

## The relation of low grade mental ability to fractures in young men

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**Summary.** Reaction time, choice reaction time and mental ability were measured in a sample of 123 young men. Previous musculoskeletal injuries were noted. Eight subjects who had experienced a bone fracture in the preceding 20 months had significantly longer choice reaction time and poorer mental ability test results than the non-injured. This preliminary result shows that long choice reaction time and poor performance on mental ability tests are associated with accidental musculoskeletal injuries.

**Résumé.** Sur un échantillon de 123 jeunes hommes on a évalué le temps de réaction, le temps de réaction avec choix et la capacité intellectuelle. On a noté l'existence d'antécédents traumatiques ostéo-articulaires. Huit sujets qui avaient eu une fracture au cours des 20 mois précédents présentaient un temps de réaction avec choix significativement plus long et une moins bonne capacité intellectuelle que les sujets non traumatisés. Ce travail préliminaire montre qu'il existe une relation entre les lésions accidentelles du squelette et la longueur du temps de réaction avec choix ainsi qu'avec des résultats médiocres aux tests mesurant la capacité intellectuelle.

### Introduction

Musculoskeletal injuries result from a complex interaction of extrinsic and intrinsic risk factors. Extrinsic factors are related to the type of activity, the environmental conditions, and the equipment used at the time of risk. Injury rates have been successfully reduced by modifying extrinsic factors [10, 11, 32]. Intrinsic factors are individual

characteristics, such as anatomical and biomechanical factors [6, 15, 16, 21, 22, 26], lack of fitness [4, 20, 26, 36], previous injuries [9, 24, 25, 26, 30, 33], psychological factors [17, 26, 27, 35] and accumulation of life stress [3, 7, 8, 13, 20, 28]. Attempts at correcting intrinsic factors have been few, and some potential influences have received only a little attention [31]. Bergenudd and Nilsson [1] observed in a sample of 575 middle-aged subjects that individuals with back pain had been less successful in a childhood intelligence test. In sports, beginners are at a higher risk of traumatic injury than skilled performers, even when the sport is not vigorous [2, 34, 37], indicating that lack of the specific motor skills needed in different activities is a factor in risk of injury. There are few reports on the relationship between basic motor ability and musculoskeletal injuries. The relation between low grade intelligence and musculoskeletal injuries has been little studied, and the aim of this investigation was to evaluate the relation of psychomotor speed of reaction and mental ability to the history of musculoskeletal injury in young men.

### Patients and Methods

A sample of 123 healthy young Finnish men gave their informed consent to take part in the study at the beginning of their compulsory military service. Subjects with very low mental ability or chronic diseases are excluded from military service in the Finnish army. All recruits who started compulsory military service in the Turku Anti-Aircraft Department, Turku, Finland in October 1987, were asked to volunteer. Four refused to participate. The age range was 18–28 years, mean 20.3 y (SD 1.4 y). Previous injuries and sports activity during the year preceding military service were recorded by a physician. One physician interviewed the subjects for history of injury, using a structured questionnaire to evaluate different

body regions. Attention was focused on traumatic bone fractures which had occurred during leisure time activities in the preceding 20 months. Injuries due to traffic accidents or acts of violence were excluded.

Simple reaction time and choice reaction time were measured. In the simple reaction time test the subject was instructed to press a button in response to a red light stimulus as fast as possible using the index finger of the dominant hand. The finger was held ready on the button. Time was recorded and the mean of three middle values out of five attempts was calculated. The speed of choice reaction was tested by the Vienna Determination Apparatus (Dr. G. Schuhfried GMBH, Mödling, Austria). The subject panel of the apparatus consists of ten stimuli lights in two rows in five different colours, and two white lights for foot reaction signals, as well as corresponding buttons for responses. The signals were presented in cycles of 36 signals each. After the termination of one series, the next series began without interruption. The subject pressed five buttons on colours as well as the foot pedals in response to the corresponding stimuli.

Two types of tests were performed. In the choice reaction time test switching over to the next stimuli was effected only if the subject had reacted correctly. The number of both correct and false reactions during a test period of 40 s were recorded. In the determination test switching over to the next stimuli was effected automatically at 0.950 s intervals during the first 50 signals and then at 0.833 s intervals during the next 50 signals. The number of correct, delayed and false reactions were recorded during a test period of 100 stimuli (90 s). Two subjects were excluded from reaction time and response orientation tests due to a defect in colour vision. Neither of these subjects reported injuries.

The subjects also answered a series of psychometric tests of mental ability developed by the Finnish Army Military Psychology Office [5, 14, 29] and including spatial (block design), verbal and arithmetic components plus total score. The study was blind. The physician who examined the subjects' injury history and the people who supervised testing were not aware of each other's findings.

## Results

Eight subjects reported a bone fracture. There were six upper limb fractures (three phalangeal fractures and three metacarpal fractures), one rib fracture and one ankle fracture. The fracture group earned significantly poorer results in all the mental ability components tested than the other subjects on average (Table 1). The fracture group also had significantly longer mean choice reaction time (Table 1). There was a tendency to achieve better results within the no injury group in the determination test also (Table 1). No significant difference was noticed in sports activity between the groups.

## Discussion

The results of mental ability tests differed between the groups, the fracture group performing significantly worse in all the components tested, i.e. spatial, verbal and arithmetic ability (Table 1). The mean choice reaction time was 112 milliseconds longer in the fracture group than in the uninjured group (Table 1). The results in the determination test also tended to be better in the uninjured group, though no statistically significant difference was reached. These results indicated lower mental ability and long choice reaction time in the fracture group. There was no evidence that the fractures had caused any permanent defect which could have affected the results in motor ability testing. The minimum time elapsed after a

**Table 1.** Mental ability test results: group means, standard deviations (SD) and level of significance (p) between the groups. Scoring was standard-ten (min 1, max 10, mean 5.5) in the mental ability tests. Mann-Whitney U-test and t-test were used in the comparison of the groups

	No fracture (n = 115)		Fracture (n = 8)		p
	mean	SD	mean	SD	
Mental ability					
-spatial ability	5.6	1.8	3.9	1.3	0.013
-verbal ability	5.5	1.8	4.3	1.3	0.045
-arithmetic ability	6.5	2.0	4.1	1.6	0.003
Total score	6.0	1.8	4.1	1.3	0.005
Reaction time (msec)	182	22	192	40	0.99
Choice reaction time (msec)	864	104	976	209	0.01
mistakes	2.2	2.3	5.1	8.6	0.35
Determination reactions out of 100 stimuli					
correct	55	23	45	23	0.18
delayed	28	17	31	16	0.57
false	9	8	12	13	0.61

fracture was five months. No previous head injuries were reported in the fracture group. No significant difference was noticed in sports activity, and the risk of bone fracture had apparently been the same in the both groups.

This preliminary result indicates that long choice reaction time and poor performance on mental ability tests are associated with accidental musculoskeletal injuries. Many reports have also shown an association between slow psychomotor reaction and low grade psychometric intelligence in the normal population [12, 18, 19, 23].

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