are expected to sign and submit a copyright release. Although this is not always convenient, it is the only practical way that an editor can confirm that all authors have approved the manuscript and its contents. In the past, it was common for one person to publish an article without consulting the other authors, who might not have sanctioned the submission or might have disagreed with certain aspects of the manuscript. Requiring all signatures at submission circumvents this problem, but it unfortunately does not ensure that everyone who should be listed as an author actually is. Professional jealousies or ignorance may lead to the exclusion of a key contributor.

In most of North America, Japan, and Europe, publication of an article transfers the copyright of the material from the authors to the publisher. Under all copyright laws, only the copyright holder has the privilege of reprinting or waiving reprint rights to any published material. Most authors recognize that single-publication is the rule for peer-reviewed journals. Yet double-publication-the unauthorized and unethical publication of exactly the same article in more than 1 journal-still occurs.

Authorized republication is another matter. Some journals seek special permission to reprint an article of particular interest or excellence in their own journal. The proper procedure is to obtain permission from the copyright holder (prior publisher) and then acknowledge the true copyright. This process is quite common when articles are published in multiple languages.

Color: When is it necessary?

Almost all journals offer the option of printing part or all of an article in color. The authors' desire for color reproduction often is much stronger than the true need for it. In fact, color can be a liability. Journals that use pastel or other low-contrast colors may make articles difficult, if not impossible, to adequately reproduce on a copier.

Color generally offers a significant improvement over black and white when photographs include clinical scenes or patient profiles. Uncomplicated figures, however, look cleaner in black and white. It makes no sense to print a 2-bar histogram in color, because it adds no understanding or ease of interpretation to the figure. Because color pages are more expensive to reproduce, most editors and publishers are conservative in their authorization of color use.

Scientific impact factor

Concerns about quality versus quantity are endemic to scientific publication. Taken together, large numbers of low-quality publications can have some general importance. The quality of any publication is difficult to judge because it changes with time. The contribution of a cutting-edge article published today, for example, may not be recognized for many years. This was certainly true for the polymerase chain-reaction technique. Before being hailed for its tremendous value, the subject was deemed not worthy of print space and rejected by 11 journals.

The quandary remains: How do you take into account quality versus quantity? Count the number of times references occur in the literature. By examining the frequency of article references in a particular journal for any given year or group of years, one can produce scientific impact factors.[3] The company ISI has developed the most widely referenced system for this process. Rankings for the ISI impact factors run from 0 to approximately 90, but there is no true top of the scale. As reported by ISI in 1998, the dental journals with the highest impact factors are the *Journal of Dental Research* (4.060), *Critical Reviews in Oral Biololgy and Medicine* (2.478), the *Journal of Dentistry* (1.104), and the *Journal of Prosthetic Dentistry* (0.829). Most other dental journals rank under 1.000, whereas journals like *Cell* (38.686) rank significantly higher.

SUMMARY

This article outlined the key principles of sound scientific writing for authors and reviewers of manuscripts submitted to peer-reviewed dental journals. The 10 major sections of a formal research report were described in terms of content, format, and common errors. The review process was summarized, and a method for conducting fair and expeditious manuscript evaluations was suggested. Special topics related to print publication were discussed. It is hoped that the guidelines provided herein will improve relations among authors, reviewers, editors, and publishers and help strengthen dental writing now and in the future.

Guidelines for the composition and evaluation of the *Journal of Prosthetic Dentistry* manuscripts have grown annually. The process began in 1992 with a series of workshops sponsored by the *Journal of Prosthetic Dentistry* and conducted for its reviewers and publishing staff.

Special contributions were made by the following persons: Jean Gasper (Editorial Manager, 1991-1999); the late Dr I. Kenneth Adisman (Editorial Council Chairman, 1987-1998); and Dr Brien Lang (Editorial Council Chairman, 1999-present).

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Noteworthy Abstracts of the Current Literature

Changes in expansion and mechanical strength during watr storage of a traditional and three modified resin composite
Munksgaard EC. *Acta Odontol Scand* 2002;60:203-7.

Purpose. Although composites have excellent properties, one imperfect property remains: polymerization contraction during setting leading to color changes and marginal leakage. Leakage may lead to secondary caries and pulpal damage. The aim of this study was to test and compare the hygroscopic expansion in cavities of 4 materials and to measure their mechanical properties during extended water storage.
Material and Methods. The materials tested were: Dyract AP (Dentsply De Trey, Konstanz, Germany) (DRY), Definite (Degussa AG, Hanau, Germany) (DEF), Ariston pHc (Ivoclar-Vivadent, Schaan, Liechtenstein) (ARI), and Spectrum TPH (Dentsply De Trey) (SPE). Cylindrical caries were prepared in extracted human teeth. The following tests were performed on the restorations placed to restore these carious areas: flexural strength, flexural modulus, and marginal gaps at the restoration-tooth interface. These tests were performed in 2 different ways: 1 series of restorations were finished shortly after polymerization, and the maximal gaps of the restorations were followed over time during water storage; the other series was finished immediately after polymerization, before gap size measurement, and after water storage for various periods. Data was collected and analyzed. ANOVA was used for flexural strength and moduli, and the Kruskal-Wallis test with multiple comparisons was performed on gap sizes.
Results. The absence of, or reduced, gap size at 180 days was compared to 1 hour or 1 day, was observed for all materials using either method. At 180 days, DYR and ARI showed significantly smaller gap sizes than the other 2 materials. There were no significant differences in flexural strength when the means at 180 days were compared to 1 day. All materials except DYR showed a significant increase in the flexural moduli as compared to 1 day.
Conclusion. Based on this in vitro study, the author concluded that restorations made of DYR or ARI may show the absence of gaps or very small gap sizes between the cavity wall and the restoration after 180 days, with no significant reduction in their mechanical properties. 20 references.—*RP Renner*