

Cavitation Emptor: Tracking the Holy Grail of Manipulation

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From Roston and Haynes' classic force-displacement curves of the third metacarpophalangeal joint in 1947,¹ through Sandoz' application of this phenomenon to manipulation,² through the criteria established by Mierau, Cassidy, et al., in 1988 to operationally differentiate manipulations from mobilizations,³ chiropractors have held the audible release to be a virtual hallmark (if not a holy grail) of a successful manipulation. Indeed, an elegant model proposed by Raymond Brodeur, one of FCER's Peter Bommarito Residency Award-holders, has suggested⁴ that the cavitation process provides a simple means for initiating reflex patterns associated with a manipulation.⁵⁻⁷

Like all promising theories that advance our thinking, however, this one does not appear to be airtight. In my opinion, the problem began eight years ago, with the appearance of a simple study from Walter Herzog that utilized a mixture of chiropractic patients and asymptomatic subjects to compare the reflex responses of high-velocity, low-amplitude (HVLA) treatments at T6 that yielded a cavitation (confirmed by both the attending chiropractor and an accelerometer) with those that did not. The reflex response appeared to be the same, whether or not a cavitation was recorded. Furthermore, low-velocity treatments requiring two to three seconds, rather than the usual 100-150 milliseconds, never yielded measurable reflex responses, although cavitations sometimes were present. Thus, it was apparent that in this instance, cavitations were not essential for eliciting the observed reflex response following an HVLA procedure⁸ or, as has been said elsewhere, it would conceivably be possible to undergo a successful manipulation and, with only the slight transformation of a popular slogan, be able to say afterward, "Look Ma no cavitations!"

The second shoe dropped in July 2004, with the emergence of a study by another of FCER's postgraduate study awardees, Kim Ross. After calibrating accelerometers to measure the source of vibrations, Dr. Ross' group attached these to the skin over the spinal column and used them as monitoring devices for cavitations after an adjustment, comparing their calculated source of vibration to the actual site of a thoracic or lumbar thrust actually applied. The results were sobering. In terms of where the actual cavitation was shown to occur, spinal manipulation was found to be accurate only half the time in the lumbar spine. But since most procedures were associated with multiple (two to six) cavitations, at least one cavitation almost always originated from the target joint. Is this really a surprise? Not really, because as the authors suggested, due to the nature of the positioning of both the practitioner's hands and the patient in lumbar manipulations, the procedure actually appears to be a long-lever procedure that exposes any of the joints between the patient's pelvic and the thoracic spine as a moment and thus the site of a possible cavitation.

In the thoracic spine, only slightly more than half of the cavitations were deemed to be accurate. However, the discrepancy between the target and the cavitation location was less than that observed

in the lumbar spine. In this instance, with the practitioner's hands directly over the vertebra of interest, it is likely that the vertebra directly under the point of contact would have cavitated.⁹ However, as shown by Herzog, during the actual force application to the patient's back, the area of contact increased,¹⁰ which may explain the high rate of error for even thoracic cavitations. All of this is to say that our concept of the chiropractic derivative of the classic civil rights credo of "one man, one vote" ("one manipulation, one cavitation") has undergone some serious debunking indeed.

What do the Ross findings indicate? One could infer that the technique employed for spinal manipulation may not have been as accurate as once assumed. But the fact that multiple cavitations have appeared could explain the widespread and reproducible prevalence of clinical responses we have observed through the years.

However, there are other problems to consider. For one, joints have been described that are either too lax or too tight to allow cavitations to occur.^{1,11} A simple-minded question might be: What advantages are found in the hands of people who crack their knuckles regularly over those who don't? Finally, as suggested by Dr. Brodeur,⁴ the use of drop-pieces, the Activator adjusting device or other instruments may provide means of stimulating the high-threshold receptors within periarticular tissue as means to initiate the reflexes associated with manipulation.⁵⁻⁷

Where does this leave the casual observer, no doubt beginning to wonder if he or she, with an ear to the ground (or the spine, as the case may be), might have been listening for sounds in all the wrong places? Certainly not in a position to jettison the entire concept of cavitation, since it represents a clear sequela for at least most manipulations and remains a plausible mechanism for initiating reflex responses. Besides, the recent evidence from Gregory Cramer's group in Lombard which demonstrated the increased gapping of zygapophyseal joints specifically after manipulation¹² seems to beg for a model that can accommodate (if not include outright) the phenomenon of cavitation.

What this chain of events tells us is the typical drill in research science: No principle, with the exceptions of death, gravity and perhaps Coca-Cola, is immutable (and even the latter experimented with an innovation some 30 years ago and was forced to backtrack). But if these concepts were never advanced in the first place, our understandings of their limitations and discoveries of new linkages would never have taken place, and we would be that much more lost in the woods. For the present, one must accept these maverick observations as "friendly amendments" that occur at least under the specific circumstances in which they were recorded. The reason that research efforts, including ours at FCER, must be able to go forward is to gain the capacity to more firmly establish the circumstances when these models, including cavitation, are functional and when they are not. In other words, accepting the cavitation model with a grain of salt *cavitation emptor* is very much in order.

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