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Short Commentary

Evidence-Based Imaging Guidelines for Chiropractic Biomechanical Spine Care, Reconsideration of X-Ray Exposure Risks, and Practical Applications of Research Evidence

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Abstract

Evidence-based imaging guidelines in chiropractic are used in policy-making to direct practitioners in their usage of imaging, especially with radiology. The practical application of these policies is often at odds with conventional approaches to biomechanically based chiropractic spine care. Many factors are involved in the different perspectives on the use of imaging between factions in the chiropractic profession, such as the importance of evidence of the biomechanics of spinal conditions on imaging, the risks versus benefits of x-ray examinations, the goals of care, interpretations of data from research, and the practical applications of the research findings. First, the perceived risks of very low dose radiation exposures from x-rays in health care must be reconsidered with regard to their effects in humans. Second, a more practical application of data analyses from research is needed than the prevailing current approach. And third, the biomechanical conditions of previously injured spines in patients who present for chiropractic spine care should, when possible, be examined by imaging prior to applying forces from spinal manipulation or adjustments to ensure optimal safety and effectiveness.

Keywords: Chiropractic; Evidence-Based Guidelines; Radiology; Spinal Manipulation; Spine; X-ray

Introduction

Alternatives to main-stream western medicine have long faced uphill battles in terms of public perceptions of legitimacy. Chiropractic care in the United States is the largest alternative health care practice and has struggled against main-stream medicine's attempts to monopolize health care in the U.S. since its inception, including illegal anti-trust actions [1]. Thankfully, the modern practice of chiropractic faces fewer overt obstacles from medicine, and co-operative practice between the two professions is more common now. Over 15% of chiropractors in the U.S. are now employed in multi-disciplinary health care facilities [2].

The main challenges to chiropractic originally came from medical associations, but significant conflicts occurred within the profession between its ranks [1]. These internal conflicts fragmented the profession early on, and continue to some extent to this day [3]. The present article discusses the current debate between factions within the chiropractic profession as it relates to the use of x-ray examinations in practice, with some significant influence from external sources as well.

As fate would have it, the invention of x-ray and the discovery of chiropractic both occurred in the same year, 1895. X-rays have been a part of the chiropractic profession since 1910 [4]. The history of this debate within chiropractic relating to the usage of x-rays in practice has been described in detail by Coleman et al., [5]. It will be useful in this discussion to describe the two main factions in this debate, and we will accept Ebrall's description for this purpose: the minority left wing of the profession versus the majority conventional part of the profession (there reportedly is no right wing in the data) [3]. The main concerns from the minority on the left are the perceived risks of exposure to x-rays and a lack of frequentist data supporting the usefulness of x-ray examination findings in chiropractic care of symptoms related to spinal problems [6]. The main concerns of the conventional majority of the chiropractic profession include: (1) the perceived importance of biomechanical evidence on imaging of spinal problems; (2) the perceived improved safety of chiropractic care from radiographic findings; (3) the perceived improved force applications for spinal adjustments using biomechanical evidence from radiographs; and (4) goals of care beyond relief of initial presenting symptoms [6].

Perceived Risks of Very Low Dose X-ray Examination versus Reality

Without the perceived risks of radiation exposure from x-rays, there would likely be little basis for objection to its use in chiropractic. The policy called ALARA (as low as reasonably achievable) guides healthcare practitioners to minimize x-ray imaging procedures and is based upon the assumption that all exposures to radiation, no matter how small, are harmful to humans [7]. This ideology is based on the Linear-No-Threshold (LNT) assumption, which was adopted over 70 years ago, and theorizes that there is no safe threshold of radiation exposure for health risks and that even very low levels of radiation exposure, such as those used in plain spine radiography, are dangerous [8]. The problem is that the LNT assumption is outdated and used mostly out of convenience, yet virtually all models of risk for radiation exposures in published literature are based on that theory. There is substantial evidence in opposition to the LNT theory. Based on the evidence, rather than a linear model for risk that assumes risks

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for radiation exposure at any level above zero, the likelihood is that there is a hormetic U or J shaped curve that best represents the risks of radiation exposure at the lowest levels [9-11]. The hormesis-based model suggests that at very low doses, cancer risks would actually be reduced compared to no exposures. Another model of cancer risk would suggest there are no risks to cancer until a certain level of radiation exposure is met (a threshold model), but based on available published data, it does not appear to have much support.

Instead of creating more cancers, low dose radiation exposure has shown a protective effect against cancer. People who live in high background residential radiation areas or are exposed to chronic intermittent occupational radiation or medical radiation show a hormetic response to such exposures with reduced overall cancer rates compared to what would be expected by the LNT assumption [12]. Cuttler and Polygrove state that "Based upon human data, a single whole-body dose of 150 mSv (effective dose measure) is safe. The high background of 700 mSv/year in the city of Ramsar, Iran is also a safe dose limit for continuous chronic exposure. Both dose limits are also beneficial [12]". The Health Physics Society [13] and the French Academy of Science and National Academy of Medicine [14] further state that there is no evidence of harm for radiation exposure levels below 100 mSv.

The radiation exposure to a patient in plain x-ray examinations of the spine involves an estimated 0.2, 1.0, and 1.5 mSv for the cervical, thoracic, and lumbar regions, respectively [15]. These levels show that medical x-rays of the spine are less than half the yearly average background level of radiation exposure in the U.S., which is about 3.1 mSv [16]. Therefore, with plain medical x-rays that are likely not harmful and may even be beneficial to stimulate the immune system (hormesis) [17], the policy of ALARA should not include discouraging potentially helpful radiographic imaging of the spine to guide chiropractic treatment of the spine.

There is also general agreement, even on both sides of the ongoing debate about the risks of radiographic examinations, that the risks of patients being exposed to very low levels of radiation during plain x-ray medical examinations are either too small to be demonstrated or non-existent [7]. While it may be prudent to reasonably limit x-ray examinations rather than take the principle of ALARA to the level of avoiding useful x-rays, we should reconsider how we view very low level radiation exposures during spinal x-ray examinations.

Evidence, Guidelines and Practical Application of Data

The minority left wing of chiropractors, primarily academic and policy-making people, have taken evidence-based best practice efforts to the extreme in terms of limiting the use of imaging and goals of care [3]. There is also a predominant use of frequentist data analysis in interpreting results from published studies that is not congenial with conventional experiential and pragmatic patient care in practice [6]. Frequentist interpretations of data are, in general, applicable to an average result seen in a particular study population. However, they are not practically applicable to a particular patient in practice [18]. Healthcare practitioners typically use a pseudo-Bayesian approach to diagnosis on a patient-to-patient basis. A Bayesian approach to data analysis takes "priors" into consideration in order to interpret the significance of a particular finding, much like a health care practitioner considers historical information and physical examination findings in order to interpret the significance of other findings, such as those from radiographic examinations [19]. The combination of a negative bias from frequentist dominated evidence-based guidelines and the bias against conventional chiropractic practice approaches from a minority of chiropractors, primarily in academia and policy making, has led to increasing pressure to eliminate radiography from usual chiropractic examinations in most cases and to de-emphasize vitalistic health care goals beyond pain-relief in chiropractic [20,21].

A partial solution to this conundrum is that the chiropractic profession should adopt guidelines for chiropractors that are different from those of non-physical intervention practitioners. Chiropractic treatment of the spine involving high velocity, low amplitude adjustments or manipulations (HVLA/SM) most often has beneficial effects, but can also have mild to moderate adverse effects [6]. The purpose of imaging in chiropractic, particularly weight-bearing spinal radiographs, should focus on biomechanical aspects of the spinal structure to determine the optimal approach to adjustments/manipulations using HVLA/SM and other potentially helpful forces for the spine. The current prevailing imaging guidelines for chiropractors are no different than those for medical practitioners, focusing on a red flags (pathology, fracture, infection, etc.) only approach to imaging for the first four to six weeks of care [22]. It is not logical for such guidelines to be the same for chiropractic and medicine. The use of force by chiropractors on the structurally damaged spine logically requires different imaging guidelines, acknowledging the importance of biomechanical assessment rather than for the practice of medicine and red flags only.

Biomechanical Damage to the Spine and Its Implications

Biomechanical balance of the spine is important to human health and spinal malalignment is associated with decreased quality of life and increased adverse effects and symptoms [23]. The patterns of spinal structural damage include buckling deformations, translations, and rotations that cause misalignments at the inter-articular levels, as well as in whole spinal regions with respect to other regions. Such patterns of distortions of spinal structure serve as a model of the manipulable spinal lesion and form a systematic characterization of corrective manual procedures [24]. Once damaged, the supportive soft tissues are less load-tolerant and should be protected when applying HVLA/SM and other mobilization forces to the spine while treating patients for neuro-musculo-skeletal spinal conditions.

Imaging, particularly plain radiography, is the best tool for discovering the patterns of spinal structural damage prior to administering conventional chiropractic care. Radiography is relatively inexpensive, safe, and/or beneficial to health at very low levels of typical spine x-ray exposure. Radiography, however, should not be used as a screening tool. A chiropractor should first perform a history and physical examination sufficient to confirm that the patient is a good candidate for chiropractic care, rule out contraindications to chiropractic treatment, and ascertain that an x-ray examination would provide important information that would significantly assist in the chiropractic application of HVLA-SM forces.

Radiology Guidelines and Evidence-Based Best Chiropractic Practice

The debate between the minority of the profession against x-rays in practice and the majority made up of conventional chiropractors is unsettled to date. Radiological guidelines enforcement by policy makers for chiropractors has appeared to enter more of a political realm

than a reasonable application of available evidence for chiropractic practice. Sackett described three essential parts of evidence-based practice as scientific evidence, practitioner experience and knowledge, and patient preferences [25]. Others have tried to clarify Sackett's meaning as a three-legged stool analogy of best practice [26], as more of a funnel through which the evidence should flow [27], which is the beginning of the clinical decision-making process, or an unevenly weighted stool with less emphasis on the patient's preferences or the clinician's influence [28]. Current policymakers, however, appear to ignore the last two legs of that stool completely. They rely on limited, frequentist-based data analysis of evidence and the biased application of the same to rule the practice of chiropractic in some areas with respect to x-ray usage [20,21].

But even Sackett warned that "Good doctors use both individual clinical expertise and the best available external evidence, and neither alone is enough. Without clinical expertise, practice risks becoming tyrannized by evidence, for even excellent external evidence may be inapplicable to or inappropriate for an individual patient [25]". He further noted that "External clinical evidence can inform, but can never replace, individual clinical expertise, and it is this expertise that decides whether the external evidence applies to the individual patient at all and, if so, how it should be integrated into a clinical decision." Kaplan et al., [29] provide further reason for caution about frequentist data analyses emphasizing Randomized Controlled Trials (RCTs) stating that "Over-reliance on RCTs is similar to resting all of health care evidence on a one-legged stool." He goes on to say that RCTs often have limits, such as lacking external validity and generalizability, and that "aggregated results are uninformative of the potential benefit of a treatment for any individual in the study, and more importantly, for the individual who was not in the study but whose treatment decisions will nevertheless be made on the basis of the study".

In chiropractic and this x-ray usage debate, there is a further problem of an almost total lack of research comparing treatment outcomes without utilizing imaging evidence of spinal conditions versus treatment utilizing such imaging evidence for biomechanical assessment prior to administering chiropractic care. A single study was recently published that had the stated purpose of such a comparison, but unfortunately, due to poor design, the study results were unable to lead to conclusions that would have been helpful to the debate [30].

Conclusion

It appears that the minority of academics and policy-makers in chiropractic are currently pushing for wider influence in limiting radiology in practice. Such efforts are based on likely erroneous and irrational fears of very low level x-ray exposure risks and a lack of practical application of data from studies that would benefit from data analysis based more on Bayesian principles. A reconsideration of the potential benefits of imaging to inform chiropractic care strategies and an acknowledgement of the lack of risks and possibly even health benefits from very low level x-ray exposures from plain x-ray examinations would allow chiropractors to perform to the best of their abilities to assist people with spinal structural problems. Top-down mandates from policy-makers based solely on selective reviews of average results for certain patient populations are not a wise replacement for a well-informed and experienced clinician's perspective, in the context of a single patient with individual needs. This is especially true regarding the use of x-ray examinations in chiropractic when the selective reviews of the literature upon which guidelines are constructed lack studies on the clinical applications similar to the in-practice, biomechanically based use of radiographs in chiropractic.

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