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Original article

Fear of movement and its effects on hand function after tendon repair

La crainte du mouvement et ses conséquences sur la fonction de la main après réparation tendineuse

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ABSTRACT

After tendon injuries, it has been observed clinically that patient-reported disability is more severe than the patient's actual performance. This is thought to result from a fear of movement (kinesiophobia) after surgery. The aim of this study was to investigate the presence of kinesiophobia in this patient population and its effects on the clinical outcomes. Patients ($n = 118$) with tendon repairs were included. All the participants received early passive mobilization and were assessed at the end of the 8th week. Grip and pinch strengths were measured and the Nine-Hole Peg Test (9HPT) was conducted. Patients also filled out the Michigan Hand Outcomes Questionnaire (MHOQ) and Tampa Scale for Kinesiophobia (TSK). Patients were divided according to their kinesiophobia: Group 1 with low kinesiophobia (TSK < 37) and Group 2 with high kinesiophobia (TSK ≥ 37). The groups were compared on the assessed parameters. Fifty-nine percent of the patients had a high kinesiophobia level. The performance-based test results were similar between the groups ($P > 0.05$). Patient-reported MHOQ and TSK scores were significantly lower in the high kinesiophobic group ($P = 0.001$ and $P = 0.000$, respectively). Patients with tendon repairs often develop kinesiophobia, which may contribute to difficulty when starting to re-use their hand in daily life. None of the objective results were affected by this fear of movement–only patient-reported disability. Clinicians should be aware that clinical outcomes may be affected by the patient's kinesiophobic thinking and must be cautious during treatment.

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Mots clés :
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RÉSUMÉ

Après les traumatismes tendineux, on observe cliniquement que la gêne rapportée par le patient est plus importante que ses performances réelles. On a pensé que cela résultait de la crainte du mouvement (kinésiophobie) après chirurgie. Le but de cette étude était de chercher la présence de la kinésiophobie dans cette population de patients et son effet sur les résultats cliniques. Cent-dix-huit patients avec réparation tendineuse ont été inclus. Tous les participants bénéficièrent d'une mobilisation passive précoce et furent évalués à la fin de la huitième semaine. Les forces de poigne et de pince furent mesurées et un *Nine-Hole Peg Test* (9HPT) fut réalisé. Les patients remplirent également le Michigan Hand Outcomes Questionnaire (MHOQ) et la *Tampa Scale for Kinesiophobia* (TSK). Les patients furent divisés selon leur niveau de kinésiophobie : le groupe 1 avec un bas niveau de kinésiophobie (TSK < 37) et le groupe 2 avec un haut niveau de kinésiophobie (TSL ≥ 37). Les groupes furent comparés au regard des paramètres évalués. Cinquante-neuf pour cent des patients avaient un haut niveau de kinésiophobie. Les résultats sur la performance basés sur les tests réalisés étaient similaires entre les deux groupes ($p > 0{,}05$). Les scores MHOQ et TSK rapportés par les patients étaient significativement moins bons dans le groupe à haut niveau de kinésiophobie ($p = 0{,}001$ et $p = 0{,}000$ respectivement). Les patients dont les tendons ont été réparés développent souvent une kinésiophobie et cela peut entraîner des difficultés à la réutilisation de leurs mains dans la vie quotidienne. Cependant, la crainte du mouvement ne modifie

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aucun résultat objectif, seulement la gêne rapportée par le patient. On peut conclure que les soignants devraient être avertis que les résultats cliniques peuvent être affectés par la kinésiophobie du patient et être prudents pendant le traitement.

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1. Introduction

Tendon injuries are common types of traumatic hand injuries. They cause a dramatic decrease in functional performance of the hand due to both protective behavior after surgical repair and splint use. Therefore, patients have difficulty when starting to re-use their hand. In our outpatient clinic, we have observed many times that patients with tendon repairs have clumsiness when using their hand even after their splint is removed. They seem to avoid using their injured hand even despite being free to move it.

Kinesiophobia is a relatively recent term in the surgery literature defined as the avoidance of movement due to fear of (re) injury or pain [1]. It affects the functionality of patients with various musculoskeletal pathologies or surgical history [2–5].Both kinesiophobia and catastrophic thinking are claimed to – at least partly – cause delayed recovery and increase the disability level [2,4]. However, studies on this topic in hand and upper extremity problems are very rare. Das De et al. showed that hand-injured patients have catastrophic thinking about their impairment levels [6]. They included patients with a wide range of upper extremity problems. In that study, catastrophic thinking and kinesiophobia were founded to be the greatest factors responsible for disability in hand and upper extremity conditions. Moreover, those two independent factors were shown to affect the disability more than the diagnosis did [6].

In our clinical setting, we also observed that patients with tendon injuries avoid using their hand in activities although they could move it. This clinical experience led us to seek for solutions to encourage functional use of the hand earlier in patients with tendon repairs. But in order to find suitable solutions, it was necessary to identify the reasons for this dysfunction. First of all, we observed that patients could complete the performance-based measurements with good scores although their patient-reported outcomes were poor. In other words, patients' self-perceptions were worse despite the fact they were clinically better. This mismatch in the objective and subjective outcomes brought out the idea that fear of movement may be present. This study was designed after publishing a letter to the editor confirming the authors' clinical suspicion [7].

The main reason underlying this clinical opinion was the observation that patients are generally better clinically than they express in patient-reported outcomes. This mismatch between the objective results and the patient's self-expression has raised the question: "Is this mismatch between the outcomes a result of the kinesiophobic thinking?" Previous studies on various clinical conditions like chronic musculoskeletal pain and knee surgeries revealed that disability level and functional recovery are affected by the patient's level of kinesiophobia [2–5]. Despite one study including various upper extremity conditions, tendon injuries have not been assessed specifically in the context of kinesiophobia [6]. Therefore, we hypothesized that high kinesiophobia levels may worsen the functional outcomes in patients with tendon repairs. The aim of this study was to compare the functional results of patients with tendon injuries based on their level of kinesiophobia.

2. Patients and methods

2.1. Patients

This study was carried out in an outpatient hand clinic. All the patients had primary tendon repair of the hand and consulted for hand therapy within the first postoperative week. The study protocol was approved by the local ethics committee of our university (number 09.09.2015-933). Informed consent was obtained from each patient before inclusion.

Adult patients with primary flexor and extensor tendon repair were included in the study. They all started to wear dynamic splints from the first postoperative week. Patients with concomitant fracture, peripheral nerve (other than digital nerves) or vessel injury and with a history of a systemic diseases (diabetes mellitus, rheumatoid arthritis, etc.) were excluded from the study. During the follow-up period, some patients dropped out from the study and others did not comply with the therapy instructions. The results of these patients were excluded from the analysis. Digital nerve injured patients were not excluded as a digital nerve injury generally occurs with zone 2 tendon injuries with a small area of sensory deficit. Moreover, previous tendon studies did not exclude patients with concomitant digital nerve injuries as it was shown that these injuries did not affect the functional results after tendon repair [8–10].

The patients received regular hand therapy sessions twice a week using an early passive motion protocol. All the patients removed the splint at the end of the 6th week and started to use their hand in light daily life activities like hair combing, using spoon and fork, and texting on their mobile phone. The assessments were performed at the end of the 8th postoperative week for each patient. Therefore, all the patients were assessed after a total of 2 weeks of daily hand use.

2.2. Methods

To assess the functional status of the hand, grip and pinch strength (lateral, bipod and tripod) measurements and the 9-Hole Peg Test (9HPT) were performed. All the patients filled out the Michigan Hand Outcomes Questionnaire (MHOQ) for disability and Tampa Scale for Kinesiophobia (TSK) for kinesiophobia evaluation. Both questionnaires have been validated for Turkish-speaking patients [11,12].

Grip strength was measured with a hand-held dynamometer and pinch strength with a pinch-grip meter. Measurements were performed in the standard position with the shoulder in full adduction, elbow at 90° flexion and forearm in neutral position with the patient sitting on a back-supported seat. Each strength measurement was repeated three times and the average result was recorded. All measurements were made for both hands and values were given in kilogram-force (kg–f) [13].

The 9HPT is a functional test of hand dexterity with timed performance. The test is scored as the number of seconds the subject needs to place nine pegs in a pegboard and then to remove them from the pegboard, using each hand. This is a valid, reliable and objective test to evaluate hand function in a practical manner in various populations in the clinical setting [14].

Self-reported disability level was determined with the Turkish version of the MHOQ. The MHOQ is a domain-specific questionnaire that was developed to measure outcomes for patients with all types of hand disorders. The validity, reliability, and responsiveness have been reported for a variety of upper extremity conditions [15]. The MHOQ is a self-reported questionnaire with 57 items in 6 domains:

- overall hand function;
- activities of daily living;

- pain;
- work performance;
- esthetics;
- patient satisfaction [15].

Each item is scored using a scale of 1 to 5. Each domain gets scores ranging from 0 to 100, with 0 being the worst and 100 being the best result, except the pain domain in which a higher score indicates more pain. All domains assess each hand separately and are scored relative to the affected hand. Cross-cultural adaptation and validation of the Turkish version was performed by Öksüz et al. in 2011 [11].

Kinesiophobia was evaluated using the Turkish version of the TSK. This scale consists of 17 questions developed to measure fear of movement and/or re-injury. The scale includes injury/re-injury and fear-avoidance parameters in occupational activities. The scale uses 4 point Likert scoring (1 = entirely disagree, 4 = entirely agree). A total score is calculated after items 4, 8, 12, and 16 are inverted. The individual obtains a total score between 17 and 68. Higher scores indicate a high kinesiophobia level [16]. The Turkish version of the scale was validated by Yilmaz et al. [9]. The threshold score for the questionnaire is 37; thus, patients who scored < 37 were identified as having a low level of kinesiophobia and those who scored ≥ 37 as having higher kinesiophobia [1]. For the statistical analysis, patients were divided into two groups:

- Group 1 had a low level of kinesiophobia;
- Group 2 had a high level of kinesiophobia.

2.3. Statistical analysis

All the statistical analyses were performed using the SPSS 20.0 software package (IBM, USA). The frequencies were given as % besides the number of patients within the groups. Grip and pinch strength results and MHOQ and TSK scores were given as mean ± standard deviation. Comparisons of these quantitative variables between Group 1 and Group 2 were performed with an independent *t*-test. The *P* value was accepted as < 0.05 for statistical significance.

3. Results

Initially 130 patients with tendon repairs were enrolled in the study. Twelve patients were excluded due to various reasons: eight of them dropped out during the follow-up period two had a rupture due to a fall and two did not comply with the treatment instructions. The study was completed with 118 patients. Flow diagram of patient enrollment in the study is shown in Fig. 1.

When the patients were divided into two groups, 41% (n = 47) of them had low kinesiophobia level (Group 1) while 59% (n = 69) had high kinesiophobia level (Group 2). In Group 1, 26% of the patients were female (n = 13) and in Group 2, 23% (n = 16) were female. In Group 1, 23 (49%) patients had an injury in their dominant hand while 36 (53%) patients had a dominant hand injury in Group 2. Flexor tendons were injured in 19 patients in Group 1 (39%) and in 29 patients in Group 2 (42%). The descriptive results of the two groups are given in Table 1.

The performance-based functional results and patient-reported outcomes in the two groups are given in Table 2. All the objective performance-based results were found to be similar between the two groups ($P < 0.05$). On the other hand, subjective patient-based MHOQ and TSK scores were statistically different between groups (P = 0.001 and P = 0.000, respectively).

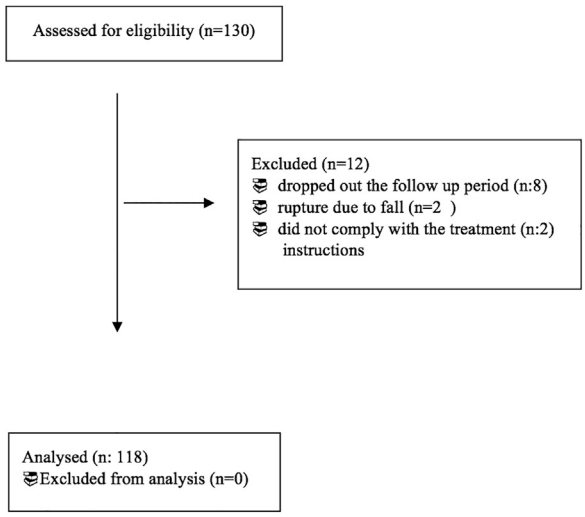

Fig. 1. Flow chart for the study.

Table 1
Distribution of gender, injured side and injured tendon across the two kinesiophobia groups.

	Group 1 (n = 49)	Group 2 (n = 69)
Gender (n of patients)		
Female	13	16
Male	36	53
Injured side (n of patients)		
Dominant	24	36
Non-dominant	25	33
Injured tendons		
Flexor	19	29
Extensor	30	40

Table 2
Comparison of age, performance-based and patient-reported results of the two kinesiophobia groups.

	Group 1 (mean ± SD)	Group 2 (mean ± SD)	*P* value
Age	31.3 ± 14.1	33.1 ± 14.1	0.508
Grip strength (kg–f)	13.8 ± 12.7	12.5 ± 11.1	0.528
Lateral pinch (kg–f)	6.1 ± 3.1	5.5 ± 2.6	0.315
Bipod pinch (kg–f)	3.3 ± 2.1	3.1 ± 1.9	0.507
Tripod pinch (kg–f)	4.3 ± 2.7	4.1 ± 2.4	0.708
9HPT (seconds)	24.8 ± 10.1	29.4 ± 12.7	0.051
MHOQ	64.7 ± 13.8	55.2 ± 15.4	0.001*
TSK	30.6 ± 4.3	41.5 ± 3.6	0.000*

9HPT: 9-hole peg test; MHOQ: michigan hand outcomes questionnaire; TSK: tampa Scale for kinesiophobia.
* $P < 0{,}01$.

4. Discussion

This study showed that more than half of the patients with primary tendon repairs have high level of kinesiophobic thinking. Moreover, the patient-reported disability level is more severe in patients with high kinesiophobia levels compared to those with low kinesiophobia levels while objective functional hand performance is similar.

Fear of movement is accompanied by an avoidance behavior due to the fear of re (injury) or pain [16]. It is defined as kinesiophobia and is measured with self-reported scales. Evidence about the negative effects of kinesiophobia on functional recovery has been accumulating in the recent studies with various clinical conditions [2–5,17–19]. The surgical literature on this topic has

generally focused on the lower extremity – especially knee – problems so far. Although daily life activities mostly depend on hand and upper extremity use, studies in patients with hand or upper extremity injuries are very rare. In one of those studies, kinesiophobia and catastrophic thinking were found to be the most effective predictors of disability in various upper extremity conditions [6]. Kinesiophobia also accounted for a greater proportion of the variance in the disability than the diagnosis did. The current study, similarly, showed that more than half of patients (59%) have a high kinesiophobia level. This result was parallel to the results of Morgounovski et al. who found that 58% of the patients with orthopedic trauma developed kinesiophobia [20]. The reasons underlying the kinesiophobic thinking have not been clarified yet. It might originate from various factors including the strict postoperative instructions given to the patients. The initial postoperative instructions to protect the surgical repair might be magnified by some patients due to psychosocial factors. As a result, they develop protective behaviors. One recent study showed that hand-injured patients with higher kinesiophobia and catastrophizing levels have protective behaviors [21]. The predictive factors for higher kinesiophobic thinking should be explored further to prevent such an overprotective behavior.

In our study, all the patients were assessed 2 weeks after splint removal and free hand use. The similarity in the functional performance between the groups can be interpreted as the kinesiophobic thinking arising from psychosocial aspects rather than the physiological healing process. The most important finding supporting this opinion was the worse patient-reported disability level in the high kinesiophobia group even though executive performance test scores did not differ. This may be interpreted as the kinesiophobic thinking affecting the patients' perception rather than their objective performance. We did not encounter any studies supporting or opposing this finding in the literature. Nevertheless, this finding supports our initial hypothesis that patients avoid using their hand despite being free to move it. The poor patient-rated disability level may result from self-limited use of the hand in daily life.

Gender, injury to the dominant side and injured tendons were also recorded as potential factors affecting patient-related outcomes. Female patients were one-quarter of the total number in each group. On the other hand, dominant and non-dominant side injuries were equally distributed within each group. Likewise, flexor and extensor tendons were injured in a similar percentage of patients in both groups. Therefore, in our study, the two groups (high and low kinesiophobia groups) were similar regarding the gender distribution, injured tendon (flexor or extensor) and side of injury (dominant or non-dominant). We compared the disability and kinesiophobic thinking levels between two groups that were matched as closely as possible. Moreover, the MHOQ was preferred in this study as it provides a separate score for each hand and we used the score of the affected hand in the analysis. Thus, we think that our results were minimally affected by potential confounding factors.

To sum up, the results of this study confirms our initial opinion based on the clinical experience in a considerable number of patients. Nevertheless, we are aware of the limitations of our study. First of all, as kinesiophobia has been rarely studied in patients with tendon injuries, none of the kinesiophobia scales, including the TSK, have been validated in this population yet. However, there are some studies that used the TSK to evaluate kinesiophobia in patients with hand injuries [21,22]. The TSK is the most common kinesiophobia scale in the literature and is the only kinesiophobia scale translated into our language. Secondly, clinical details like injury zone or other parameters like total active motion were not assessed in this study. We focused on performance-based tests, as they are more functional measures. Moreover, despite these limitations, this study had similar findings to one of the leading studies on kinesiophobia in hand injuries. Further investigations may be planned for both subgroup analyses and validation testing. Psychosocial factors affecting kinesiophobia and catastrophizing need to be fully investigated along with depression and anxiety in patients with hand injuries. Underlying factors for the limited/delayed recovery despite the optimal treatment in those patients may be revealed.

5. Conclusion

Patients with tendon injuries often have a fear of movement due to (re) injury. Patients with high kinesiophobia levels reported that their disability level was poorer although their true hand performance was better. This suggests that patients should be carefully encouraged to use their hand in a gradual manner to cope with the kinesiophobic behavior as soon as possible, because such a kinesiophobic thinking may impair the patient's compliance with the treatment especially in the later periods where functional use of the hand has a great importance. Clinicians should add coping strategies to the treatment protocol when indicated.

Disclosure of interest

The authors declare that they have no competing interest.

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