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Clinical effectiveness of the activator adjusting instrument in the management of musculoskeletal disorders: a systematic review of the literature

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Objective: *The purpose of this study was to conduct a systematic review of the literature investigating clinical outcomes involving the use of the Activator Adjusting Instrument (AAI) or Activator Methods Chiropractic Technique (AMCT).*

Methods: *A literature synthesis was performed on the available research and electronic databases, along with hand-searching of journals and reference tracking for any studies that investigated the AAI in terms of clinical effectiveness. Studies that met the inclusion criteria were evaluated using an instrument that assessed their methodological quality.*

Results: *Eight articles met the inclusion criteria. Overall, the AAI provided comparable clinically meaningful benefits to patients when compared to high-velocity, low-amplitude (HVLA) manual manipulation or trigger point therapy for patients with acute and chronic spinal pain, temporomandibular joint (TMJ) dysfunction and trigger points of the trapezius muscles.*

Conclusion: *This systematic review of 8 clinical trials involving the use of the AAI found reported benefits to patients with a spinal pain and trigger points, although the clinical trials reviewed suffered from many methodological limitations, including small sample size,*

But : *La présente étude a pour objet d'effectuer un recensement systématique des écrits portant sur les résultats cliniques suivant l'utilisation de l'instrument d'ajustement activateur (Activator Adjusting Instrument ou AAI) ou de la technique chiropratique des méthodes de l'activateur (Activator Methods Chiropractic Technique ou AMCT).*

Méthodologie : *Une synthèse des écrits a été effectuée à partir des bases de données de recherches et celles sur support informatique disponibles, ainsi qu'en cherchant manuellement dans des revues et en effectuant un suivi des références trouvées dans les études portant sur l'efficacité clinique de l'AAI. Les études qui répondent au critère d'inclusion ont été évaluées au moyen d'un instrument calculant leur qualité méthodologique.*

Résultats : *Huit articles ont répondu au critère d'inclusion. En général, les bienfaits cliniquement significatifs de l'AAI sont comparables à ceux de la manipulation à haute vitesse et faible amplitude ou de la thérapie par zone gâchette pour les patients souffrant de douleur aiguë ou chronique à la colonne vertébrale, de dysfonction de l'articulation temporomandibulaire (ATM) et de zone gâchettes du trapèze.*

Conclusion : *Selon la présente revue systématique de huit essais cliniques portant sur l'utilisation de l'AAI, on rapporte des bienfaits pour les patients souffrant de douleur à la colonne vertébrale et de zones gâchettes, quoique les essais cliniques étudiés étaient soumis à de nombreuses limites sur le plan méthodologique, comme un échantillon de petite taille, des périodes de suivi*

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relatively brief follow-up period and lack of control or sham treatment groups.

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KEY WORDS: Activator Methods chiropractic technique, mechanically assisted adjusting instrument/device, instrument assisted manipulation

Introduction

With the notable exception of the manual Diversified technique, which involves high velocity and low amplitude (HVLA) thrusting spinal manipulative therapy (SMT) (also commonly referred to as spinal adjustments), the therapeutic intervention most commonly used for patient care by chiropractors is instrumented-adjusting using the Activator Adjusting Instrument (AAI). According to the 2005 National Board of Chiropractic Examiner's (NBCE) Job Analysis¹ 51.2% of American chiropractors report using the AAI for patient care, although this data does not differentiate between those practitioners who use the AAI only (often as a substitute for HVLA manipulation) from those practitioners who use the Activator Methods Chiropractic Technique (AMCT), a technique system that involves a group of specialized diagnostic procedures during prone leg length checking.² [The 2005 NBCE Job Analysis is the most recent source of information on the rates of use of different technique systems by chiropractor since the NBCE's Practice Analysis of Chiropractic 2010 did not capture this data]. The 1993 NBCE Job Analysis³ reported roughly 40% of Canadian chiropractors use an AAI, although more recent estimates range from 31.4%⁴ to 22%.⁵ A survey of British chiropractors reported 82% of respondents indicated they use an AAI, although only 2% of them stated they used it as their primary treatment method⁶ and the NBCE 1994⁷ reported that 72.7% and 54.3% of Australian and New Zealand chiropractors, respectively, used an AAI.

In 2001, Cooperstein et al.⁸ and Gatterman et al.⁹ published companion articles that sought to characterize the literature with respect to chiropractic technique procedures for various low back conditions and rate the effectiveness of specific chiropractic procedures for low back conditions, respectively. These systematic reviews

relativement brèves, et d'un manque de groupes témoins ou placebo.

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MOTS CLÉS : Technique chiropratique des méthodes de l'activateur (*Activator Methods chiropractic technique*), instrument/dispositif d'ajustement à assistance mécanique, manipulation aidée par un instrument

reported that the widest base of evidential support existed for side posture HVLA manipulations and a panel of experts ascribed a value of 9.3/10 with respect to clinical effectiveness for acute low back pain and 8.1/10 for chronic low back; by contrast, instrumented-adjusting was only allocated a score of 3.7/10 for acute low back pain and 1.6/10 for chronic low back pain.⁹ This led Cooperstein et al. to assert: "These considerations suggest that those researchers attempting to validate the appropriateness of their favored methods had best focus more on the type of research they do- more on outcomes and less on peripheral matters such as modeling and the reliability of diagnostic procedures."^{8p410}

A review of the literature conducted in 2001 found that the number of retrievable articles from the peer-reviewed literature on AMCT (n = 21) was second only to the number of retrievable articles on Upper Cervical techniques (n = 28).¹⁰ [It should be noted that the developers of Chiropractic BioPhysics/Clinical Biomechanics of Posture have also been very prolific with respect to publishing in the peer-reviewed literature, but many of those studies principally focused on mathematical modeling of the spine.^{11,12}].

Since that time, investigations of AAI and AMCT have continued at an impressive rate. That being said, many of these published articles have investigated the mechanical properties of the AAI, the reliability and validity of prone leg length checking and the reliability and validity of diagnostic tests unique to AMCT (isolation, stress and pressure tests). Despite Cooperstein et al.'s admonishment a decade earlier, relatively few studies have investigated the clinical effectiveness of the AAI. For example, the 2001 review of the literature cited above¹⁰ found only 6 case studies, 2 case series and 2 clinical trials involving AAI or AMCT. A textbook chapter devoted to describ-

ing AMCT published in 2004¹³ found only one additional clinical trial published between 2001 and 2004. Moreover a DVD¹⁴ listing all published studies on the AAI or AMCT [distributed by Activator Methods Inc to attendees of the 2011 Association of Chiropractic Colleges and Research Agenda Conference (ACC-RAC)] had only one incomplete additional clinical trial, indicating a continued under-representation of studies of this nature. Even so, notwithstanding the relative paucity of clinical investigations, advocates of the AAI and AMCT continue to extol its clinical value and usefulness.^{13,14}

The purpose of this study was to conduct a systematic review of the literature investigating clinical outcomes involving the use of the AAI or AMCT. A brief narrative review of each article that met the inclusion criteria is also provided.

Methods

This study was approved by the Ethics Review Board of the Canadian Memorial Chiropractic College.

The following electronic databases were searched from their earliest date of publication to April 2010: ICL, MANTIS, and AMED. CINHAHL and MEDLINE were searched through EBSCO publishing. The following key terms were used: “Activator Adjusting,” “Activator Technique,” “Neck pain,” “Low back pain,” “Mechanical manipulation,” “Mechanically assisted device” and “Instrument assisted manipulation.”) The initial search strategy was then further refined by using the following MeSH terms: chiropractic*, therapy*, joint dysfunction* and cervical vertebrae*. References were also used from citations found in papers that were included after reviewing the inclusion and exclusion criteria for each. Citations from specific articles (reference tracking) were then researched independently through selected databases followed by hand searching throughout the periodicals.

Inclusion/exclusion criteria

Several inclusion/exclusion criteria were used to select studies eligible for this review. Inclusion criteria were as follows: studies must involve more than one subject; treatments must have been administered by a qualified chiropractor; papers were written in English; were published between January 1980 and March 2010; prospective or retrospective studies including RCTs, controlled clinical/quasi-experimental trials, cohort, case control and

case series; studies using some type of outcome measure for determining the effect of chiropractic care [i.e. Visual Analogue Scale (VAS), Numerical Pain Rating Scale (NPRS), Neck Disability Index (NDI), Oswestry Disability Index (ODI), McGill Pain Questionnaire, range of motion, algometer/goniometer devices]; published in peer-reviewed journal and; only studies involving human subjects.

Subject age, sex, demographic, and pain type and duration were not consistent among studies and were therefore not utilized as inclusion criteria in this review. Manuscripts from conference proceedings or abstracts of studies were not included in this review since the criteria for inclusion in a conference proceeding is often much less stringent than the criteria used for inclusion in peer-reviewed indexed journals. Using these inclusion criteria, eight articles qualified for review.

Instrument Used to Review Eligible Articles

The articles selected for review were evaluated using an instrument developed by Sackett (see Table 1).¹⁵

Four authors (TH, ALB, MP, LB) independently reviewed the studies meeting the inclusion criteria. The data from all included articles were recorded onto a data extraction sheet by the authors as part of the review. The authors checked and edited all entries for accuracy and consistency. Recorded data included study authors and quality score, details of the study design, sample, interventions, outcome measures, and main results/conclusions of the study. These four authors met on April 5th, 2010 to compare their graded scores. Any discrepancies of scores between the authors were settled via discussion until consensus was reached.

Results

The initial search strategy yielded 283 hits when using the search terms “Instrument and Manipulation.” Many articles found that discussed instrumentation other than an AAI or discussed unrelated topics such as historical development of the Activator, diagnostic testing used by AMCT practitioners or other non-clinical issues. Once refined to “Mechanically Assisted Manipulation” 51 articles were found. Of these 51 articles, only eight met our inclusion criteria.^{16–23} After methodological quality assessment of each article using the grading instrument, papers were allocated scores out of a possible 50 points

Table 1 *Instrument Categories Used to Grade Articles for this Review*

Grading Criteria:

Assignment of patients (/9)

No mention of randomization-score 0; case study fully described-score 2; retrospective study fully described-score 4; prospective study fully described-score 5; non-randomized clinical trial-score 6; randomized clinical trial-score 7; non-randomized controlled trial with inadequate randomization-score 8; randomized controlled trial with adequate randomization described-score 9.

Baseline values of groups (/8)

No mention of baseline values-score 0; baseline values mentioned but not statistically significant-score 4; baseline values mentioned and not statistically significant-score 8.

Relevance of outcomes and clinical significance (/7)

No mention of outcomes and clinical significance-score 0; subjective outcome measures-score 3; objective outcome measures-score 5; both subjective and objective outcome measures-score 7.

Prognostic stratification (comorbidity and risk factors) (/6)

No clear mention of study inclusion or exclusion criteria-score 0; inadequate mention of inclusion or exclusion criteria-score 3; complete mention and description of inclusion and exclusion criteria-score 6.

Blinding strategies (/5)

No blinding strategies mentioned-score 0; single blinded study without method described and appropriate-score 2; single blinded study with method described and appropriate-score 3; double blinded study without method described and appropriate-score 4; double blinded study with method described and appropriate-score 5.

Contamination/co-intervention (/4)

No mention of ways to control for contamination or co-intervention-score 0; some patients received some sort of contamination or co-intervention-score 2; assumed that no contamination or co-intervention took place due to immediate follow-up-score 3; contamination and co-intervention closely monitored and accounted for-score 4.

Compliance of subjects to study procedures (/4)

No mention or detail given to compliance of study subjects-score 0; compliance and co-intervention of patients monitored but not closely monitored-score 1; some patients were compliant and did not receive co-interventions and was closely monitored and detailed-score 2; compliance of subjects was assumed due to immediate follow-up-score 3; all patients were compliant and closely monitored and detailed-score 4.

Drop-out rates of subjects (/3)

No mention of drop-out rates-score 0; drop-out rates mentioned-score 1; no drop-out rates assumed due to immediate follow-up-score 2; number and reason for drop-outs described- score 3.

Follow-up levels (/2)

No mention of subject follow-up-score 0; immediate follow-up mentioned/performed-score 1; adequate follow-up mentioned/performed-score 2.

Publication date of research (/2)

Published prior to 1990-score 0; published after 1990 and before 2000-score 1; published after 2000-score 2.

Total Score: /50

(Table 2). Articles are listed in descending order of their score using the Sackett criteria; in the event two or more articles had the same score, they were arranged alphabetically (Table 3).

Discussion

When assessed in terms of clinical effectiveness, AAI and manual manipulation were both found to result in equally statistically significant patient outcomes, although the differences between the use of these two treatment interventions was not statistically significant. Studies investigating the use of AAI only reported that it conveyed clinically meaningful benefits to patients.

Instrumented-Adjusting in Chiropractic

Instrumented adjusting has grown in popularity since the time Solon Langworthy first developed a table mounted percussive device in the early 19th century.²⁴ Along with the AAI other chiropractic technique systems have developed adjusting instruments. There are a number of instrumented Upper Cervical techniques that involve cervical adjusting devices that are handheld, floor-mounted or table-mounted.²⁵ Other notable examples include the Integrator associated with Torque Release Technique²⁶ and a floor mounted device used by CBP practitioners.²⁷ An internet search for “instrumented-adjusting devices in chiropractor” found a device called an “Impulse Adjusting Instrument” developed by NeuroMechanical Innovations,²⁸ and a device called the “Pro-Adjustor”²⁹ has recently been demonstrated at chiropractic trade shows over the past few years (for example, the 2011 World Federation of Chiropractic conference in Rio de Janeiro, Brazil and the 2010 Canadian Chiropractic Conference in Toronto, Ontario, Canada).

Instrumented adjusting is thought to convey multiple benefits to both patients and practitioners.^{2,30–33} From the perspective of the patient, benefits conveyed by instrumented-adjusting include: the management of patients with osteoporotic bone fragility;^{2,31–33} for children; for patients who are fearful of manipulative procedures that result in joint cavitation (i.e. “cracking”); for extremity adjusting; to (theoretically) achieve greater joint specificity^{2,30} and; it can be used for patients who wish not be physically touched (perhaps they have been physically or sexually abused, for example).³⁰ To date, no experimental or clinical evidence exists that the use of instrumented-

adjusting demonstrates a better safety profile compared to manual manipulation with respect to serious adverse events (i.e stroke) in patients with identified or unidentified vascular risk factors, since manual manipulation has not been conclusively linked to the incidence of stroke at all.³⁴

From the perspective of the practitioner, instrumented adjusting can be used in cases of doctor injuries (disabilities of the hand, wrist, elbow or shoulder, for example) and it can be used to compensate for anthropomorphic differences between a small doctor and a large patient.^{2,30} Lastly, AAI conveys benefits to the research community since it can be used as a “sham” procedure by setting it to “0” since even set to “0” the AAI will still produce an audible sound.²

Currently, instrumented-adjusting is permitted for use by chiropractors in all Canadian, American, British and Australian jurisdictions,⁵ although that has not always been the case. As recently as 2004, Saskatchewan prohibited its members from instrumented adjusting. The reasonableness of this standard of practice was raised in an article by one of the authors of this review (BG) in an article published in 2002;³⁰ this spawned a heated exchange of letters to the editor.^{35–37} Contemporaneously, the Chiropractic Association of Saskatchewan (CAS) struck a Committee to evaluate the literature on the efficacy, safety, usage and educational requirements for chiropractic practice relative to AAI [or mechanical adjusting devices (MAD) as it was termed in that report^{38,39}]. Overall, the majority of the Committee members (4–2) concluded that, while all of the studies it reviewed were flawed to varying degrees and the literature was generally weak, the evidence supported the statement that AAI procedures were as effective as manual HVLA procedures in producing clinical benefits and biological change.³⁸ The Committee reached consensus (5–1) that AAI procedures are widely used for spine related and extremity conditions, is safe and has no more risk than do manual HVLA procedures (majority opinion 4–2).³⁹ Lastly, the Committee reached consensus (5–1) that there was no evidence with respect to educational requirement to form any conclusions.³⁹

General Weaknesses of Studies Reviewed

Irrespective of the wide utilization rates among chiropractors, and despite the plethora of practical benefits to patients and practitioners championed by its proponents,

Table 2

ARTICLE CRITERIA	Gemmell et al. 2009	Yurkiw/ Mior. 1996	DeVocht et al. 2003	Osterbauer et al. 1993	Wood et al. 2001	Gemmell et al. 1995	Schneider et al. 2010	Shearar et al. 2001
ASSIGNMENT OF PATIENTS (/9)	7	7	5	6	7	7	7	7
BASELINE VALUES OF GROUPS (/8)	4	4	4	4	4	0	8	4
RELEVANCE OF OUTCOMES & CLINICAL SIGNIFICANCE (/7)	7	7	7	7	7	3	3	7
PROGNOSTIC STRATIFICATION (COMORBIDITY AND RISK FACTORS) (/6)	6	3	6	3	6	6	6	6
BLINDING STRATEGIES (/5)	3	3	0	0	0	3	0	0
CONTAMINATION/ CO-INTERVENTION (/4)	3	3	3	2	4	3	2	0
COMPLIANCE OF SUBJECTS TO STUDY PROCEDURES (/4)	4	4	3	4	0	3	0	0
DROP-OUT RATES OF SUBJECTS (/3)	3	2	2	3	0	2	0	0
FOLLOW-UP LEVELS (/2)	2	1	0	2	2	0	0	2
DATE OF PUBLICATION (/2)	2	1	2	1	2	1	2	2
TOTAL (/50)	41	35	32	32	32	28	28	28

Table 3

Reference	Objective	Trial Design	/50	Patients/ Conditions	Interventions	Main Outcome Measures	Follow-Up Period	Main Results/Conclusions
Gemmell et al. 2009	1 To examine the effects of ischemic compression vs. Activator on trigger points	Randomized Clinical Trial	41	52 volunteer subjects w/ tender, active trigger points of trapezius muscle	1 Ischemic compression 2 Activator	1 PGIC 2 NRS 3 PPA (Algometer)	10 minutes	– Both interventions showed improvement in all outcome measures, but no statistical significance b/w groups
Yurkiw & Mior 1996	1 Comparison of Diversified SMT & Activator on ROM & Pain	Randomized Comparative Clinical Trial	35	14 established patients w/ subacute unilateral neck pain	1 Diversified SMT 2 Activator	1 C-ROM Goniometric (inclinometer) device 2 VAS	Immediate	– No statistical significance b/w interventions – Both interventions showed improvement in all outcome measures, but no statistical significance b/w groups
DeVocht et al. 2003	1 To evaluate the effectiveness of Activator treatment on TMD	Prospective Case Series	32	8 patients w/ chronic articular TMD	1 Activator	1 VAS 2 Maximum active mouth opening in pain free range (ROM)	None	– Signs & symptoms of patient TMD improved w/ course of Activator treatment
Osterbauer et al. 1993	1 To evaluate diagnostic and biomechanical assessment of SIJS 2 To assess treatment value of Activator on SIJS	Descriptive Case Series	32	10 patients w/ chronic sacroiliac joint syndrome	1 Activator	1 VAS 2 ODI 3 Lumbosacral provocation tests 4 Gait analysis 5 Postural Sway	1 year	– Activator proved beneficial in treatment of chronic SIJS
Wood et al. 2001	1 Comparison of Diversified SMT & Activator on cervical spine dysfunction	Randomized Clinical Trial	32	30 patients w/ subacute neck pain	1 Diversified SMT 2 Activator	1 NDI 2 NPRS 3 McGill Pain Questionnaire 3 ROM w/ Goniometer	1 month	– No statistical significance b/w interventions – Both interventions showed beneficial effects in reducing pain & disability while increasing ROM
Gemmell et al. 1995	To examine the immediate effects of Activator vs. MERIC technique on acute LBP	Randomized Control Trial	28	30 established patients w/ acute LBP	1 Activator 2 MERIC	1 VAS	Immediate	– Both interventions showed improvement in all outcome measures, but no statistical significance b/w groups
Schneider et al. 2010	1 Examine treatment effect on NPRS and ODI when comparing Activator and manual SMT (Low back)	Non-Randomized Cohort	28	92 established patients from 3 chiropractic clinics w/ 3 month history of low back pain	1 Activator 2 Diversified Side Posture	1 NPRS 2 ODI	None	– Study found neither intervention superior to the other, while providing profession with valuable information on the influence of treatment expectation
Shearer et al. 2001	1 Comparison of Diversified SMT & Activator of SIJS	Prospective Randomized Clinical Trial	28	60 subjects w/ a previous history of SIJS	1 Diversified SMT 2 Activator	1 NRS-101 2 Revised ODI 3 Orthopedic rating scales 4 Algometer	None	– No statistical significance b/w interventions – Both interventions showed improvement in all outcome measures, but no statistical significance b/w groups

this study found only 8 clinical trials that sought to determine the clinical effectiveness of the AAI, the form of instrumented-adjusting with the most publication in the peer-reviewed journals. None of the clinical trials reviewed here were randomized clinical trials; that is, none

of them included a control (no-treatment) group or a sham treatment group or included patients without any clinical symptoms at all.

In general, examiners in the studies reviewed in this article were seasoned practitioners well acquainted with

AAI use or with AMCT as well as the other treatment modality option employed (i.e. spinal manipulation, trigger point therapy). All the studies used small study populations, ranging from 8 to 92 subjects. Moreover, not all studies were adequately controlled with respect to both subject and examiner blinding, with 5 of the studies being assigned a “0” out of 5. An additional limitation was that all but one study failed to either strategize or adjust for relevant baseline characteristics. Due to the lack of long-term follow-up care and the use of a single treatment intervention, contamination and co-intervention grading had to be assumed in 4 of the 8 studies which may have further influenced the overall quality of these studies. A further limitation was that 7 of the 8 studies utilized a previously established patient base as study subjects, thus introducing the possible confounding factors of treatment expectancy and type II errors.

Conclusion

This systematic review of 8 clinical trials involving the use of the AAI found reported benefits to patients with spinal pain and trigger points, although these results were not statistically significantly different when compared to the use of HVLA manual manipulation or trigger point therapy.

Given the wide use and clinical utility of the AAI, it is unfortunate that most of the clinical trials investigating its effectiveness were only pilot studies involving between 8 and 92 patients and typically involving only one or two treating doctors with a limited post-study follow-up. That said, there does exist case studies, case series, clinical trials and now this systematic review that suggests patients do experience positive and clinically meaningful benefits when treated for spinal pain and trigger points using an AAI. Clinically meaningful improvements were documented in patients with acute and chronic low back or SIJ pain, acute and subacute neck pain, TMJ disorders and trigger points in the trapezius muscle.

Further studies ought to include a larger patient base using a placebo or sham group and a no-treatment group, better randomization and blinding protocols and longer-term post-intervention follow-up in order to more definitively assess the benefits of AAI treatment.

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