Image Quality: It Really Does Matter

Oral and maxillofacial pathology is an area of specialization that is heavily reliant on visual input as part of the diagnostic process. Typically, this involves assessment of a combination of the clinical, radiographic and histopathologic features of a lesion. Similarly, hypothesis-driven studies undertaken by members of our specialty often involve, at least in part, the qualitative and quantitative assessment of fresh or archival human tissue. Consequently, as a prospective author, a strong emphasis on image quality is key to maximizing the impact of your manuscript.

A review of decision letters for manuscripts submitted to the oral pathology section of this journal over the past 2 years substantiates that the most common reasons for a decision to reject or a delay in publication include both poor image quality and an inadequate quantity of figures to support an author's stated findings. This is particularly disheartening in the case of manuscripts that otherwise follow a logical sequence, are based on a sound premise, and in the case of a hypothesis-driven study, are novel and supported by a well designed study protocol, or, in the context of a case report-type manuscript, are sufficiently unusual or interesting to otherwise warrant publication. The reality is that absent the inclusion of a sufficient number of high quality images that clearly highlight the diagnosis or results being reported, the likelihood of receiving positive feedback from reviewers will be substantially diminished. Likewise, even among those manuscripts that are judged to clearly fall within the scope of interest of readers of this section of the journal, an almost universal concern that unnecessarily delays the editorial review process is poor figure quality. Too often, manuscripts are sent back to authors, sometimes multiple times, with a recommendation for improved image documentation, further delaying the review process and placing unnecessary burden on the reviewers, editors and journal support staff.

With the goal of hopefully avoiding delays in publication or outright rejection of your submitted manuscript as a result of inadequate photographic documentation, the following suggestions are offered to potential authors, categorized under the subcategories of histologic, radiographic, and clinical imaging.

Concerns with photomicrographic quality are generally of a technical or compositional nature. From a technical perspective, the use of properly calibrated optical and photographic equipment and clean glass slides, free of dust, fingerprints or other distractors, is critical. The presence of debris in an image is distracting to the viewer, and, at the editor and reviewer level, raises questions as to the overall quality of the study. Photomicrographs should be properly focused, free of blurring, with proper exposure, color saturation and white balance. Backgrounds should be clear and white in color. There are many resources available to help prospective authors improve their photomicrographic technique, including online sites.[1] Employees at university-based research core support facilities can also be excellent sources for helpful information.

Compositionally, photomicrographs must be taken from areas of the slide that are free of wrinkles, overlap or chatter. The inclusion of both low magnification images, that orient

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the reader and highlight the general features of the diagnosis, and higher magnification sections from within the same area illustrated by the accompanying low power image should be considered mandatory. Ideally, the area from which the higher magnification photomicrograph was taken should be suitably marked on the low power figure. The submission of high magnification photomicrographs alone leaves the reviewers and readers in the awkward position of having no basis for reference and therefore not being able to confirm the validity of the purported diagnosis.

Studies submitted to this journal commonly employ immunohistochemically (IHC) stained tissue sections, either as part of the overall study design or in order to confirm a histopathologic diagnosis. Representative photomicrographs of all IHC-stained sections critical to the study or to the diagnostic process should be included as figures. Preferably, these images should all be taken from the same area of the slide and at the same magnification as at least one of the accompanying hematoxylin and eosin (H&E) stained photomicrographs, so that the reader can easily compare the conventional features highlighted by H&E staining with the IHC features, greatly facilitating interpretation of the figures. On occasion, it may be necessary to include photomicrographs taken from different areas of the tissue in order to highlight specific features that may only be evident in those areas. However, this should be exception rather than the rule, and in these scenarios, consideration should be given to the potential benefit of also including an H&E-stained photomicrograph from this area.

In addition to ensuring the highest photomicrographic image quality, inclusion of a sufficient number of images is critical to not only convincing the readership of the validity of your histopathologic diagnosis or experimental results, but it is also fundamental to maximizing the scientific impact of your manuscript. When referencing IHC staining, representative images of all pertinent positively-stained markers should be considered for inclusion, especially if deemed important enough to reference these findings in the body of the text. It may also be beneficial to include images from negative IHC staining tissue specimens, particularly if the absence of staining is critical to the diagnosis or study findings or is otherwise unanticipated. Consideration to including images from both positive and negative controls should also be given, depending on the nature and objectives of the study. Similarly, when either grading of H&E or other histochemically-stained tissue sections or quantification of the degree of IHC staining is a key study objective, representative images highlighting each of the different grades or staining intensity patterns should be included.

One feature that has been notably absent from the majority of pathology-focused journals has been the ability to visualize more than just selected areas of the histology described within individual articles. The conventional approach to publishing pathology manuscripts, namely presenting one or more static photomicrographs that are selected on the basis of being “representative” of the overall histology in question, typically limits to a dozen or fewer the number of images publishable per manuscript. As practicing pathologists, we are also all well aware that reliance on only selected fields of view of a slide, taken out of context, can be misleading at best. A long overdue paradigm shift in viewing histologic images in scholarly manuscripts, and one that capitalizes on the

benefits of electronic publishing, is the ability to incorporate links to whole slide digital images directly within articles, permitting the reader to view a complete digitized representation of one or more conventional glass slides. Mark Lingen, this journal's editor-in-chief, Jane Ryley, journal publisher, and Elsevier are all committed to making this technology available to authors in the oral pathology section by the end of this year. This truly is an exciting development that will afford our readers the ability to access an electronic version of the same whole slides used by our authors!

With respect to radiographic image quality recommendations, I defer to my colleague, Dr. William Scarfe, editor of the oral radiology section of this journal. Nevertheless, I do offer a few suggestions, based on common trends noted among submissions to the oral pathology section. For starters, names, dates of birth and other patient identifiable labels must be removed from all radiographic images. Digital radiographs or other imaging modalities should be exported directly using the built in imaging software as high-resolution images. Images taken from screenshots are generally of poor quality and their use is discouraged. When preparing figures from film-based radiographs, they should be digitally scanned as grayscale images at a minimum 300 pixels per inch. Images of radiographs that have been taken of printed films placed on radiographic view boxes or even against windows as the light source, using inexpensive digital cameras typically do not rise to the level of publication quality. An in depth list of author guidelines is available online.[2]

Clinical images represent the third visual component of the diagnostic process in oral and maxillofacial pathology. This is of particular significance with respect to clinical pathologic conference (CPC) manuscripts published in the oral pathology section of this journal. It is important for prospective authors of CPC cases to be aware, prior to preparing a manuscript, that CPC articles cannot be published in the absence of high quality clinical photographs or radiographs. Also of note is that case report manuscripts are often submitted with accompanying intra-operative surgical photographs, pictures of excised tissue specimens and images taken at follow-up appointments, the intent being to highlight a successful treatment outcome. While interesting in their own right, these images are rarely of sufficient impact to warrant including for publication in the oral pathology section, unless they demonstrate unusual or unexpected findings or are derived from a clinical study that includes a specific treatment arm.

Final general comments:
Since journal readers often decide whether to read the full text of an article after first glancing at the figures and accompanying captions, in addition to ensuring high quality images there are clear benefits to also providing sufficient detail in the figure captions to help guide the reader's interpretation of the figures. Additionally, areas of interest that are not clearly evident in photomicrographs and radiographs should be highlighted with arrows or other symbols.

The format in which figures are transmitted to the journal is also an important consideration that should not be left to chance or convenience. Failure to submit high-resolution images inevitably leads to a delay in publication. The TIFF file format is the

preferred format for submissions to this journal, as this storage format is not associated with data loss ("lossless"). The practice of converting previously compressed JPEG files, from which data has already been removed to TIFF format, while increasing the file size, should be avoided, as this does not increase image quality or resolution. A preferred approach to preventing issues with respect to image resolution is to save the image at the highest practical resolution, in a lossless format, at the initial image capture stage. Also, in lieu of submitting a figure that consists of multiple subfigures as a single composite image, uploading as separate files will help preserve the resolution of the images and give the editorial office greater flexibility to optimize figure arrangement. Note that a discussion on image manipulation has purposely not been broached, as this is the subject of a full editorial in and of itself.

One question that is often asked by prospective authors is "how many figures can I include in my manuscript?" Simply put, this is the minimal number of figures required to effectively highlight your findings, conclusions or diagnosis. This journal has no predetermined limit on the number of figures in a manuscript. Borrowing from the legislated daytime motor vehicle speed limits in effect in the state of Montana during the mid to late 1990s, the limit to the number of figures is that which would be reasonable and prudent for the situation. If in doubt, it is preferable to err on the side of including more rather than fewer photomicrographs, as recommendations to remove figures from the final manuscript can be made at the review stage if necessary.

In summary, I leave the prospective author with a question: why lessen the potential impact of your hard work and scholarship by not including the highest quality images? Not only will this increase the likelihood of a favorable editorial decision, it will also decrease the time from manuscript submission to publication. More importantly, once published, the inclusion of high quality figures will increase the likelihood of your manuscript being widely read, and hence cited, by your peers. So while we very much welcome and encourage your continued submissions to the journal, please consider that image quality really does matter.

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