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Article *in* Physical Therapy · May 2012

DOI: 10.2522/ptj.20110371 · Source: PubMed

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Stephen J. May and Richard Rosedale

PHYS THER. 2012; 92:1175-1186.
Originally published online May 24, 2012
doi: 10.2522/ptj.20110371

A Survey of the McKenzie Classification System in the Extremities: Prevalence of Mechanical Syndromes and Preferred Loading Strategies

Stephen J. May, Richard Rosedale

Background. Classification of patients with extremity problems is commonly based on patho-anatomical diagnoses, but problems exist regarding reliability and validity of the tests and diagnostic criteria used. Alternatively, a classification system based on patient response to repeated loading strategies can be used to classify and direct management.

Objective. The purpose of this study was to investigate the prevalence of McKenzie's classification categories among patients with extremity problems and the loading strategies used in their management.

Design. This was a prospective, observational study.

Methods. Thirty therapists among 138 invited (response rate=22%) with a Diploma in Mechanical Diagnosis and Therapy (MDT) were identified from the McKenzie Institute International registry and recruited worldwide to complete an e-mailed questionnaire. They provided data about their age, years qualified, years since gaining a diploma, and practice, and prospectively provided data on anatomical site and categorization for 15 consecutive patients with extremity problems.

Results. Data were gathered on 388 patients; classification categories were as follows: derangement (37%); contractile dysfunction (17%); articular dysfunction (10%); and "other" (36%), of which 20% were postsurgery or posttrauma. Exercise management strategies and syndrome application varied considerably among anatomical sites. Classification categories remained consistent in 85.8% of patients over the treatment episode.

Limitations. These findings are not generalizable to therapists who are not experienced with use of MDT in the extremities.

Conclusions. This study demonstrates that trained clinicians can classify patients with extremity problems into MDT classifications and that these classifications remain stable during the treatment episode. Further work is needed to test the efficacy of this system compared with other approaches, but if derangements are as common as this survey suggests, the findings have important prognostic implications because this syndrome is defined by its rapid response to repeated movements.

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[May SJ, Rosedale R. A survey of the McKenzie Classification System in the extremities: prevalence of mechanical syndromes and preferred loading strategies. *Phys Ther.* 2012;92:1175–1186.]

Published Ahead of Print: May 24, 2012
Accepted: May 16, 2012
Submitted: November 1, 2011

In spine care, despite decades of research, patho-anatomical classification has failed to stand up to scientific scrutiny[1] and has been shown to be generally unachievable from clinical examination.[2] Despite the widespread use of patho-anatomical labels, the evidence establishing their validity is scant and controversial.[3] In contrast, the validity for non–patho-anatomical classification systems in the spine has been well established, with classification systems based on clinical presentations clearly demonstrating superior outcomes compared with control groups.[4–11] There are several systems that are routinely used with varying degrees of validation in the literature; a recent systematic review identified 34 classification systems,[12] and a number of clinical prediction rules have been developed.[13] These systems and the clinical prediction rules attempt to identify homogeneous subgroups of patients that respond to particular interventions. These subgroups are based on clinical characteristics rather than theoretical patho-anatomical problems.

The same issues that have undermined and raised questions about the patho-anatomical model in the spine are now being recognized in the extremities, for instance, at the shoulder and knee,[14,15] and have raised a similar call for a standardized non–patho-anatomic classification system that can be reliably applied to all joints.[16] In particular, this is due to the poor criteria for present diagnostic labels,[16] the questionable reliability of most orthopedic tests,[17–19] and the questionable validity of commonly used orthopedic tests to identify the patho-anatomical structures they are meant to identify.[20–31] In addition, there is the confounding effect of pathological findings in individuals without extremity musculoskeletal problems, which has been shown to have a high prevalence in the extremities.[32–36] Diagnostic discrimination based on patho-anatomical structures from clinical examination and imaging studies is clearly as problematic in the extremities as it is in the spine.

The system of mechanical diagnosis and therapy (MDT), well known for use with patients with spinal problems, also has been applied to patients with extremity problems.[14] The classification categories in the MDT system are non–patho-anatomical and are based on the patient's response to repeated end-range movements. Thus, MDT clinicians can classify patients with extremity musculoskeletal problems into MDT categories.[14] Classifications vary between derangement, articular dysfunction, contractile dysfunction, or postural syndrome and are categorized as "other" if not meeting the operational definitions of one of the classification categories. Patients then are managed with an appropriate repeated exercise loading strategy.

For instance, in derangement, if extension exercises abolished symptoms and restored range of movement at the knee, the patient would be said to have a directional preference for extension and would be given this direction of movement as his or her loading strategy. In articular dysfunction, if extension was consistently painful and restricted, extension exercises would be prescribed to gradually restore the pain-free range of movement. In contractile dysfunction, if resisted exercises were consistently associated with pain, these exercises would be used to restore pain-free contractile function. Both would be said to be the preferred loading strategies for those examples, and both would be prescribed regular repeated movements as their therapeutic exercise. "Directional preference" is a term applied only to patients classified with derangement mechanical syndrome. Patients who cannot be classified as having one of the mechanical syndromes are classified under "other" (see Appendix for operational definitions).

There have been a few reports in the literature regarding MDT and extremity problems. Case studies have been published describing derangements at the shoulder and thumb[37,38] and a contractile dysfunction at the shoulder.[39] A reliability study that distributed 25 patient vignettes printed on MDT extremity assessment forms to 96 highly trained MDT therapists worldwide had 92% agreement on the classifications of the vignettes, with a kappa value of .84.[40] A survey of highly trained McKenzie therapists produced data on 849 patients who 57 therapists had classified, treated, and discharged, each providing data on 15 consecutive patients.[41,42] There were 242 patients with extremity problems, and 69% of these patients were classified within MDT classification categories.[42]

The preferred loading strategies in patients with spinal problems consistently tend to be for extension; 70% to 80% of spinal derangements respond to extension, whereas smaller proportions require lateral or flexion forces.[10,42,43] Data on the direction of loading that was used to reduce derangements and remodel dysfunctions in the extremities showed much greater variety of loading strategies.[42] Some common patterns emerged, but such a mapping of treatment directions has not been replicated. Further insight into the prevalence of classification categories and commonly used loading strategies in patients with extremity problems at different anatomical sites would be useful. Because the application of MDT to the extremities is relatively new, this study had 2

purposes: (1) to determine prevalence rates of MDT syndromes and (2) to determine loading strategies used in patients classified into an MDT category.

Method

Study Design

A prospective questionnaire was used to determine prevalence rates and loading strategies used in patients classified with MDT classification categories.

Participants

Consenting therapists were asked to provide data on 15 consecutive patients with an extremity problem that they would prospectively assess, classify, and manage after receipt of the survey. The only exclusion criterion was the patient's lack of consent for anonymous data to be collected.

Therapists

Participating therapists were holders of the International McKenzie Institute Diploma, which is the highest education award in the institute; these were experienced clinicians who are familiar with MDT concepts and are based in more than 20 countries worldwide. The diploma is a mixed course, with a distance learning theoretical component, a practical clinical component, and a practical oral examination, all of which must be passed. Therapists had to be contactable by e-mail, because permanent postal addresses were not available, and had to consent to participate. There were 303 diploma holders in 2009; e-mail addresses were available for 186 of these therapists, of whom 138 were invited to participate because they had consented to participate in a previous study. They were contacted to see whether they were interested in participating in the study if they treated patients with extremity problems. If they consented to participate, they were sent the instructions and data collection forms, with a repeat mailing 1 month later. After this point, no further effort was made to involve that clinician.

Examination Procedure and Classification Criteria

Once consent was gained from the patient for his or her data to be used in the survey, a normal MDT assessment process was conducted with the use of the McKenzie Extremity Assessment form. This process involved a standard history taking followed by a physical examination, in which single movements were used to assess range of movement and pain response, and resistance tests, which were used to assess pain response. After these baseline assessments were made, repeated movements were used to determine symptomatic and mechanical responses. These movements were not standardized but typically would be initially in the sagittal plane in joints with predominantly uniaxial movement, such as the elbow or knee, whereas multiple directions of movement would be explored in multiaxial joints, such as the shoulder or hip. Commonly, the most impaired movement would be the one explored first. Several sets of 10 to 15 repeated movements might be performed before exploring alternative directions. Repeated movements could be active or with patient or therapist overpressure, or could be against resistance, depending on baseline responses. The exact order of movements was left to the clinical reasoning process of the MDT therapist.

According to responses to repeated movements, a provisional classification was made at the initial assessment, which was confirmed or repudiated at subsequent sessions by

The Bottom Line

What do we already know about this topic?

The use of patho-anatomical diagnoses in patients with extremity problems is fraught with validity issues. Alternative classification systems, based on clinical criteria rather than pathoanatomical diagnosis, are commonly used in evaluating the spine and have been applied to the extremities. One such system is mechanical diagnosis and therapy (MDT), which has demonstrated excellent reliability.

What new information does this study offer?

Thirty therapists with a diploma in MDT provided data on 15 consecutive patients with extremity problems. The MDT system was able to classify all of 388 patients with extremity problems, with 64% classified with the MDT mechanical syndromes. The most common classification was derangement (37%). The remainder of the patients were classified in the "other" categories.

If you're a patient, what might these findings mean to you?

This study shows that therapists who were properly trained in the MDT classification system classified patients with extremity problems in a consistent manner.

reassessment of baseline variables of symptoms, movement, and function. The MDT classification categories are based on symptomatic and mechanical responses to repeated movements or sustained postures, and classification proceeds in a comprehensive algorithmic process. In people with extremity problems, the classification categories are predominantly derangement, articular dysfunction, or contractile dysfunction, but postural syndrome may be relevant in a few. Operational definitions were provided but were well known to the therapists. Patients who did not meet the operational definitions for one of the categories were classified as "other." This group refers to patients not classified in one of the above categories and considered to be nonmechanical according to operational definitions, such as recent trauma, postsurgery, or chronic pain state. The categories are mutually exclusive. Detailed operational definitions of mechanical and nonmechanical classifications are presented in the Appendix. Thus, there were 5 potential categories: 4 MDT classification categories and "other."

Survey Tool

One data sheet allowed the therapists to provide their clinical and practice details, such as how long they had been qualified, when they obtained a diploma in MDT, what proportion of their patients had extremity problems, and how often they typically use an MDT approach to assessment. The second data collection sheet gathered information about the patients (sex, age), the problem (site, MDT classification), and management (loading strategy for MDT-classified patients, whether initial classification remained stable between initial assessment and discharge, and number of treatment sessions). The loading strategy could be, for instance, flexion, extension, adduction, abduction, medial or lateral rotation, or other movement directions at different anatomical sites. Patients' personal details were not recorded; therefore, anonymity was maintained at all times.

Pilot Study

Before undertaking the main study, 6 therapists were recruited for a pilot study, with the emphasis on those for whom English was a second language, which was conducted to ensure that the data collection method was effective. No changes were needed as a result of the pilot study; therefore, these data were included in the overall results.

Data Analysis

The data were entered into SPSS/PASW (version 18, SPSS Inc, Chicago, Illinois) under the following variables: sex, age, anatomical site, final classification category, initial and final classifications, loading strategy, number of sessions, and duration of treatment. Percentages were used to present prevalence rates and loading strategies per anatomical site, with 95% confidence intervals (CIs) calculated where appropriate, by the following formula: $p \pm \sqrt{p\,(1-p)/N}$, where p is the prevalence estimate as a decimal and N is the sample size. The data were nonparametric. A chi-square test was used to assess significant differences in the proportion of each classification among anatomical sites, in the proportion of loading strategies among classifications, and in the proportion of loading strategies used among anatomical sites. An analysis of variance (ANOVA) was used to assess differences between classification category and number of sessions and duration of treatment because both of these variables were found to be evenly distributed. The number of treatment sessions was dichotomized, somewhat arbitrarily, into fewer than 5 sessions and 5 or more sessions. First, an overall chi-square test was used to compare differences in the proportion of patients with 4 or fewer sessions across all classifications, and the test then was repeated between pairs of classifications to determine whether there were significant differences between classifications. Statistical significance was set at $P<.05$.

Patient Confidentiality and Informed Consent

All data remained strictly anonymous, and the researchers at no time had access to patient details other than the survey variables. Patients signed consent forms stating that their anonymous data could be included.

Results

Therapists

Of 138 invited therapists, 78 (56%) declined to participate, chiefly because they saw mostly or only patients with spinal problems (42%), because of other time commitments (33%), or because they did not use an MDT assessment for patients with extremity problems (12%). There were no responses or returned e-mails from the rest (22%). Thirty therapists ultimately contributed data, which represents 22% of those invited to participate or 10% of all diploma holders.

Of the 30 therapists who contributed data, 17 were from the Americas, 12 were from Europe, and 1 was from New Zealand. They were generally experienced therapists, working in private clinics and experienced in MDT, who saw a proportion of patients with extremity problems in their clinical load and used the MDT assessment process for these patients (see Tab. 1 for therapist details). Data were collected between February 2010 and February 2011, and information was collected on a total of 388 patients with extremity problems. Not all therapists provided data on 15 patients because of other demands on their

time; however, all therapists confirmed that the patients they saw were consecutive patients and were reflective of their normal practice.

Patients

Of the 388 patients for whom data were collected, 52% were female, and the mean age was 47.6 years (SD=17.3). The 2 most common problems were related to the shoulder (31%) or the knee (26.5%), and 90% of the problems were related to the shoulder, knee, ankle (including Achilles tendon), hip, or elbow, in that order (see the Figure for body sites). Regarding final classifications, 98% received a single classification category according to the operational definitions; 2% were classified as spinal problems. The MDT classification categories were identified in 64% of the patients, with derangement (37%) or contractile dysfunction (17%) the most common. Under the "other" category, postsurgery, trauma/recovering from trauma, and articular structurally compromised made up an additional 24.5% of patients (see Tab. 2 for final classification categories).

In 333 (85.8%) of the 388 patients, the initial and final classifications were the same. In the remaining 60 patients (14.2%) for whom classification was changed, there were no clear patterns. Among the patients who had a difference between initial and final classifications, 22 changed MDT classifications, 11 changed from "other" to an MDT classification, 15 changed from an MDT classification to "other," and 2 changed among "other" subcategories.

The prevalence of derangement, articular dysfunction, contractile dysfunction, and "other" varied at different anatomical sites from 20% to 43%, 4% to 20%, 9% to 40%, and 14% to 50%, respectively. Derangements represented approxi-

Table 1.
Demographics of Participating Therapists (N=30)[a]

Variable	Values
Sex, male, n (%)	17 (57%)
Age, y, $\bar{X}$ (SD)	47 (6.5)
Qualified, y, $\bar{X}$ (SD)	19.2 (8.1)
Diploma, y, $\bar{X}$ (SD)[b]	9 (5.2)
Setting, n (%)	
Private	24 (80%)
Hospital	5 (17%)
Occupational health	1 (3%)
Extremity practice, n (%)[c]	
<25%	9 (30%)
25%–50%	17 (57%)
>50%	4 (13%)
Use of MDT with extremity problems, n (%)[d]	
All of the time	20 (67%)
Most of the time	9 (30%)
Some of the time	1 (3%)

[a] MDT=mechanical diagnosis and therapy.
[b] Years since receiving diploma in MDT.
[c] Therapists' estimation of proportion of clinical practice is patients with extremity problems.
[d] Therapists' report of how much they use MDT with patients with extremity problems.

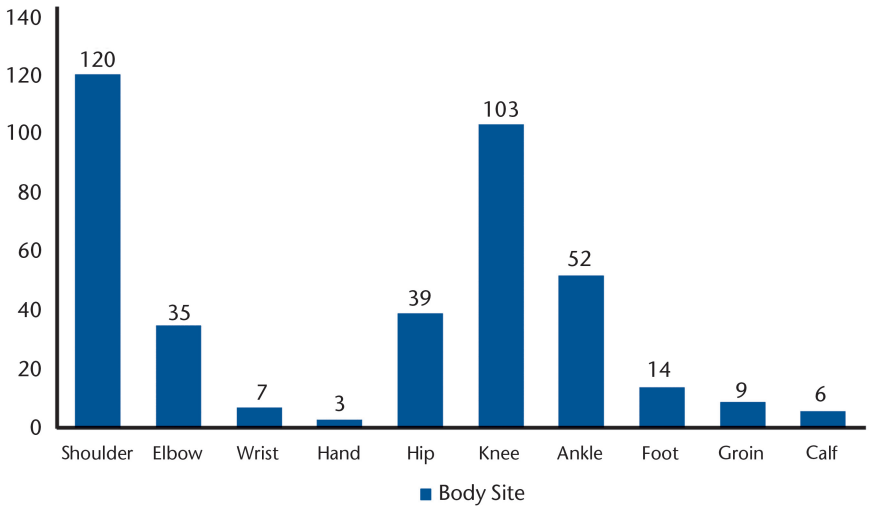

Figure.
Anatomical site of problems (N=388).

Table 2.

Final Classification Recorded by Therapist (N=388)[a]

Classification Subgroup	No. of Patients	% (95% CI)
MDT		
Derangement	142	36.6 (31.8 to 41.4)
Contractile dysfunction	66	17.0 (13.0 to 21.0)
Articular dysfunction	39	10.1 (7.1 to 13.9)
Postural syndrome	1	0.3
Total	248	63.9 (59.1 to 68.7)
Non-MDT		
Postsurgery	48	12.4
Trauma/recovering from trauma	28	7.2
Articular structurally compromised	19	4.9
Mechanically inconclusive	16	4.1
Inflammatory	7	1.8
Other	22	5.6
Total	140	36.1 (31.3 to 40.9)
Total classified in MDT system	388	100

[a] MDT=mechanical diagnosis and therapy, 95% CI=95% confidence interval.

Table 3.

Classification of Patients[a]

Body Site	Derangement n/% (95% CI)	Articular Dysfunction n/% (95% CI)	Contractile Dysfunction n/% (95% CI)	Other n/% (95% CI)	Total
Shoulder	51/42.5% (33 to 51)	13/10.8% (3.3 to 16.3)	14/11.7% (5.6 to 17.8)	42/35% (26.5 to 43.5)	120
Elbow	14/40% (23.8 to 56.2)	2/5.7% (−2.0 to 13.4)	14/40% (23.8 to 56.2)	5/14.3% (2.6 to 26)	35
Wrist/hand	2/20% (−5 to 45)	2/20% (−5 to 45)	1/10% (−8.6 to 28.6)	5/50% (19 to 81)	10
Hip/groin	15/31.2% (18.1 to 44.3)	8/16.7% (6.2 to 27.2)	8/16.7% (6.2 to 27.2)	17/23% (11.1 to 34.1)	48
Knee	44/42.7% (33.2 to 52.2)	4/3.9% (0.2 to 7.6)	9/8.7% (3.3 to 14.1)	46/44.7% (35.1 to 54.3)	103
Ankle/foot/calf	16/22.2% (12.6 to 31.8)	10/14% (6 to 22)	20/27.8% (17.4 to 38.2)	26/36% (24.9 to 47.1)	72
Total	142/36.6%	39/10.1%	66/17.0%	141/36.3%	388

[a] 95% CI=95% confidence interval.

Table 4.

Directional Preference in Derangements (n=142)

Body Site	Extension	Flexion	Adduction	Abduction	Lateral Rotation	Medial Rotation	Two Directions	Multiple Directions (>2)	Total
Shoulder	13	2	2		5	25	2	2	51
Elbow	9	2					3		14
Wrist/hand	2								2
Hip	8					3	4		15
Knee	40	2					2		44
Ankle/foot	12[a]	3[b]				1			16
Total	84	9	2	0	5	29	11	2	142

[a] Dorsiflexion.
[b] Plantar flexion.

Table 5.
Loading Strategies for Management of Dysfunction (n=105)

Body Site	Dysfunction[a]	Extension	Flexion	Adduction	Abduction	Lateral Rotation	Medial Rotation	Two Directions	Multiple Directions (>2)	Total
Shoulder	AD	1	1			1	5	3	2	13
	CD				9	2	1	1	1	14
Elbow	AD	1							1	2
	CD	9	4	1						14
Wrist/hand	AD	1							1	2
	CD	1								1
Hip	AD	2						6		8
	CD	1	1	2	3				1	8
Knee	AD	2	1					1		4
	CD	7						2		9
Ankle/foot	AD	5[b]	3[c]				2			10
	CD	10[b]	9[c]				1			20
Total	AD	12	5			1	7	10	4	39
	CD	28	14	3	12	2	2	3	2	66

[a] AD=articular dysfunction; CD=contractile dysfunction.
[b] Dorsiflexion.
[c] Plantar flexion.

mately 40% of classifications at the shoulder, elbow, and knee. Contractile dysfunction was proportionately most common at the elbow (40%), and 40% to 50% of wrist/hand and knees were "other" (Tab. 3). The directional preference used in the management of those with a derangement syndrome varied depending on the anatomical site of the problem (Tab. 4). At the shoulder, medial rotation (49%) and extension (25.5%) were dominant; extension was dominant at the elbow (64%), hip (53%), and knee (91%); and dorsiflexion/extension was dominant at the ankle/foot (75%). There also was considerable variability in the loading strategies used in dysfunction, although some common patterns emerged (Tab. 5). Common management strategies for articular dysfunctions were medial rotation at the shoulder (38.5%), 2 directions at the hip (75%), and dorsiflexion at the ankle/foot (50%). Common contractile dysfunctions were abduction at the shoulder (64%), wrist extension at the elbow (64%), extension at the knee (78%), and both dorsiflexion/extension (50%) and plantar flexion/flexion (45%) at the ankle/foot.

There were significant differences in anatomical site among the patients within each final classification (chi-square test, $P<.0001$). There also were significant differences among the proportions of each recommended loading strategy across the anatomical sites ($P<.0001$). Furthermore, there were significant differences among the proportions of loading strategies used among the different final classification categories ($P<.0001$). There were significant differences in the number of sessions and days to discharge across classifications (ANOVA, both $P<.0001$). When treatment sessions were dichotomized into fewer than 5 sessions and 5 or more sessions, there was a significant difference ($P<.0001$), with proportionately more derangement requiring 4 or fewer sessions (47%) than 5 or more sessions (25%).

Discussion

Ninety-seven percent of the participating therapists with a diploma in MDT reported that they used the MDT assessment most or all of the time with patients with extremity problems; 64% of the 388 patients were classified into 1 of the MDT categories, and the rest were classified into 1 of the "other" subcategories. Classifications remained consistent between initial and final sessions in 85.8% of cases. Single-direction loading strategies were used in 91% of derangements, 92% of contractile dysfunctions, and 68% of articular dysfunctions. There was no clear pattern in classification changes between initial assessment and discharge. Twenty-two patients had a changed MDT classification, with most commonly going from derangement to dysfunction (n=11) or derangement with articular dysfunction (n=5). There were dif-

ferences across anatomical sites regarding the proportions of final classifications. There also were differences in the proportions of loading strategies used across the final classifications and the classification sites. The proportion of patients requiring fewer than 5 treatment sessions also differed among final classifications. This last point may indicate that use of the classification system could potentially have prognostic implications because derangements had shorter duration of therapy. The study maps contemporary classification patterns for therapists using the MDT system.

The strength of this study is in the high level of training and experience of the participating clinicians, the consecutive sampling of consenting patients, and the international "cocktail" of contributing therapists. These attributes lend credence to the value of these findings in experienced MDT clinicians. Furthermore, we were unaware of any other comprehensive extremity classification systems that have tried to collect this kind of data. Reliability data have been collected, for instance, on the Cyriax evaluation for the shoulder[44] and the Southampton examination schedule for the upper extremity,[45] but the proportion of consecutive patients allocated to specific classifications has not been evaluated before, to our knowledge.

A weakness of the study is the poor generalizability of the clinician group with a diploma in MDT, which is only a few hundred worldwide. Generalizability within this select group of therapists may be limited further because only 22% of those invited participated, which represents only 10% of those with a diploma. A common explanation for not participating was that their practice dealt primarily or solely with patients with spinal problems. In addition, therapists who had taken the diploma more than 15 years before may have been reluctant to participate because extremity training was not included at that stage. The sample frame was those who had participated in a previous survey, and thus potentially were willing to participate again, and those with a known e-mail address. This recruitment process may have resulted in a potentially biased sample, although there was no particular reason to think this was so. The majority of therapists worked in private practice, and findings may not be generalizable to other settings, with different patient populations. We have not reported on the reliability of the assessment and classification process, but a previous study showed a good kappa value of .84 when therapists interpreted a complete McKenzie extremity assessment form.[40]

May[42] reported on the prevalence of classification categories and loading strategies in patients with spinal and extremity problems, of whom 242 were patients with extremity problems. In this group, depending on anatomical site, 48% to 95% (mean=69%) were classified in an MDT category. This report also summarized audit data from 5 other surveys, which all together included data on 753 patients with extremity problems. From the amalgamated data, classifications were as follows: derangement (19%, 95% CI= 16.2%–21.8%), articular dysfunction (26%, 95% CI=22.9%–29.1%), contractile dysfunction 27%, 95% CI= 24.8%–30.2%), and "other" (28%, 95% CI=24.8%–31.2%).[42] In the present study, at different anatomical sites, 33% to 72% (mean=64%) were classified in an MDT category. Over all anatomical sites, in the present study, the distribution of classifications was split 4 ways, but the proportions were somewhat different: derangement (37%, 95% CI=32%–42%), contractile dysfunction (17%, 95% CI=13%–21%), articular dysfunction (10%, 95% CI= 7%–13%), and "other" (36%, (95% CI=31%–41%).

The "other" classification was recorded if the operational definitions of 1 of the mechanical syndromes was not met, or if the operational definitions for that "other" group were met (Appendix). Of the 36% so classified, 19.6% were classified from features in their history, namely, recent trauma or recent surgery, and thus would have been responsive to normal protocols rather than MDT. Another 4.9% were articular structurally compromised, such as a meniscal, shoulder dislocation, or cruciate ligament rupture, and so probably would have been referred for further investigations. The rest were a mixture of categories.

The proportion classified in MDT categories was similar; however, the finding of derangement increased in prevalence from 19% to 37%. This increase was compensated for by a decrease in the identification of articular dysfunctions from 26% to 10% and a decrease in contractile dysfunctions from 27% to 17% in the current survey. Hence, in the current study, there was a >90% increase in the recognition of derangement; by definition, a derangement has a rapid response to specific loading strategies.[14] In the spine, this classification has been shown to be associated with a good prognosis.[10,11,43] If clinicians are able to identify a greater proportion of problems that fit into this category, more patients have the potential to achieve a rapid positive response to simple end-range loading exercises. In the current survey, more than one third of patients with extremity problems were classified as derangements; if future research verifies the rapid response of this subgroup in the extremities as has been done in the spine, this

will have major implications for the future management and outcomes of a significant proportion of patients with extremity problems.

The change in proportions from previous surveys may reflect the fact that derangements are by nature variable in presentation and can initially appear to mimic other mechanical syndromes.[38] There may have been a learning curve to recognize the clinical presentations of the derangement classification. Thus, it may be only with experience and continued application of the system that derangements may be more frequently identified. Another possible explanation is that the differences were due to a different mix of therapists, with different caseloads, and that the surveys were conducted several years apart.

As made clear, the derangement classification is reached because of patient response to repeated movements, namely, a decrease in or abolition of symptoms or "localization" of distal symptoms to their source or recovery of reduced movement. These changes can occur rapidly, and they occur long-term in derangement. It is not known why localization can occur, nor why these rapid changes might occur. However, intra-articular inclusions, such as fat pads and fibroadipose meniscoids, as found at the elbow,[46] may be among the possible patho-anatomical explanations for this phenomenon.

It has been suggested by Schellingerhout et al[16] that regarding the diagnosis of shoulder problems, there were no consistent criteria for diagnostic labels, no reliability about making these diagnostic classifications, and no indication that current diagnostic practices lead to improved patient outcomes. We would suggest that their recommendations for "time for a different approach" apply to the majority of extremity musculoskeletal problems. They recommended identifying subgroups on the basis of common characteristics, symptom responses, reliable examination procedures, and prognostic indicators. The MDT classification categories have been found to be useful by trained therapists in the categorization of >60% of patients with extremity problems in this and previous surveys.[42] It also has demonstrated reliability among therapists trained in the MDT assessment and examination process when classifying from a completed assessment form.[40,47] Thus, the classification system offers clinicians an alternative that can potentially fulfill these recommendations and avoid the pitfalls inherent within the patho-anatomical approach. In this survey, 100% of patients with extremity problems were classified using MDT categories. What is particularly noteworthy is that more than two thirds were classified into MDT categories, and more than half of these were derangements with the potential for a rapid response to intervention.

These findings potentially have major implications for the classification and management of extremity musculoskeletal problems, and, because prognostic and treatment outcomes may differ among classifications, further research is needed. The classification could be used to screen patient subgroups that could then be randomly assigned to MDT management or more traditional physical therapy interventions. It would be useful also to determine what level of training is needed to acquire the skills required to use the classification system effectively.

Conclusion

In this multisite survey of MDT clinicians that included data on 388 patients collected from 30 therapists worldwide, 64% of the patients were classified into one of the MDT syndromes. However, all patients were classified into one of the MDT syndromes or one of the "other" classifications. Classifications were largely consistent over time but varied considerably across anatomical sites. Patients who were classified as having derangement syndrome required fewer treatment sessions.

Both authors provided concept/idea/research design and consultation (including review of manuscript before submission). Dr May provided writing, data collection and analysis, and project management.

Ethical approval for the study was obtained from the Faculty of Health and Wellbeing Ethics Committee at Sheffield Hallam University.

DOI: 10.2522/ptj.20110371

References

1 Lebouef-Yde C, Lauritsen JM, Lauritzen T. Why has the search for causes of low back pain largely been inconclusive? *Spine.* 1997;22:877–881.

2 Hancock MJ, Maher CG, Latimer J, et al. Systematic review of tests to identify the disc, SIJ or facet joint as the source of low back pain. *Eur Spine J.* 2007;16:1539–1550.

3 Kent P, Keating JL. Classification in non-specific low back pain: what methods do primary care clinicians currently use? *Spine.* 2005;30:1433–1440.

4 Aina A, May S, Clare H. Centralization of spinal symptoms: a systematic review of a clinical phenomenon. *Man Ther.* 2004;9:134–143.

5 Brennan GP, Fritz JM, Hunter SJ, et al. Identifying subgroups of patients with acute/sub acute "non-specific" low back pain. *Spine.* 2006;31:623–631.

6 Childs JD, Fritz JM, Flynn TW, et al. A clinical prediction rule to identify patients with low back pain most likely to benefit from spinal manipulations: a validation study. *Ann Intern Med.* 2004;141:920–928.

7 Cook C, Hegedus EJ, Ramey K. Physical therapy exercise intervention based on classification using the patent response method: a systematic review of the literature. *J Man Manip Ther.* 2005;13:152–162.

8 Fritz JM, Delitto A, Erhard RE. Comparison of classification-based physical therapy with therapy based on clinical practice guidelines for patients with acute low back pain: a randomized clinical trial. *Spine.* 2003;28:1363–1371.

9 Hicks GE, Fritz JE, Delitto A, McGill SM. Preliminary development of a clinical prediction rule for determining which patients with low back pain will respond to a stabilization exercise program. *Arch Phys Med Rehabil.* 2005;86:1753–1762.

10 Long A, Donelson R, Fung T. Does it matter which exercise? A randomized control trial of exercise for low back pain. *Spine.* 2004;29:2593–2602.

11 Long A, May S, Fung T. Specific directional exercises for patients with low back pain: a case series. *Physiother Can.* 2008;60:307–317.

12 McCarthy CJ, Arnall FA, Strimpakos N, et al. The biopsychosocial classification of non-specific low back pain: a systematic review. *Phys Ther Rev.* 2004;9:17–30.

13 May S, Rosedale R. Prescriptive clinical prediction rules in back pain research: a systematic review. *J Man Manip Ther.* 2009;17:36–45.

14 McKenzie R, May S. *The Human Extremities: Mechanical Diagnosis and Therapy.* Wellington, New Zealand: Spinal Publications New Zealand Ltd; 2000.

15 Lewis JS. Rotator cuff tendinopathy/subacromial impingement syndrome: is it time for a new method of assessment? *Br J Sports Med.* 2009;43:259–264.

16 Schellingerhout JM, Verhagen AP, Thomas S, Koes BW. Lack of uniformity in diagnostic labelling of shoulder pain: time for a different approach. *Man Ther.* 2008;13:478–483.

17 May S, Chance-Larsen K, Littlewood C, et al. Reliability of physical examination tests used in the assessment of patients with shoulder problems: a systematic review. *Physiotherapy.* 2010;96:179–190.

18 Nomden JG, Slagers AJ, Bergman GJD, et al. Interobserver reliability of physical examination of the shoulder girdle. *Man Ther.* 2009;14:152–159.

19 Walsworth M, Doukas WC, Murphy KP, et al. Reliability and diagnostic accuracy of history and physical examination for diagnosing glenoid labral tears. *Am J Sports Med.* 2008;36:162–168.

20 Beaudreuil J, Nizard R, Thomas T, et al. Contribution of clinical tests to the diagnosis of rotator cuff disease: a systematic literature review. *Joint Bone Spine.* 2009;76:15–19.

21 Dessaur WA, Magarey ME. Diagnostic accuracy of clinical tests for superior labral anterior posterior lesions: a systematic review. *J Orthop Sports Phys Ther.* 2008;38:341–352.

22 Green R, Shanley K, Taylor NF, Perrott M. The anatomical basis for clinical tests assessing musculoskeletal function of the shoulder. *Phys Ther Rev.* 2008;13:17–24.

23 Hegedus EJ, Goode A, Campbell S, et al. Physical examination tests of the shoulder: a systematic review with meta-analysis of individual tests. *Br J Sports Med.* 2008;42:80–92.

24 Hughes PC, Taylor NF, Green RA. Most clinical tests cannot accurately diagnose rotator cuff pathology: a systematic review. *Aus J Physiother.* 2008;54:159–170.

25 Jackson JL, O'Malley PG, Kroenke K. Evaluation of acute knee pain in primary care. *Ann Intern Med.* 2003;139:575–588.

26 Meserve BB, Cleland JA, Boucher TR. A meta-analysis examining clinical tests utilities for assessing meniscal injury. *Clin Rehabil.* 2008;22:143–161.

27 Mirkovic M, Green R, Taylor N, Perrott M. Accuracy of clinical tests to diagnose superior labral anterior and posterior (SLAP) lesions. *Phys Ther Rev.* 2005;10:5–14.

28 Munro W, Healy R. The validity and accuracy of clinical tests used to detect labral pathology of the shoulder: a systematic review. *Man Ther.* 2009;14:119–130.

29 Scholten RJPM, Deville WLJM, Opstelten W, et al. The accuracy of physical diagnostic tests for assessing meniscal lesions of the knee: a meta-analysis. *J Fam Pract.* 2001;50:938–944.

30 Scholten RJ, Opstelten W, van der Plas CG, et al. Accuracy of physical diagnostic tests for assessing ruptures of the anterior cruciate ligament: a meta-analysis. *J Fam Pract.* 2003;52:689–694.

31 Solomon DH, Simel DL, Bates DW, et al. Does this patient have a torn meniscus or ligament of the knee? Value of the physical examination. *JAMA.* 2001;286:1610–1620.

32 Boden SD, Davis DO, Dina TS, et al. A prospective and blinded investigation of magnetic resonance imaging of the knee: abnormal findings in asymptomatic subjects. *Clin Orthop Relat Res.* 1992;282:177–185.

33 Englund M, Guermazi A, Gale D, et al. Incidental meniscal findings on knee MRI in middle-aged and elderly persons. *N Engl J Med.* 2008;359:1108–1115.

34 Reilly P, Macleod I, Macfarlane R, et al. Dead men and radiologists don't lie: a review of cadaveric and radiological studies of rotator cuff tear prevalence. *Ann R Coll Surg Engl.* 2006;88:116–121.

35 Schibany N, Zehetgruber H, Kainberger F, et al. Rotator cuff tears in asymptomatic individuals: a clinical and ultrasonic screening study. *Eur J Radiol.* 2004;51:263–268.

36 Silvis ML, Mosher TJ, Smetana BS, et al. High prevalence of pelvic and hip MRI findings in asymptomatic collegiate and professional hockey players. *Am J Sports Med.* 2011;39:715–721.

37 Aina A, May S. A shoulder derangement. *Man Ther.* 2005;10:159–163.

38 Kaneko S, Takasaki H, May S. Application of mechanical diagnosis and therapy to a patient diagnosed with de Quervain's disease: a case study. *J Hand Ther.* 2009;22:278–284.

39 Littlewood C, May S. A contractile dysfunction of the shoulder. *Man Ther.* 2007;12:80–83.

40 May S, Ross J. The McKenzie classification system in the extremities: a reliability study using McKenzie assessment forms and experienced clinicians. *J Manipulative Physiol Ther.* 2009;32:556–563.

41 May S. Classification by McKenzie's mechanical syndromes: a survey of McKenzie-trained faculty. *J Manipulative Physiol Ther.* 2006;29:637–642.

42 May S. Classification by McKenzie's mechanical syndromes: report on directional preference and extremity patients. *Int J Mech Diagn Ther.* 2006;3:7–11.

43 Hefford C. McKenzie classification of mechanical spinal pain: profile of syndromes and directions of preference. *Man Ther.* 2008;13:75–81.

44 Pellecchia GL, Paolino J, Connell J. Intertester reliability of the Cyriax evaluation in assessing patients with shoulder pain. *J Orthop Sports Phys Ther.* 1996;23:34–38.

45 Walker-Bone K, Byng P, Linaker C, et al. Reliability of the Southampton examination schedule for the diagnosis of upper limb disorders in the general population. *Ann Rheum Dis.* 2002;61:1103–1106.

46 Mercer SR, Bogduk N. Intra-articular inclusions of the elbow joint complex. *Clin Anat.* 2007;20:668–676.

47 Kelly E, May S, Ross J. The reliability of the McKenzie classification system using extremity McKenzie assessment forms. *Int J Mech Diagn Ther.* 2008;3:3–6.

Appendix.

Operational Definitions[a]

Operational definitions for MDT classifications and "other":

- Derangement: lasting abolition, or decrease of symptoms or an increase in restricted range of movement in response to repeated movements.
- Articular dysfunction: intermittent pain consistently produced at a restricted end-range with no rapid change of symptoms or range.
- Contractile dysfunction: intermittent pain, consistently produced by loading the musculotendinous unit, for instance, with an isometric contraction against resistance.
- Postural syndrome: produced only by sustained loading, which, once avoided, the rest of the physical examination would be normal.
- "Other" refers to failure to classify as one of the above mechanical syndromes and is considered to be nonmechanical according to operational definitions (see below), such as recent trauma, postsurgery, or chronic pain state.

Other Categories in the Extremities

Before any of these other categories are considered, a full mechanical evaluation must be conducted, which may occur over several days. The mechanical syndromes (derangement, articular dysfunction, contractile dysfunction, and postural syndrome) must be absolutely rejected before any of these categories are considered.

To meet other categories, patients must fail to meet operational definitions for mechanical syndromes AND meet operational definitions for other categories as described below.

(Continued)

Appendix.
Continued

Common to all body sites:

Category	Definition	Criteria–Essential (Common)	Examples (Where Necessary)
Trauma/recovering from trauma	Recent trauma associated with onset of symptoms	Recent trauma associated with onset of constant symptoms/recent trauma associated with onset of symptoms in previous 6 weeks now intermittent and improving	
"Red flags"	Fracture to bone	History of significant trauma Loss of function All movement make worse	
	Malignant tumor	(Age >55 years) (History of cancer) (Unexplained weight loss) Progressive, nonmechanical pain, not relieved by rest	
Inflammatory	Inflammatory arthropathy	Constant Excessive movements exacerbate symptoms	RA, some stages of OA
Chronic pain syndrome	Pain-generating mechanism influenced by psychosocial factors or neurophysiological changes	Persistent, widespread pain Aggravation with all activity Disproportionate pain response to mechanical stimuli Inappropriate beliefs and attitudes about pain	Regional pain syndromes
Postsurgery	Presentation relates to recent surgery	Recent surgery (Local postsurgery protocols may apply)	
Mechanically inconclusive	Unknown joint pathology	Inconsistent response to loading strategies (inconsistent pattern of obstruction to movement)	
Peripheral nerve entrapment	Peripheral nerve entrapment	No spinal symptoms Local paresthesia/anesthesia (Local muscle weakness)	Carpal tunnel syndrome, meralgia paresthesia
Articular structurally compromised	Soft tissue or bony changes compromising joint integrity	Mechanical symptoms (ROM restricted, clunking, locking, catching) (Sensation of instability) Long history of symptoms or history of trauma Irreversible with conservative care	Late-stage OA, dislocation, labral tear, cruciate ligament rupture, irreducible meniscal tear
Soft tissue disease process	A fibroblastic or degenerative disease process affecting inert soft tissue with unknown or disputed etiology	Each disease process has a unique clinical presentation, natural history, and varying degrees of efficacy to a variety of interventions	Frozen shoulder, Dupuytren's contracture, plantar fascia syndrome
Vascular	Symptoms induced by poor blood supply due to pressure increase in a closed anatomical space	Poorly localized, severe ache (Commonly induced by exercise or trauma) (Paresthesia in field of local cutaneous nerve) (Muscle feels tight or full)	Compartment syndrome

[a] MDT=mechanical diagnosis and therapy, RA=rheumatoid arthritis; OA=osteoarthritis, ROM=range of motion.

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PHYS THER. 2012; 92:1175-1186.
Originally published online May 24, 2012
doi: 10.2522/ptj.20110371