Chapter 3. Results (continued)

Non-Treatment-Specific Questions

Question#12. What are the cumulative effects on functional abilities among individuals with more than one worker-related musculoskeletal disorder of the upper extremity in the same limb?

In this question, we address studies of patients with more than one worker-related, upper extremity musculoskeletal disorder in the same limb, including patients reported to suffer from "double crush" syndrome. We acknowledge that the existence of "double crush" syndrome is controversial.[14,636-638] However, we include it because these patients are experiencing symptoms, and it is important to determine whether these symptoms can be relieved.

Excluded studies

As discussed in the Methods section, we retrieved articles identified by our literature searches according to certain *a priori* criteria. Of the 23 publications that were retrieved as possibly addressing this question, none met our criteria for inclusion (Table 368). Twenty-one studies were excluded for not containing functional ability data. The remaining two reported information indirectly related to functional abilities, but neither measured functional abilities using validated functional status scales or attempted to determine a patient's ability to perform individual functional activities.[639,640] One of these studies evaluated outcomes such as grip strength, pinch strength, and range of motion,[639] while the other study reported the number of patients with grip weakness or pinch weakness.[640] None of these outcomes is a direct measure of the ability of patients to perform daily or work-related activities.

Table 368. Excluded studies reporting patients with more than one work-related musculoskeletal disorder of the upper extremity in the same limb.

Study	Reason for exclusion
Bursell 1999 [641]	No functional activity outcomes
Chung 1999 [642]	No functional activity outcomes
Richardson 1999 [638]	No functional activity outcomes
Baba 1998 [643]	No functional activity outcomes
Morgan 1998 [644]	No functional activity outcomes
Chaudhry 1997 [637]	No functional activity outcomes
Guzel 1997 [645]	No functional activity outcomes
Moore 1996 [646]	No functional activity outcomes
Golovchinsky 1995 [258]	No functional activity outcomes
Lanzetta 1995 [647]	No functional activity outcomes
Nemchausky 1995 [648]	No functional activity outcomes
Sie 1992 [649]	No functional activity outcomes
Gonzalez 1991 [650]	No functional activity outcomes
Grundberg and Reagan 1991 [639]	No functional activity measures using validated functional status scales or assessing ability to perform specific functional activities.
Narakas 1990 [640]	No relevant functional activity measures
Wood 1990 [651]	No functional activity outcomes
Kerrigan 1988 [652]	No functional activity outcomes
Osterman 1988 [653]	No functional activity outcomes
Eason 1985 [654]	No functional activity outcomes
Hurst 1985 [655]	No functional activity outcomes
Bryar 1984 [656]	No functional activity outcomes
Massey 1981 [657]	No functional activity outcomes
Nissenbaum 1980 [658]	No functional activity outcomes

Evidence base

After the above exclusions, no studies remained that met the general or question-specific inclusion criteria.

Conclusions

There were no studies that met the inclusion criteria for this question. Therefore, it cannot be answered in an evidence-based fashion.

Question#13. What level of function can patients achieve in what period of time when required to change hand dominance as they are a result of injury to their dominant hand?

In this question, we address studies of patients that were forced to change hand dominance. Workers may be required to perform tasks with the non-dominant hand because of severe injury or amputation prevents the use of the dominant hand. Workers may also wish to switch tasks to the non-dominant had to give relief to the dominant hand.

Excluded studies

We did not exclude any study from consideration for this question.

Evidence base

We found two studies with a total of 89 patients that addressed the use of the non-dominant hand in work activities and the effect of training programs or learning on this transfer. The two studies differed in the type of patients they examined. Mitchell-Krever and Lacroix, 1998[659] looked at extensive skill training in patients who could not use their dominant arm, while Salazar and Knapp, 1996[660] used volunteer subjects to evaluate differences between dominant and non-dominant hands and the effect of learning.

Internal Validity

Both studies examined for this section were prospective observational studies in which issues of randomization, blinding, and compliance are not relevant (Table 369). These issues are applicable for questions comparing the outcomes of different treatments or treatment and placebo. The present question does not relate to treatment, and neither of the included studies had more than one patient group. There was no attrition for the outcomes evaluated up to two to six months of followup. However, Mitchel-Krever et al. reported an 80% loss to followup at their 1.5 to two year evaluation of outcomes.

Table 369. Internal Validity

Author	Number of patients	Number of centers	Funded by a for-profit agency?	Prospective	% Attrition	Intent to treat analysis
Mitchell-Krever and Lacroix 1998 [659]	53	1	NR	Yes	At 2-6 months: 0 At 1.5-2 years: 80	Yes
Salazar and Knapp 1996 [660]	36	1	NR	Yes	0	Yes

NR – Not reported

Generalizability

Patient ages were similar in the two studies, they fall within the typical range reported in epidemiologic studies (see Introduction section for the individual disorders), and roughly half of the patients in each study were female (Table 370). Other patient characteristics were incompletely reported.

Table 370. Generalizability

Author	Number of patients	Mean age (range)	% female	Duration of condition mean and range (months)	% Patients with diabetes	% Patients with arthritis	% Patients with prevous relevant injuries	% Patients with other relevant nerve impingement conditions	% Patients with peripheral neuropathy	% Patients pregnant	% Patients on kidney dialysis	Did the study exclude patients with severe disease?	Did the study exclude patients with mild disease?
Mitchell-Krever and Lacroix 1998 [659]	53	Range: 20-59	41.5	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Salazar and Knapp 1996 [660]	36	Range: 20-55	66.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NR – Not reported

Results

Both studies used measures of individual functional activities to determine level of function in non-dominant hands. The results are shown in Table 371. In the study by Mitchell-Krever and Lacroix, higher scores indicate better function. Three of the tests in this study (finger dexterity, Purdue pegboard test, and the O'Connor tweezer dexterity test) were particularly informative because the reported scores represent percentile ranking compared to the same sex dominant hand. Because Salazar and Knapp measured the time it took to perform specific tasks, lower scores indicate better functional ability in their study. Both studies showed statistically significant improvement over time in the functional ability of non-dominant hands.

Mitchell-Krever and Lacroix found that almost every task improved after their training program as assessed during a two to six month followup period. Gross motor skills, fine motor skills, combined fine and gross motor skills, writing skills, and grip strength all showed statistically significant improvement. Typing and keypadding speed also increased, but accuracy for both skills was unchanged perhaps because accuracy was already high (>95%). Age was not related to post-

test performance except for manuscript writing (no data reported) and sex had no effect on any of the pre- and post-tests except for the strength measurement where men were stronger than women (no data reported). A questionnaire was sent to participants one-and-a-half to two years following program completion to assess the long-term effects of the program. However, only 20% of the participants returned the questionnaire, and this attrition rate may be too high to allow a meaningful conclusion about the long-term outcomes of this training program. The results assessed at two to six months do not suffer from this difficulty.

Salazar and Knapp reported their results separately for men and women. Both men and women showed an increase in the dexterity test using tweezers and in the drilling task. However the bolt task and nail-driving test showed no improvement after one week. The lack of improvement in the bolt task may have been due to a ceiling effect, as the participants were already performing as fast as possible on the first day. The lack of improvement in nail-driving may have been related to the physical nature of the task and more time may be needed to learn how to use the non-dominant hand in this task.

Table 371. Results of outcomes measured in publications that reported information on changing hand dominance.

Author	Length of followup	Outcome	Pretest Mean	Pretest SD	Post-test Mean	Post-test SD
Mitchell-Krever and Lacroix, 1998[659]	Mean: 5 months (range 2-6 months)	Peg transfer [a]	53.68	10.97	87.43	11.10
		Peg turn [a]	49.53	12.21	89.06	10.63
		Rivets and washers [a]	41.85	11.76	77.30	13.66
		Finger dexterity [a]	26.11	24.43	61.97	29.74
		Purdue pegboard test [a]	13.77	17.53	42.93	26.10
		O'Connor Tweezers Dexterity test [a]	10.40	17.61	38.55	29.71
		Writing – manuscript [a]	7.27	2.68	15.42	4.95
		Writing – cursive [a]	7.44	3.26	14.82	6.05
		Typing speed [a]	8.21	4.79	17.83	8.05
		Typing accuracy	94.92	4.78	95.00	4.75
		Keypadding speed [a]	10.73	5.26	30.71	13.85
		Keypadding accuracy	95.21	9.41	96.17	3.45
		Grip strength [a]	32.57	14.36	36.97	13.68
Salazar and Knapp, 1996[660b]	One week after first test	Bolts task				
		Men	36.9	10.2	33.0	8.3
		Women	46.5	13.4	42.9	12.7
		O'Connor Tweezers Dexterity test [c]				
		Men	33.7	11.4	24.4	6.0
		Women	34.2	13.5	31.2	15.0
		Drilling task [c]				
		Men	36.4	10.9	20.0	6.8
		Women	63.1	27.9	34.4	22.1
		Nail-driving task				
		Men	15.9	5.8	15.2	4.0
		Women	58.3	35.8	48.4	28.0

a Significant improvement between pre- and post-test scores, *t*-test with P<0.001 as reported in Mitchell-Krever and Lacroix, 1998[659]

b Only data for non-preferred hand is presented

c Significant improvement between pre- and post-test scores, F-test with P<0.05 as reported in Salazar and Knapp, 1996[660]

Conclusions

The evidence presented in these two studies suggests that learning and training in the use of the non-dominant hand is possible and statistically significant improvement can be accomplished in 2 to 6 months of training. For some activities, statistically significant improvement can be accomplished within one week. However, these studies lack long-term followup data to determine how well the interventions work towards providing the patient with employment opportunities and if the improvement of the non-dominant hand is sufficient to allow resumption of normal activities.