



Activator Methods

The Rise and New Status of Instrument Adjusting

A. Introduction

MUCH OF THE HISTORY OF the chiropractic profession features bold leadership and triumph over adversity. Both of these elements are seen in the remarkable rise of Activator Methods instrument adjusting to its current clinical, research and market status.

When Dr Warren Lee, a chiropractor in rural Minnesota, persuaded a teenage patient named Arlan Fuhr to become a chiropractor in the 1950s, and when that patient graduated and joined him in his practice, little did he know that he was ushering in one of the most significant advances in chiropractic technique in the history of the profession. He began a small mid-west American movement which, like the chiropractic profession itself, has gone truly global despite controversy and resistance, challenges that would have defeated all but the most resilient and determined of people.

That movement was the technique system known as Activator Methods. Here is the history of that movement, and the story of its visionary and now much-honored leader for over 45 years – Dr Arlan Fuhr.

Spinal adjusting instruments soon appeared amongst the early chiropractors. In 1901 Minnesota chiropractors were using a rubber-tipped stick and mallet developed by Thomas Storey DC. DD Palmer's one time partner Alva Gregory DC and Albert Abrams MD developed a mallet and metal pleximeter cushioned by felt and rubber "for evoking concussion reflexes."¹

However it has been Activator Methods (AM), co-founded by Dr Arlan Fuhr and Dr Warren Lee in Minnesota in 1967, that has brought manually-assist-

ed instrument adjusting into mainstream chiropractic practice. Today:

- Use of an Activator adjusting instrument (Activator) is the second most common chiropractic technique in the USA and internationally after manual Diversified technique.
- A recent systematic review of clinical trials of Activator Methods, now more researched than any other manipulative technique, concludes it is as safe and effective as manual manipulation or trigger point therapy for patients with acute and chronic spinal pain, and other biomechanical restrictions such as temporomandibular joint dysfunction and trigger points in the trapezius muscles.²
- AM has an impressive continuing record of commitment to research. In 1985 it received the first ever US National Institutes of Health (NIH) grant for chiropractic research, to study the safety and effectiveness of the Activator. In 1987 AM and Dr Fuhr established the National Institute of Chiropractic Research (NICR) funded initially by AM practitioners with \$250 donations that raised a total of \$685,000. The NICR went on not only to fund AM research, including the mechanical properties of the Activator and the effectiveness of AM protocols, but also general chiropractic education and research.

AM has contributed to the better understanding of the mechanisms of action of spinal manipulation. For example, an award-winning trial by Song, Gan et al. from the Department of Neurobiology at Parker University demonstrated that a course of Activator adjustments greatly reduced inflammation and healing time in the intervertebral foramen in white rats in comparison with untreated controlled rats.³ That result has now been supported in

Professional Notes

MV Accidents and Concussion

Incidence, Course, Prognosis

A new study to determine the incidence, course and prognosis of adult mild traumatic brain injury (MTBI) – concussion – caused by motor vehicle collisions is important because:

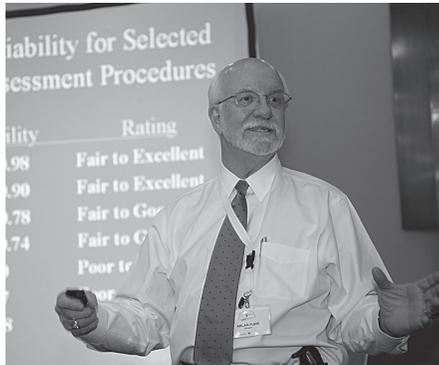
- Previously there has been very little good quality research in this area. This is a high-quality prospective study with new evidence on prognostic factors.
- The principal author is chiropractic scientist Dr David Cassidy, an epidemiologist and health policy researcher affiliated with the University of Toronto and the University of Southern Denmark. Other authors are Dr Eleanor Boyle and Dr Linda Carroll, whose backgrounds respectively are physical therapy and psychology.
- The study is published in the Archives of Physical Medicine and Rehabilitation, official journal of the American Congress of Rehabilitation Medicine and the most highly accessed/read journal in the field

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humans by Roy, Boucher et al.⁴ Those trials are reviewed below.

• Over the years increasingly sophisticated Activator instruments and protocols have arrived.

This trail-blazing has produced other contemporary instrument-adjusting methods and products – for example by Neuromechanical instruments (NMI) and Pro-Adjustor. For these reasons this issue of *The Chiropractic Report* looks at Activator Methods (AM) and the leader synonymous with it – Dr Arlan Fuhr (below), now of Phoenix, Arizona.



B. History

2. From the time of the first AM seminar in 1970 the use of the Activator specifically, and instrument-adjusting generally, spawned a storm of controversy. “It was not the method of analysis that met early resistance,” says Dr Fuhr, “but the instrument itself.”⁵

Resistance came from all quarters. The mainstream profession, using manual methods, gave the most opposition. “They just believed and new that we could not be effective with such a light force,” says Fuhr. “The straight community was particularly vocal, and considered us mixers because adjustment should be by hand only.”

However there was controversy also over the method of patient assessment and spinal analysis, with its central focus on leg length inequality and isolation tests.

3. **The Instrument.** As their practices grew in the 1960s Lee and Fuhr looked for mechanical ways to produce a thrust into the spine, reducing physical stress on the clinician and controlling for speed, force and direction.

In 1967 a local dentist in Minnesota, a patient of Fuhr’s who suffered from sciatica, gave them a surgical impact mallet designed to split impacted wisdom teeth. This, with scalpel removed

and rubber door stop affixed, became the prototype for the first activator and was used by them with further modifications until 1976. It was manufactured by Union Broach in New Jersey.

Believing they were actively moving or “activating” the vertebrae with their instrument, it was named the Activator. After further design improvements the US Patent Office issued a patent for the “Activator Adjusting Instrument” (AAI) in September 1978. Since then it has been a registered medical device with the US Food and Drug Administration (FDA).

The Activator II, incorporating improvements arising from research by Dr Tony Keller, Professor of Mechanical Engineering, University of Vermont, appeared in 1994. The latest and most sophisticated instrument is the cordless, battery-powered Activator V.

4. **The Assessment Method.** Doctors of chiropractic use the Activator in one of two ways, either in accordance with an assessment and treatment protocol that is Activator Methods (AM), or simply as a mechanical adjusting instrument for some patients in some clinical situations.

Comprehensive information on the AM approach to patient assessment is given elsewhere in AM textbooks and educational programs, but central features are:

a. Use of functional leg length inequality (LLI) as a measure of asymmetry, pelvic distortion and resulting spinal joint subluxation/dysfunction. Lee and Fuhr first incorporated functional LLI in their practices in the 1960s from the Derefield Leg Check protocol.

Functional LLI has been used as an assessment method in many chiropractic technique systems, and was formerly controversial. A recent literature review by Triano, Budgell et al. sponsored by the Association of Chiropractic Colleges reports that there is now “high-quality evidence” supporting measures of LLI as a valid and reliable method of determining the site of subluxation/dysfunction and application of spinal manipulation.⁶

b. Use of isolation tests, which are provocative maneuvers to test for the specific level of subluxation/dysfunction. The first test was developed accidentally by Fuhr in 1976. His adjusting table had a manually-operated foot piece that required pulling up with the left hand

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into the locked position. Eventually Fuhr began to notice a fairly constant, dull aching pain in his left rib cage at the level of the twelfth thoracic vertebra.

He asked an associate chiropractor for an adjustment, explaining that when he raised his left arm over his head the pain increased. The associate doctor noticed that Fuhr’s functional short leg shortened dramatically during this movement. Thus was born the first Isolation Test, specific to the twelfth thoracic vertebra.⁷

Subsequent tests came from clinical observations by Lee and Fuhr, then from other clinicians instructed in AM, and later from an AM Instructors Review Panel.

5. **Seminar Program and Education.** Lee and Fuhr commenced formal AM weekend seminars in 1970. The first international seminars were in Bourne-mouth, England in 1972 and Sydney,



Activator I and Activator V



Australia in 1974. From November 1976 AM was taught at all Parker seminars, greatly increasing its exposure.

Lee retired from AM in 1982. Fuhr was joined by a growing faculty of instructors who, since 1986, have attended annual re-credentialing meetings. The week-end seminars currently certify chiropractors at the three levels of basic, intermediate and

advanced. More than 50 hands-on seminars are given by 150 instructors annually in many countries.

AM first entered mainstream chiropractic education when Logan College of Chiropractic in St. Louis, Missouri, Fuhr's alma mater, offered AM as an elective in 1980. In 1985 Parker College of Chiropractic was the first to include AM in the core curriculum. Today, almost 30 years later, AM is taught at most chiropractic schools internationally, including newly established schools such as the Barcelona Chiropractic College and the Madrid Chiropractic College in Spain, UNEVE in Mexico, and Feevale University in Brazil.

In 1997 instruction manuals were superseded by AM's first mature textbook, *Activator Methods Chiropractic Technique*, edited by Fuhr and published by Mosby. This and a second edition published in 2004 are now available translated into Chinese and Japanese.

Today AM has added online learning to its educational offerings and has the chiropractic profession's first competency-based, interactive, online technique program which can be found at www.activatoronline.com.

6. Research. Throughout the history of the profession many technique systems have been developed. None has made a greater commitment to research than AM. As already mentioned this began with an NIH grant in 1985 for first study of the safety and effectiveness of the Activator. This produced AM's first two published papers, both in the *Journal of Manipulative and Physiological Therapeutics (JMPT)*, namely:

- Fuhr AW, Smith DB (1986) *Accuracy of Piezoelectric Accelerometers measuring displacement of a spinal adjusting instrument.*⁸
- Smith DB, Fuhr AW, Davis BP (1989) *Skin Accelerometer Displacement and Relative Bone Movement of Adjacent Vertebrae in Response to Chiropractic Percussion Thrusts.*⁹

There are currently 18 published clinical trials of effectiveness. By the early 1990s national evidence-based chiropractic clinical guidelines in the USA in 1993¹⁰ and Canada in 1994¹¹ gave AM mechanical force manually-assisted technique a "promising to established" rating for the treatment of patients with acute and chronic spinal pain.

A recent independent systematic review, including all studies to March 2010, acknowledged that many of the AM studies had methodological limitations – such as small size, relatively brief follow-up period, lack of a sham/control group – but reported that the overall evidence supported the conclusion

that AM treatment had similar safety and effectiveness to manual manipulation or trigger point therapy for patients with acute and chronic spinal pain, TMJ dysfunction or trigger points of the trapezius muscles.²

Why is this commitment to research so rare in physical treatment methods? First, it requires great expense and effort. Fuhr provides a window on second reason in the Preface to his textbook:

"I found that scientific investigation is a bit like taking your clothes off in public, as it leaves you with more questions than answers, a not altogether pleasant experience. Unfortunately, it will take more than my life-time to explore all of those questions, but I remain dedicated to that exploration, come what may.

All I ask of the reader is an open, objective as well as critical mind while exploring the theories and rationales behind AMCT, realizing that although we have come a long way, there is still a long way to go."¹²

8. Legal and Professional Acceptance. As Fuhr built AM in the 1980s and 1990s many jurisdictions either prohibited or actively discouraged instrument adjusting. The last to prohibit it, as recently as 2004, was the province of Saskatchewan in Canada. However the demand grew exponentially because of the benefits to both patients and practitioners.

For patients, the high-velocity, light-force properties of instrument adjusting were found to be a valuable alternative to manual manipulation, especially for specific categories of patient. These include, for example, children, patients with osteoporotic bone fragility, and those fearful of manual manipulation and its perceived forcefulness. For practitioners, instrument adjusting places a lesser physical toll on the body than manual techniques. This provides particular assistance to older practitioners or those with disabilities to the back, shoulder or upper extremities.

However, it was also the growing clinical and research evidence of effectiveness for all patients that led to the quite remarkable growth of use of AM and the Activator from the 1990s. International surveys by the US National Board of Chiropractic Examiners (NBCE) have reported the following use of the Activator by chiropractors with at least some of their patients:

- In 1993 - 40% of Canadian chiropractors.
- In 1994 - 72.7% of Australian and 54.3% of New Zealand chiropractors.
- In 2005 - 51.2% of American chiropractors.²

A survey by Read, Wilson et al. from the UK published in 2006 reported that 82% of responding British chiropractors used an Activator, although only 2% used it as their primary treatment method.¹³

C. Activator Research – Reduced Inflammation, Sensitivity and Pain

9. Most of the more than 50 AM studies supported by the NICR and published in the peer-reviewed literature investigate aspects of the Activator and AM, such as the mechanical properties of the Activator, the reliability and validity of prone, leg-length checking, the reliability and validity of diagnostic

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The Chiropractic World

MV Accidents and Concussion

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of rehabilitation. Notably, this is as part of a special supplement devoted entirely to the report of the International Collaboration on Mild Traumatic Brain Injury Prognosis, an international team of clinician scientists from prominent universities in Canada, Denmark, France, Sweden and the United States led by Dr Cassidy and with several other chiropractic researchers prominent.

To summarize:

a) Study participants were all 1,716 adults suffering an MTBI in a MV collision in the 2-year period November 1997-1999 in the province of Saskatchewan in Canada, which had a population of 1 million. Exclusions included those who were unconscious for more than 30 minutes (52 individuals) and all those with a workers' compensation claim. There was no-fault compensation in place, and therefore, importantly, no financial gain for patients exaggerating their injuries and symptoms.

b) The criteria for MTBI included a head impact in the collision, immediate loss of consciousness or amnesia or disorientation, and subsequent symptoms such as dizziness/forgetfulness/attention problems.

c) There were telephone interviews six weeks and 3, 6, 9 and 12 months post injury. Those answering "all better or cured" or "feeling quite a bit of improvement" were judged recovered, those answering "feeling some improvement" or none or worse were judged not recovered.

d) Results included:

i. 24% of all those injured in a MV accident suffered MTBI. 80% of them were taken to a hospital but only 1 in 3 (34%) were admitted overnight.

ii. Mean/average recovery time was 100 days, but 23% or almost 1 in 4 did not recover within one year.

iii. Delayed recovery "was highly associated with poor expectations for recovery measured at baseline." Loss of consciousness, post-traumatic amnesia, and gender were not associated with, or prognostic factors for, time to recovery.

iv. Other factors associated with delayed recovery included being older than 50 years, having less than a high-school education, having depressive symptoms, having arm numbness, having hearing problems, having headaches, having low-back pain and having thoracic back pain.

Cassidy et al. suggest that poor expectations for recovery or "negative beliefs" may be treatable through early reassurance and patient education.

(Cassidy JD, Boyle E et al. (2014) *Population-Based, Inception Cohort Study of the Incidence, Course, and Prognosis of Mild Traumatic Brain Injury After Motor Vehicle Collisions* Archives of Physical Med and Rehab 95(3 Suppl 2):S278-85)

Symptoms and Who Treats

In a companion study to the one just reviewed Danish chiropractic researcher Dr Jan Hartvigsen joins Boyle, Cassidy, and Carroll as principal author. In the same population of 1,716 with concussion/MTBI after a motor-vehicle accident, and with the same follow up points over a period of 12 months, Hartvigsen et al. report:

a. Six weeks after the accident 75% of patients report having more than three symptoms, 26% report having more than eight symptoms.

b. Six weeks after the accident 30% had "clinically significant pain in more than three body sites."

c. The most common symptoms were sleep disturbances (65%), neck pain (50%), headache (39%), dizziness (39%), and low-back pain (35%).

d. Over time the prevalence and severity of all symptoms decreased. However after 12 months common symptoms that participants related to the collision were sleep disturbances (44%), tiredness (39%), forgetfulness (27%), dizziness (25%), neck pain (25%), and low-back pain (19%). "More than half still reported more than three symptoms."

e. Almost all participants sought healthcare for their symptoms within the first six weeks – physician (95.9%), a physiotherapist (41.7%), a chiropractor (19.9%), a massage therapist (24.4%), or another type of provider (10.1%). Over the 12 months, care-seeking from physicians remained constant and high (over 90%), but care-seeking from all other providers increased. "The majority of the participants received care from more than one provider at all time points, with most still seeking two or three providers after one year."

This research is important as the first population-based study describing self-reported symptoms and care-seeking by individuals with a traffic-related MTBI. "One year later multiple symptoms are very common and the majority (74%) continued to seek care from multiple providers." "Individuals seeking care from allied health professionals have in general more symptoms than do persons seeking care from physicians."

Hartvigsen, Boyle et al. refer to an earlier Canadian study by Carroll, Holm et al. reporting that "persons who expect to get better after the collision recover more than three times faster than do persons who never expected to get better after a whiplash injury." For whiplash and/or MTBI they suggest that many practitioners underestimate "the degree of patient distress in the post-injury period" and that "a greater focus on depression, emotional distress, and patient expectations instead of on bodily symptoms may result in less seeking of care and faster recovery."

(Hartvigsen J, Boyle E et al. (2014) *Mild Traumatic Brain Injury After Motor Vehicle Collisions: What Are the Symptoms and Who Treats Them? A Population-Based 1-Year Inception Cohort* Archives of Physical Med and Rehab 95(3 Suppl 2):S286-94)

Other New Research

1. Do Manual Therapies Help Patients with Low-Back Pain?

You should be aware of, but not overly concerned about, a new meta-analysis of the low-back literature by Michael Menke DC, PhD currently employed at the Division of Psychology at the IMU School of Medicine in Kuala Lumpur, Malaysia. This was published in *Spine* in March, and provocative conclusions made include:

- “All treatments of acute and chronic low-back pain are much less effective than natural history and non-specific factors”
- The best that can be said for treatments is that they deliver psychosocial support, promoting patient perseverance “as time and encouragement resolve 97% of acute and 67% of chronic pain.” “The acupuncturist’s Qi, chiropractic subluxations, and the surgeon’s disc protrusions might serve as essential allegories in a therapeutic alliance.”
- Future care guidelines should follow the evidence and “support cautious observation, monitored exercise, and authoritative encouragement – services not requiring a licensed professional.”
- Bonesetters are as effective as those trained more formally in SMT – “education may add value in recognizing and referring pathologies.”

Responses from members of the Research Council of the World Federation of Chiropractic, to be incorporated in a letter to the editor of *Spine*, include:

- a) From the perspective of methodology, “this is a seriously flawed attempt at analyzing the determinants of recovery in patients with low-back pain.”
- b) A meta-analysis of randomized controlled trials (RCTs) should only be conducted when clinically homogenous (similar) trials are available for pooling. Clinical homogeneity is one of two essential prerequisites for this statistical method to have any validity. This is not the case with the LBP literature, which is clinically heterogeneous, because:
 - The definition of LBP varies between trials.
 - The source populations are different.
 - The inclusion/exclusion criteria differ.
 - The outcomes vary.
 - The presence of residual confounding is frequently ignored.
- c) The author provides very little information about the methods used – often a red flag.
- d) From a statistical perspective, this is an exercise or analysis “that completely lacks a valid clinical and conceptual underpinning.”

To quote another reply received, “if you torture data enough it will confess to anything.”

(Menke JM (2014) *Do Manual Therapies Help Low-Back Pain? A Comparative Effectiveness Meta-Analysis*. *Spine* 2014;39:7, E463-E472)

2. Research Agenda for the Profession in Europe

Rubinstein, Bolton et al. have just presented a first agenda for chiropractic research in Europe. This arises from annual ECU/ European Academy of Chiropractic Researchers’ Days being held at the time of the ECU Convention since 2008. A representative group of participants reached consensus in 2013 on 19 priorities of future research. The top 10 in order of importance are:

- 1) Cost effectiveness/economic evaluations.
- 2) Identification of subgroups likely to respond to treatment.
- 3) Initiation and promotion of collaborative research activities.
- 4) Promotion of chiropractors to obtain PhD’s.
- 5) Dose response and frequency of treatment.
- 6) Biopsychosocial variables as predictors of outcome.
- 7) Anatomical and/or neurophysiological bases for chiropractic treatment of MSK pain.
- 8) Effects and response of treatment on function and performance.
- 9) Establishing clinical research networks throughout Europe.
- 10) Prevention of MSK pain in primary and secondary care.

(Rubinstein SM, Bolton J et al. (2014) *The First Research Agenda for the Chiropractic Profession in Europe*. *Chiropractic & Manual Therapies* 2014;22:9)

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tests unique to AM (isolation, stress and pressure), and overall clinical safety and effectiveness.

Here we review in detail two controlled trials already mentioned because of their wider importance to clinical research and chiropractic practice. These are:

- An animal research study by Song, Gan et al., medical and chiropractic researchers from Parker College in Dallas, Texas, which reported that when trial rats with experimentally-induced inflammation of the intervertebral foramen (IVF) at the fifth lumbar vertebra (L5) received a course of 10 adjustments over two weeks, there was a much faster recovery than for comparison, control rats. This was faster recovery both from pain (in 2-3 weeks rather than 4-5 weeks) and the pathological and neurological changes caused by the inflammation (e.g. pathological changes in the dorsal root ganglion were significantly reduced after 3-4 weeks in rats receiving manipulation, but not the others).
- A follow up pilot trial in humans by Roy, Boucher et al., chiropractic and basic science researchers from the University of Quebec at Trois Rivieres in Canada, which reported a reduction in pro-inflammatory plasma cytokines in the blood of individuals with chronic low-back pain after a course of nine Activator adjustments over two weeks.

10. Song, Gan et al. Study³. Song, Gan et al. explain that inflammation of the intervertebral foramen (IVF) plays a critical role in the production of back pain. The objective of their study, which won the Scott Haldeman Award, first prize at the World Federation of Chiropractic's Congress and international research symposium in 2005, was to assess and document the influence of spinal manipulative therapy on pain and hyperalgesia. They used behavioral, electrophysiological and pathological outcome measures. This was in a sophisticated animal experiment with 148 adult male rats. Manipulation was delivered with an Activator.

11. Method of Inflammation. For 100 rats an "inflammatory soup" containing bradykinin, 5-HT, histamine and prostaglandin was injected directly into the left IVF at L5 under anesthesia. This followed exposure of the L5 IVF by a midline incision from L4 to L6 and separation of the paraspinal muscles. After injection the muscle and skin layers were sutured. For 48 control rats there was an identical surgical procedure but no injection.

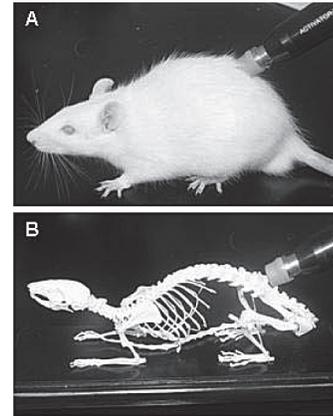
12. Treatment Protocol. Rats in the treatment group received spinal manipulation with a manually-assisted Activator adjusting instrument set at its lowest level. More specifically:

- a) There was a series of 10 adjustments – the first given one day after surgery, then others daily for a week and then every second day.
- b) Each treatment involved one adjustment, applied to the spinous process of the vertebra at a prescribed angle (40° to 50° to the vertebral horizontal line) as illustrated in Figure 1.
- c) Different groups of rats received adjustment to L4, L5, L6, and L5 and L6 (this last group therefore actually had two adjustments per treatment session).

13. Measurements and Results – Behavioral Testing. The primary measurements used were behavioral, and these were used on 80 of 100 injected rats, and 40 of the 48 control rats. These rats were tested on the two days prior to surgery, 1, 3, 4, 5, 7, 10 and 14 days after surgery, and then once weekly for five weeks. The two behavioral measures were:

Figure 1. Treatment Protocol

Method of the Activator-assisted spinal manipulative therapy applied to the lumbar spinous process in the rat. The location and direction of the thrust to the spinous process are shown in an experimental rat (A) and an artificial rat skeleton (B).



Courtesy of Song et al. and JMPT, 2006.

a) **Thermal hyperalgesia (sensitivity to heat).** This was measured by the time that elapsed before movement of a hind paw when the rat was placed on a smooth glass surface that was then subjected to a controlled heat stimulus (technically 'foot withdrawal latency' to heat stimulus). This stimulus was delivered four times to each hind paw at 5-6 minute intervals. Results were:

- i) The injected animals demonstrated "significant thermal hyperalgesia", whereas the other control rats did not. In injected rats the left hind paw on the same side as the IVF inflammation became significantly more sensitive to thermal stimulus, the right hind paw did not, which is what one would expect if the injection, inflammation and hyperalgesia were all related.
- ii) Both the severity and duration of hyperalgesia were significantly reduced for those rats which received the course of adjustments to L5, L6 or L5 and L6. Severity was significantly reduced after three adjustments, and recovery time or duration was shortened from 4 to 5 weeks to 2 to 3 weeks.
- iii) The rats adjusted at L4 showed no benefits and, like those given no treatment, had hyperalgesia for 4 to 5 weeks. This, of course, strongly confirms that the good results in the rats adjusted at L5, L6, and L5 and L6 did result from the treatment.

b) **Mechanical Allodynia.** The second behavioral measure, performed on the same schedule of days as the first, was mechanical allodynia, which is pain as a result of a normally non-noxious or non-painful stimulus to skin. A graduated set of filaments, capable of exerting forces of 10, 20, 40, 60, 80 and 120 milli-Newtons (mN) but with the same tip diameter were applied to 10 selected points on the plantar surface (sole) of the paw.

This was done from underneath while the rats were in a cage with a wire mesh floor – with the filaments inserted through 1 × 1 cm openings in the mesh. Each filament was applied to each point on each paw in ascending or increasing order

of force. Contact time was one second, with 10-20 seconds between each contact or stimulus.

“Foot withdrawal threshold”, and therefore degree of mechanical allodynia, was a calculation based on these measures. Allowance was made for pre-existing differences. Results were:

- i) As with thermal hyperalgesia, there was a significant reduction in severity and duration of mechanical allodynia in the injected animals that received manipulative treatment. With respect to duration, they recovered in 10-14 days instead of 3-4 weeks.
- ii) Again, adjustments to L4 produced no benefit. Additionally, there was not significant benefit in mechanical allodynia in the sub-group adjusted at L5 – statistically significant benefits were shown only by those adjusted at L6 or L5 and L6.

14. Measurements and Results – Electrophysiological Recordings. Electrophysiological recordings were taken from L5 dorsal root ganglia (DRG) neurons surgically removed from three groups of 6 rats – one group with induced IVF inflammation, a second with induced IVF inflammation plus manipulation, and a third without IVF inflammation – the surgical control rats. Individual DRG neurons were inspected by microscope to identify each of:

- Small nociceptive cells from unmyelinated C-fibers that transmit pain information into the spinal cord.
- Medium-sized cells from A-delta fibers that mainly convey fast and sharp pain information.
- Large cells from A-beta fibers that primarily transmit non-nociceptive information – such as touch and light pressure.

For each class of cell/neuron, there was evaluation of the readiness to respond to stimulus (excitability) by examination of several factors (e.g. resting membrane potential, the action

potential (AP) current threshold, repetitive discharge evoked by depolarizing current) as described. Results were:

- a) L5 IVF inflammation did cause increased and excessive excitability (hyperexcitability) of the L5 DRG neurons on the tests performed.
- b) This hyperexcitability was significantly reduced in the manipulation group. Two to 4 weeks later there was significantly reduced excitability in neurons from treated rats, but not in neurons from untreated rats.

15. Measurements and Results – Pathological Studies. For these studies L5 DRG were taken from rats over a period of one day to 4 weeks after initial surgery and injection of the inflammatory soup. In 18 rats ganglia destined for physiological recordings were first examined under light ($\times 4$) and higher ($\times 40$) magnification. In 10 animals (4 IVF inflammation, 4 IVF inflammation with manipulation, 2 control) both L5 DRGs were removed and prepared for microscopic analysis of the glia cells – the cells which provide the supporting structure for the nerve cells or neurons and which multiply in number following inflammation. Results were:

- a) Under light-dissecting microscope, the DRGs from inflamed IVF rats showed obvious pathological changes – including formation of a layer of connective tissue and increased vascular formation on the surface of the ganglia. There were “clear inflammatory signs . . . the DRG neurons were surrounded by significantly increased numbers of glia cells”.
- b) Song, Gan et al. produce photos demonstrating that this accumulation of glia cells and expression of inflammation were significantly reduced after 3-4 weeks in those IVF inflammation animals that received manipulation, but not in those that were untreated.
- c) Further, there was no obvious or apparent pathological change in the ganglia from the IVF at L5 on the right side – opposite or contralateral to the side of inflammation. Once again, this absence of change on the opposite side provides confirmation of the causative link between the injected inflammatory soup, the inflammation and the early reduction of inflammation brought about by the manipulation treatment.

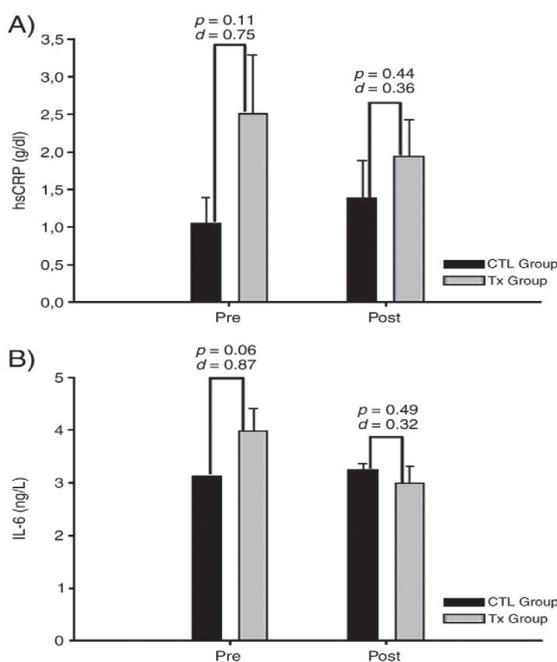
16. Summary of Results. Summarizing the results of their study, Song, Gan et al. note:

- a) The injection of inflammatory mediators into the left L5 IVF in this study produced “acute inflammation to the constituents within the IVF, that is, the DRG (dorsal root ganglion), nerve root and blood and lymph vessels.”
- b) The study shows that the form of manipulation given “can significantly alleviate symptoms and shorten the duration of pain and hyperalgesia caused by the IVF inflammation. Furthermore, by means of electrophysiological and pathological assessments our studies showed that the fast relief of pain and hyperalgesia after AMST (manipulation) may result from the faster recovery of hyperexcitability of the sensory neurons and elimination of the DRG inflammation.”

17. Roy Boucher et al. Trial.⁴ Inflammation is associated with an elevated/increased level of plasma cytokines in the blood. These are described as “inflammatory markers”. Two of these cytokines/markers are:

- Interleukin-6 (IL-6) – a pro-inflammatory marker in the acute phase of pain.

Figure 2. Inflammatory mediator response for both treatment and control groups. Dark bars represent control. Gray bars represent treatment.



From Roy, Boucher, et al. (2010)

• C-reactive protein (CRP) – linked to IL-6 in that IL-6 is responsible for the production/synthesis of CPR from the liver.

The purpose of Roy, Boucher et al.'s study was to observe the responses of these two inflammatory markers after a course of nine Activator adjustments in subjects with chronic low-back pain (at least three month's duration).

18. Groups and Treatment. The two groups compared were:

a) Treatment group (number 10). These were adults with chronic LBP who received nine Activator adjustment treatments within two weeks, given to the lumbar region (T12 – L5) at the functional short leg/pelvic deficient side according to AM protocols.

b) Control group (n 10). These were pain-free healthy adults with similar overall body size to the treatment group (“there were no significant differences for anthropometric characteristics”). They received the AM evaluation before and after the trial but did not receive any form of treatment within the two week span of the trial - in the trial or otherwise.

19. Results. See the paper for thorough details of the taking and analysis of blood samples from all subjects in the trial. Results were:

a) At the beginning of the trial (pre-intervention) there was “a large, standardized, effect-size difference for both CRP and IL-6 between the treatment and control groups.”

b) After two weeks (post-intervention) that difference narrowed considerably as demonstrated in Figure 2, “suggesting that nine interventions are capable of attenuating the inflammatory response.”

c) Clinically the treatment group “improved considerably” as measured by the Oswestry Disability Questionnaire. Roy,

Boucher et al. conclude it is likely that “the inflammation processes were being reversed but that complete healing was not achieved following two weeks of treatment.”

Significant limitations in this study were small group size and a relatively short treatment period. However, while more research is clearly needed, this is a promising first study of the relationship between spinal manipulation and inflammation in humans – and an encouraging follow up to the earlier animal experiment.

D. Conclusion

20. On one hand, as Dr Arlan Fuhr says, with Activator Methods he has raised more questions than can be answered in a lifetime. On the other hand, important clinical and research questions asked in a small rural chiropractic office are now being tested by expert interdisciplinary teams engaged in sophisticated research in major universities. And AM is being practiced throughout the world bringing benefit to numerous patients each day.

There is an extremely talented and visionary farmer's son from Minnesota who can be justly proud of his achievements over the past 50 years. **TCR**

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