

the calculation of the percentage of error of US output.

Regarding the need to increase the tolerance in the measured power value due to the  $\pm 10\%$  measurement accuracy of the Bio-Tek UW-2 wattmeter, we do not concur with Mr Hussey that the power measured by the Bio-Tek UW-2 wattmeter should have differed by more than 30% from the power indicated by the US device to be considered out of calibration for power. The UW-2 instrument used in our study was calibrated just prior to the beginning of testing and was guaranteed by the manufacturer for accuracy within 10% for a period of 1 year.

When the UW-2 instrument was sent to the manufacturer for calibration 2 weeks prior to the beginning of data collection, the manufacturer tested it at 3 different times within 1 week for measurements of reliability at a frequency of 1 MHz and powers of 0 to 20 W. In fact, the UW-2 instrument we used was found to be accurate within a 2% range and did not require any adjustments from the manufacturer. Although the UW-2 instrument was guaranteed for an accuracy of 10%, it was found to be accurate within a 2% range during its calibration testing.<sup>7</sup>

Our study design further enhanced the accuracy of the application of the wattmeter because one investigator (who had a perfect correlation coefficient of 1.0, with zero variance during test-retest protocol of the pilot study) took all of the measurements and because optimum conditions such as degassed water with oxygen content of less than 2 ppm was used and a clamp attached to a ring stand was used to eliminate any motion of the transducer during testing. Therefore, we do not concur with Mr Hussey that our results should be revised to allow a  $\pm 30\%$  error acceptance. By allowing a  $\pm 22\%$  error acceptance, we would have had an additional 3 machines considered within the standard for calibration. Thus, instead of 32 machines (39%) out of calibration for intensity output, only 29 machines (33%) would be considered out of calibration in our study.

Again, we thank Mr Hussey for sharing his expertise in the area of therapeutic

US and taking the time to bring very interesting issues to the table in an area in need of continued research and evaluation of the calibration of the devices for the safety and benefit of the patient population.

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## Craniosacral Therapy Is Not Medicine

*To the Editor:*

Although the prescientific thinking emblematic of most "alternative" health care may lead infrequently to fortuitous insights, many of these techniques have been tested, have failed, and should be abandoned.

For example, we have observed in our laboratory and described in *Scientific Review of Alternative Medicine*<sup>1</sup> one of the manipulation procedures (craniosacral therapy/cranial osteopathy) used by many physical therapists, occupational therapists, osteopathic physicians, and others. Based on our observations, we have drawn several conclusions.

We believe that Sutherland's Primary Respiratory Mechanism is invalid. "Cranial" rhythms cannot be generated through organic motility of brains because neurons and glial cells lack the dense arrays of actin and myosin filaments required to produce such movement. Other hypotheses regarding genesis of this rhythm (eg, Upledger's "pressurestat" model<sup>2</sup>) remain purely speculative. Movement between the sphenoid and occipital bones at their bases is impossible past late adolescence because, by then, they have become one very robust bone.<sup>3,4</sup> Movement among components of the cranial vault also is impossible in most adults because coronal and sagittal sutures usually have begun to ossify by age 25 to 30 years and the lambdoidal suture only slightly later.<sup>7,9</sup> Interexaminer reliability is approximately zero, many published coefficients have been negative, and the most parsimonious explanation for data collected thus far is that practitioners are imagining the cranial rhythm.<sup>1</sup> Finally, even if purported cranial and intracranial movements are real, are being propagated to the scalp, and are being assessed accurately by practitioners, there is no reason to

believe that parameters of such movements should be related to health and no scientific evidence that they can be manipulated to a patient's health advantage.

Similarly, in 1997, the authors of a report prepared for The Insurance Corporation of British Columbia concluded that "no plausible functional background and no empirical evidence of effectiveness of craniosacral therapy could be discerned from the materials reviewed."<sup>10</sup> In 1998, the National Council Against Health Fraud concluded that "cranial osteopathy is more a belief system than a science."<sup>11</sup> In 1999, independent reviewers "found insufficient evidence to support"<sup>12</sup> or "recommend craniosacral therapy to patients, practitioners or third-party payers for any clinical condition."<sup>13</sup>

We are aware of no scientific research supporting the clinical value of these techniques. We should not teach our students that health-related restrictions and imbalances in cranial and intracranial movements can be manipulated to a patient's health advantage, because there is no evidence supporting such claims. We are still deliberating these issues only because craniosacral therapy/cranial osteopathy is a belief system—not medicine—and as such has been impervious to disconfirmation for most of a century.

We are not characterizing craniosacral therapy as just another approach to health care about which knowledge is incomplete. To the contrary, we believe that craniosacral therapy bears approximately the same relationship to real medicine that astrology bears to astronomy. That is, this approach to "health care" is medical fiction, and it is not appropriate to teach fiction as part of medical or allied health curricula.

We intend no disrespect for practitioners who may feel that their professional identities are challenged by our views. However, until researchers have repli-

cated demonstrations of efficacy—using properly controlled scientific trials—we believe that craniosacral therapy/cranial osteopathy should be removed from all medical and allied health curricula.

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