Correlation Analysis of Oral Lesion Sizes by Various Standardized Criteria

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Abstract

Objective: Currently we are completing an NCI contract examining a novel method of dysplastic leukoplakia. One requirement of the contract was to compare standard bi-dimensional measurement of oral lesions to examine for correlation with Response Evaluation Criteria in Solid Tumors (RECIST) criteria, or longest measured dimension. Additionally, we were to examine the feasibility of digital image analysis for potential automated lesion measurements.

Methods: We examined the first 13 patients by bi-dimensional measurement and compared these measurements to 1) RECIST criteria, 2) scalar digital measurements with a standardized measuring device in the photograph field, and 3) number of pixels. We used a perioprobe as an extraordinarily easy device to perform such measurements.

Results: RECIST criteria correlated significantly with bi-dimensional measurement. Digitized measures in photographs correlated significantly with bi-dimensional measurements but was time consuming, taking approximately one hour per patient for the analysis. There was minimal correlation between number of pixels in Adobe Photoshop and any of the other measures, because the lens-to-subject difference of the patients varied from patient to patient, and the depth of the lesion in the oral cavity was variable.

Conclusion: We conclude that bi-dimensional measurement of oral leukoplakia and RECIST criteria are highly correlated. Additionally we found that digital photography and measurements, though highly correlative, are very cumbersome.

Study Design

Prospective Study

Methods

Thirteen patients with oral dysplastic leukoplakia were evaluated. At the time of enrollment, patients underwent history, physical examination, laboratory testing, lesion evaluation with bi-dimensional measurement and photographic documentation of the lesion. The bi-dimensional measurements were taken with a perioprobe calibration device, and the greatest length and width of the lesion were recorded. The perioprobe is a standard dental calibration device for the quantitation of gingival crevicular pocket depth for the quantitation of periodontal disease. Within each photograph, the perioprobe was used as a standardized measure. Extreme care was taken not to distort tissues when taking measurements or photographs. The patients were then treated for 12 weeks with a novel study drug. At the conclusion of the 12 week course of treatment, repeat laboratory testing, lesion evaluation via clinical examination and biopsy, and photographic documentation were performed.

Using Adobe Photoshop 7.0, the photographs were analyzed by measuring the lesion within the photo. This was performed by measuring the longest length and width of the lesion in the photograph as well as determining the length of the perioprobe specific to each photograph. The perioprobe was a standard length, and thus a conversion factor was used to scale the measurement of a lesion. For multiple lesions, the sum of the longest diameters was used. Extreme care was taken not to distort tissues when taking measurements or photographs. These data were compared to determine if there was any correlation between them.

Results

We found that RECIST criteria correlated significantly ($r^2 = 0.8356, p<0.0001$) with bi-dimensional measurement. We found that correlations between digitized measures in photographs correlated significantly with bi-dimensional measurements ($r^2 = 0.6661, p<0.0007$). Finally, we found a low correlation or no correlation between number of pixels in Adobe Photoshop and the other measures.

Discussion

There is currently no ideal method of measuring an oral cavity leukoplakia lesion, or for that matter, any cancerous lesion. In an effort to uniformly quantify change in tumor size in response to treatment, the World Health Organization in 1979 developed a standardized system that was based on bi-dimensional measurement of solid tumors. However, difficulty with this system led to the development of the RECIST guidelines for evaluating tumor response, which simplified tumor measurement by using only the longest one-dimensional measurement of a lesion. For multiple lesions, the sum of the longest diameters was used. However, debate still exists as to whether this is the most appropriate method for measuring tumor size.

To document size and response rate in leukoplakia lesions in this study, bi-dimensional measurements were obtained. Our data confirm that there was a strong correlation between bi-dimensional measurement and uni-dimensional measurements, suggesting both are adequate tools for measurement of oral leukoplakia lesions. Each patient in this study had their oral lesion photographed per protocol. In each photograph, a perioprobe was present for measurement purposes. There were several difficulties encountered when attempting to use the photograph for objective measurements. These included variability of lens-to-subject distance, adequate lighting, the irregular surface of the oral cavity and difficulty capturing the three-dimensional nature of lesions on two-dimensional media. Although the measurements of lesions obtained from the photographs correlated with the actual measurements, the process was exceptionally time-consuming, and would likely not be feasible in a clinical setting. Attempting to use pixel count as an objective measure was not highly correlative in this study.

We conclude that digital photographs are ideal for documenting lesion location and appearance. However, they cannot be used reliably for objective measurements. We recommend simple bi-dimensional or longest length measurement with a perioprobe with a simple photograph as a standard of documentation for leukoplakia lesion size.

References