Pain Catastrophizing and Kinesiophobia Affect Return to Sport in Patients Undergoing Hip Arthroscopy for the Treatment of Femoroacetabular Impingement

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Purpose: To assess whether pain catastrophizing and kinesiophobia affect return to sport (RTS) or clinically significant outcome (CSO) achievement in patients undergoing hip arthroscopy for the treatment of femoroacetabular impingement (FAI).

Methods: Patients undergoing primary hip arthroscopy at a single institution between January 2017 and March 2017 were prospectively enrolled. Patients received the Tampa Scale of Kinesiophobia-11 (TSK-11) and Pain Catastrophizing Scale (PCS) questionnaires preoperatively, 3 weeks, 6 weeks, 3 months, 6 months, and 1 year postoperatively. Patients also received the Hip Outcome Score Sport-Specific (HOS-SS) questionnaire preoperatively and 1 year and 2 years’ postoperatively. An RTS questionnaire was completed at final follow-up. Bivariate correlations were conducted between PCS and TSK-11 scores and RTS status and achievement of CSOs of HOS-SS, based on patient acceptable symptom state (PASS) and substantial clinical benefit (SCB).

Results: Fifty-eight patients with an average age of 31.9 ± 12.2 and body mass index of 24.0 ± 3.8 participated in sport prior to surgery and were included in the study. Forty-two (72.4%) patients returned to sport at 10.5 ± 7.1 months following surgery. There was a significant reduction in TSK-11 and PCS scores at 1-year follow-up (TSK-11, 26.1 ± 6.0 vs 18.6 ± 6.1, P < .001; PCS, 17.7 ± 10.5 vs 4.3 ± 6.8, P < .001) as well as a significant improvement in HOS-SS (P < .001). At 1 year, fair correlations were demonstrated between PCS (r = −0.446, P = .010) and TSK (r = −0.330, P = .029) scores and RTS. Patient who returned to sport had lower PCS (8.5 ± 11.7 vs 3.0 ± 3.7, P = .010) and TSK-11 (21.8 ± 8.5 vs 17.6 ± 4.8, P = .029) scores at 1 year. At 1-year follow-up, PCS (r = −0.572, P = .001) and TSK-11 (r = −0.441, P = .012) scores demonstrated fair correlations with achieving PASS for HOS-SS at 2-year follow-up.

Conclusions: Patient kinesiophobia and pain catastrophizing at 1-year follow-up were negatively correlated with RTS and achievement of a CSO in sport-related activities at 2-year follow-up.

Level of Evidence: III, prospective cohort study.

Femoroacetabular impingement (FAI) is a common cause of pain and dysfunction in athletes of all sports and ability levels.1–3 Hip arthroscopy is widely used to treat FAI and has demonstrated improved clinical outcomes in young, active patients at medium- to long-term follow-up.4–8 Furthermore, athletes have returned to sport at a high rate, and many reach preinjury levels following hip arthroscopy.9–13 Despite the majority of patients reaching clinical improvement, there continues to be a number of patients who return to sport with persistent symptoms.9,14–16 Pain catastrophizing and kinesiophobia, common psychological factors, have been demonstrated to negatively affect RTS.17–19 This study aims to evaluate whether pain catastrophizing and kinesiophobia affect RTS or clinically significant outcome achievement in patients undergoing hip arthroscopy for the treatment of FAI.

Methods

Patients undergoing primary hip arthroscopy at a single institution between January 2017 and March 2017 were prospectively enrolled. Patients received the Tampa Scale of Kinesiophobia-11 (TSK-11) and Pain Catastrophizing Scale (PCS) questionnaires preoperatively, 3 weeks, 6 weeks, 3 months, 6 months, and 1 year postoperatively. Patients also received the Hip Outcome Score Sport-Specific (HOS-SS) questionnaire preoperatively and 1 year and 2 years’ postoperatively. An RTS questionnaire was completed at final follow-up. Bivariate correlations were conducted between PCS and TSK-11 scores and RTS status and achievement of CSOs of HOS-SS, based on patient acceptable symptom state (PASS) and substantial clinical benefit (SCB).

Results

Fifty-eight patients with an average age of 31.9 ± 12.2 and body mass index of 24.0 ± 3.8 participated in sport prior to surgery and were included in the study. Forty-two (72.4%) patients returned to sport at 10.5 ± 7.1 months following surgery. There was a significant reduction in TSK-11 and PCS scores at 1-year follow-up (TSK-11, 26.1 ± 6.0 vs 18.6 ± 6.1, P < .001; PCS, 17.7 ± 10.5 vs 4.3 ± 6.8, P < .001) as well as a significant improvement in HOS-SS (P < .001). At 1 year, fair correlations were demonstrated between PCS (r = −0.446, P = .010) and TSK (r = −0.330, P = .029) scores and RTS. Patient who returned to sport had lower PCS (8.5 ± 11.7 vs 3.0 ± 3.7, P = .010) and TSK-11 (21.8 ± 8.5 vs 17.6 ± 4.8, P = .029) scores at 1 year. At 1-year follow-up, PCS (r = −0.572, P = .001) and TSK-11 (r = −0.441, P = .012) scores demonstrated fair correlations with achieving PASS for HOS-SS at 2-year follow-up.

Conclusions

Patient kinesiophobia and pain catastrophizing at 1-year follow-up were negatively correlated with RTS and achievement of a CSO in sport-related activities at 2-year follow-up.
of patients who are less likely to return to sport (RTS) at a preinjury level. Clinical outcomes and speed of recovery are highly influenced by patient-specific factors, including age, sex, obesity, and osteoarthritis.14,15 Recently, multiple studies have shown that mental disorders negatively influence the rehabilitation process and overall outcomes following various orthopaedic surgeries.16-23

Psychological traits have shown to influence pain interpretation and play a more significant role than initially believed.24,25 Leeuw et al.26 explained the “fear avoidance model of musculoskeletal pain” and its role in patient outcomes. Kinesiophobia is an exaggerated fear of physical movement arising from the belief of susceptibility to injury, and pain catastrophizing is an excessive or inappropriate response to that pain. Pain catastrophizing has been objectively measured using the Pain Catastrophizing Scale (PCS),27 a validated scoring system, with greater scores indicating greater catastrophizing. The Tampa Scale for Kinesiophobia (TSK) or the shorter validated Tampa Scale for Kinesiophobia-11 (TSK-11)28 can objectively quantify kinesiophobia, with greater scores indicating a greater degree of pain-related fear. Both of these psychological traits negatively affect a patient’s ability to participate in rehabilitation and RTS.19,26,29-31 Lentz et al.32 studied 46 patients who had undergone anterior cruciate ligament reconstruction and found that patients with greater pain-related fear of movement and reinjury according to the TSK-11 at 6 months postoperatively were less likely to return to preinjury level despite no difference in pain. In a systematic review of anterior cruciate ligament reconstruction by Nwachukwu et al.,33 fear of reinjury is the most common impediment to successful RTS. Clapp et al.34 demonstrated that PCS scores at 1 year postoperatively were significantly greater in patients who failed to achieve a minimal clinically important difference (MCID), but TSK-11 scores did not influence MCID achievement. Although MCID is most commonly used to demonstrate improved patient outcomes following hip arthroscopy, Patient Acceptable Symptom State (PASS) and substantial clinical benefit (SCB) may be more indicative of an athlete’s ability to RTS at a high level, as they are harder to achieve than MCID.35 PASS and SCB may be more useful markers for determining readiness to RTS at a high level.2

The purpose of this study is to assess whether pain catastrophizing and kinesiophobia affect RTS or clinically significant outcome (CSO) achievement in patients undergoing hip arthroscopy for the treatment of FAI syndrome. We hypothesized that following hip arthroscopy, patients who have lower pain catastrophizing and kinesiophobia levels would have greater rates of RTS and greater rates of achievement of sport-specific CSOs.

Methods

Patient Selection

After institutional review board approval, consecutive patients undergoing primary hip arthroscopy between January 2017 and March 2017 for the treatment of FAI by a fellowship-trained surgeon (S.J.N.) were prospectively enrolled in the study at a single institution during their preoperative visit. Patients with clinical and radiographic diagnosis of symptomatic FAI,35 failure of nonoperative management after more than 3 months (physical therapy, activity modification, oral anti-inflammatory drugs, and for some patients fluoroscopically-guided intra-articular cortisone injection), and completion of RTS survey and 2-year functional outcomes were included in the study. Exclusion criteria consisted of hip arthroscopy for an indication other than FAI, revision hip arthroscopy, previous history of ipsilateral or contralateral hip surgery, undergoing contralateral hip arthroscopy during study enrollment and follow-up, signs of osteoarthritis (Tönnis grade >1), hip dysplasia (lateral center edge angle <20°),36 or a history of pediatric hip disorders (slipped capital femoral epiphysis, avascular necrosis, developmental dysplasia of the hip, etc.).

Surgical Technique and Postoperative Rehabilitation

All hip arthroscopies were performed in a similar manner using a well described technique by the senior author.37,38 Standard anterolateral and mid-anterior portals are established under traction with the aid of fluoroscopic guidance. An interportal capsulotomy is then created and pathology addressed in the central compartment with acetabuloplasty and labral repair as needed. Traction is then released, and a T-capsulotomy performed to access to the peripheral compartment, and femoral osteochondroplasty is performed to address cam morphology and restore femoral head–neck offset. Dynamic examination of the operative leg is then performed to confirm an appropriate resolution of impingement upon completion. Lastly, the capsule is repaired using a suture shuttling system, with capsular plication performed depending on degree of capsular laxity.39 All patients underwent a previously described standard 4-phase rehabilitation protocol following surgery.40

Kinesiophobia, Pain Catastrophizing, and RTS

Patients were evaluated at a minimum of 2 years from date of surgery. TSK-1125 and PCS22 questionnaires were assigned preoperatively and at 3 weeks, 6 weeks, 3 months, 6 months, and 1-year postoperatively. Patients received an RTS survey that recorded if they returned to sport, how long after surgery it took to RTS, the level at which they returned, and the reason for
failure to return if they were unable to return. Patients also received the Hip Outcome Score Activities of Daily Living (HOS-ADL) and Sport-Specific (HOS-SS) subscales, modified Harris Hip Score (mHHS), Internation Hip Outcome Tool-12 (iHOT-12), and visual analog scale (VAS) for pain preoperatively and at 1 and 2 years postoperatively.

Due to athletes demanding significant functional improvement to RTS following hip arthroscopy for the treatment of FAI, literature-defined values for the PASS and SCB were used to quantify achievement of a CSO. The threshold scores for achieving PASS 1 and 2 years postoperatively were 76.4 and 80.9, respectively, and for SCB, the threshold scores were 77.9 and 85.8, respectively.

**Statistical Analysis**

Noncontinuous variables are reported as frequency statistics whereas descriptive statistics for all continuous variables are reported as mean and standard deviations. All data were screened to determine whether parametric statistical assumptions were met before analysis. In cases of parametric analysis violation, the nonparametric analogue tests were applied. Repeated-measures analysis of variance (ANOVA) to assess whether PCS and TSK score averages differed over the time points, and post-hoc analysis with a Bonferroni adjustment was performed to determine significant differences within the timepoints. Bivariate correlations between RTS and TSK-11 and PCS scores were performed. Independent-samples $t$ tests were used to compare preoperative PCS and TSK score averages between patients returning and not returning to sport. Bivariate correlations between PASS achievement and PCS and TSK-11 scores as well as between SCB achievement and PCS and TSK-11 scores were performed. The strength of association based on $r$ values were interpreted as follows: 0-0.29 (poor), 0.30-0.49 (fair), 0.50-0.79 (moderately strong), 0.80-1.00 (very strong). Paired-samples $t$ tests were used to compare preoperative and 2-year postoperative patient-reported outcome scores in patients with FAI. Statistical significance for all analysis was set at $P < .05$. All statistical analysis was performed using SPSS, version 25 (IBM Corp., Armonk, NY).

**Results**

**Demographics**

Of 68 patients with 2-year functional outcomes, TSK-11, and PCS scores, 58 patients indicated sports participation before surgery and were included in the analysis. The cohort was majority female (69.3%) with an average age and body mass index (BMI) of 31.9 ± 12.2 years and 24.0 ± 3.8 kg/m², respectively.

**Kinesiophobia and Pain Catastrophizing**

The TSK-11 and PCS score averages at the 6 time points recorded are summarized in Figure 1. Repeated-measures ANOVA demonstrated TSK score averages were statistically significantly different at the different time points over the course of a year ($F = 67.08$; $P < .001$). Post hoc analysis with a Bonferroni adjustment revealed that TSK-11 score averages at all time points were significantly lower from preoperative scores ($P < .001$), with an overall reduction from 26.1 ± 6.0 to 18.6 ± 6.1 at 1-year follow-up. However, there were no significant differences between the pairwise comparisons of the scores at any other time points ($P > .05$). For PCS score averages, repeated-measures ANOVA displayed statistically significant differences at the different time points over the course of a year ($F = 54.08$; $P < .001$). Post hoc analysis with a Bonferroni adjustment revealed that PCS score averages at all time points were significantly lower from preoperative scores ($P < .001$), with an overall reduction in PCS scores from 17.7 ± 10.5 to 4.3 ± 6.8. There were no significant differences between the pairwise comparisons of the scores at any other time points ($P > .05$).

**Return to Sport**

Our cohort consisted of 29 recreational athletes, 9 amateur athletes (team or club, e.g., Amateur Athletic Union), 8 college athletes, 11 high school athletes, and 1 professional athlete. Forty-two patients (72.4%) returned to sport at an average of 10.5 ± 7.1 months following surgery. Of the athletes who did not return, 4 (6.9%) noted reasons not due to their hip, 4 (6.9%) noted fear of reinjury, and 10 (12.9%) had physical limitation due to their hip (Table 1). When we compared patients returning to and failing to RTS, there were no significant differences in age, sex, or BMI ($P > .05$ for all) between the groups.

Results of bivariate correlations are in Table 2. Briefly, PCS scores at 6 weeks ($r = -0.422, P = .009$) and 1-year ($r = -0.446, P = .010$) follow-up demonstrated fair correlations with RTS, and TSK-11 scores at 1-year follow-up demonstrated fair correlation with RTS ($r = -0.330, P = .029$). The results of independent-samples $t$ test between patients returning and not returning to sport are reported in Figures 2 and 3. Patients who returned to sport had lower PCS scores at 6 weeks (10.1 ± 9.4 vs 4.5 ± 4.1, $P = .009$) and 1 year (8.5 ± 11.7 vs 3.0 ± 3.7, $P = .010$), whereas TSK-11 scores were significantly lower only at 1 year (21.8 ± 8.5 vs 17.6 ± 4.8, $P = .029$).

**Functional Outcomes**

Paired $t$-test analysis of pre- and 2-year minimum postoperative patient-reported outcome score averages for the entire cohort are reported in Figure 4. Patients had significant increases in HOS-ADL, HOS-SS, mHHS, and iHOT-12 and a significant decrease in VAS Pain at
2-year follow-up ($P < .001$ for all). To assess clinical significance, we determined the percentage of patients meeting PASS and SCB criteria for HOS-SS. At 1-year follow-up, 74.1% of patients achieved PASS and 65.5% achieved SCB, and at 2-year follow-up, 82.8% and 75.9% achieved PASS and SCB, respectively. Achievement of PASS for HOS-SS at 1-year follow-up demonstrated fair correlation with 6-week ($r = -0.466, P = .001$), 6-month ($r = -0.311, P = .043$), and 1-year PCS scores ($r = -0.493, P = .001$) and 1-year TSK-11 scores ($r = -0.318, P = .031$). HOS-SS SCB achievement at 1-year follow-up demonstrated fair correlation with 6-week ($r = -0.385, P = .010$), 3-month ($r = -0.390, P = .011$), 6-month ($r = -0.463, P = .020$), and 1-year PCS scores ($r = -0.429, P = .020$) as well as 1-year TSK-11 scores ($r = -0.429, P = .002$) (Table 3). PCS at 3-month ($r = -0.429, P = .020$), 6-month ($r = -0.572, P = .010$), and 1-year ($r = -0.441, P = .012$) follow-up exhibited fair correlations with achieving PASS for HOS-SS at 2-year follow-up, and TSK-11 scores at 1-year ($r = -0.549, P = .001$) demonstrated fair correlation with achieving SCB for HOS-SS at 2-year follow-up ($r = -0.549, P = .001$) (Table 4). In addition, 1-year TSK-11 scores at 1-year demonstrated fair correlation ($r = -0.398, P = .024$) with achieving SCB for HOS-SS at 2-year follow-up (Table 4).

**Discussion**

The main findings of this study are that 42 patients (72.4%) returned to sport at an average of 10 months postoperatively, and while both pain catastrophizing and kinesiophobia decreased during the postoperative period, PCS scores at 6 weeks and 1-year TSK-11 demonstrated fair correlation with achieving SCB for HOS-SS at 2-year follow-up ($r = -0.398, P = .024$) with achieving SCB for HOS-SS at 2-year follow-up.

**Table 1.** Return to Sport (N = 58)

| Return to sport | 42 (72.4%) |
|-----------------|------------|
| Length of time to return to sport with minimal pain, mo | 10.5 ± 7.1 |
| Return ability level | | |
| Limited effort, limited performance | 9 (15.5%) |
| Unlimited effort, limited performance | 11 (19.0%) |
| Unlimited effort, unlimited performance | 21 (36.2%) |
| Reasons for not returning to sport | | |
| Other reasons not due to hip | 4 (6.9%) |
| Fear of reinjury | 4 (6.9%) |
| Physical limitations | 10 (12.9%) |

**Table 2.** Correlation Analysis Between Return to Sport and PCS and TSK-11 Scores

|                       | Return to Sport ($r$) | $P$ Value |
|-----------------------|-----------------------|-----------|
| Preoperative PCS      | 0.012                 | .927      |
| TSK-11                | -0.077                | .563      |
| 3 wk                  |                       |           |
| PCS                   | -0.101                | .480      |
| TSK-11                | -0.025                | .864      |
| 6 wk                  |                       |           |
| PCS                   | -0.422                | .009*     |
| TSK-11                | -0.043                | .746      |
| 3 mo                  |                       |           |
| PCS                   | -0.191                | .180      |
| TSK-11                | -0.126                | .756      |
| 6 mo                  |                       |           |
| PCS                   | -0.215                | .126      |
| TSK-11                | -0.145                | .377      |
| 1 y                   |                       |           |
| PCS                   | -0.446                | .004*     |
| TSK-11                | -0.330                | .021*     |

PCS, Pain Catastrophizing Scale; TSK-11, Tampa Scale for Kinesiophobia-11. *Indicates significance at $P < .05$. 

**Fig 1.** Pain Catastrophizing Scale and Tampa Scale of Kinesiophobia-11 scores at the preoperative, 3-week, 6-week, 3-month, 6-month, and 1-year postoperative time points.
scores at 1-year postoperatively were greater in the patients who failed to RTS. Furthermore, pain catastrophizing and kinesiophobia were negatively correlated with achieving a CSO with regards to sporting function. Hip arthroscopy for the treatment of FAI has yielded improved patient outcomes for the vast majority of patients with a high rate of RTS.\textsuperscript{1-3,10,13} Despite this, there continues to be a subset of patients who are unable to RTS at a preinjury level. Patient-specific factors, including physical and mental characteristics, could influence a patient’s ability to achieve clinical improvement following surgery.\textsuperscript{18,19,22,46}

Fifty-eight athletes were included in the present study. Both kinesiophobia and pain catastrophizing scores improved from preoperative scores at each time point from 3 weeks to 1 year. There was an improvement in all PROs and a decrease in VAS pain at 2 years postoperatively, which is consistent with prior studies from this group.\textsuperscript{2} Physical limitations of the operative hip including hip pain was the most common reason for not returning to sport. The slightly lower rate of RTS, longer duration before return, and larger proportion of patients with continued pain is likely due a larger proportion of recreational athletes in this cohort compared with other studies assessing return to play in athletes.\textsuperscript{47}

Pain catastrophizing and kinesiophobia, or the exaggerated response to a given pain and the fear of reinjury, respectively, has been shown to result in inferior patient outcomes following orthopaedic surgery.\textsuperscript{48,49} Clapp et al.\textsuperscript{34} found that pain catastrophizing and kinesiophobia improved 1 year postoperatively.
and that pain catastrophizing scores were significantly
greater in those who did not achieve MCID but
kinesiophobia scores did not correlate with MCID
achievement at 1 year. The current study demon-
strated that patients with greater levels of kinesi-
ophobia at 1 year postoperatively were less likely to
RTS and achieve PASS. The fact that kinesiophobia
does not correlate with patient-reported outcomes
before RTS is not surprising and is consistent with
previous studies.34 Once patients have been removed
from the controlled environment of physical therapy,
the fear of injury upon RTS is likely at its greatest and
would affect both successful RTS and patient-reported
outcomes.

Patients with lower pain catastrophizing scores at 6-
week and 1-year follow-up and lower kinesiophobia
scores at 1-year follow-up were more likely to RTS
following hip arthroscopy. Lower pain catastrophizing
scores at 3 months, 6 months, and 1 year also were
associated with an increased likelihood of achieving
sports specific PASS. Following a structured physical
therapy regimen has shown to improve patient-
reported outcomes following hip arthroscopy.50 These
results signify that pain catastrophizing does not affect
patient-reported outcomes early in the rehabilitation
process, as patients are limited in physical activity. Pain
catastrophizing has been shown to negatively influence
physical therapy outcomes for other orthopaedic

**Table 3. Correlation Analysis Between Achieving PASS and SCB for HOS-SS at 1-Year and PCS and TSK-11 Scores**

|                | PASS (r) | P Value | SCB (r) | P Value |
|----------------|----------|---------|---------|---------|
| Preoperative   |          |         |         |         |
| PCS            | 0.123    | .048    | -0.005  | .973    |
| TSK-11         | 0.013    | .928    | -0.028  | .850    |
| 3 wk           |          |         |         |         |
| PCS            | -0.093   | .560    | 0.012   | .942    |
| TSK-11         | -0.060   | .705    | 0.151   | .339    |
| 6 wk           |          |         |         |         |
| PCS            | -0.466   | .001*   | -0.386  | .010*   |
| TSK-11         | -0.117   | .449    | -0.155  | .316    |
| 3 mo           |          |         |         |         |
| PCS            | -0.179   | .258    | -0.390  | .011*   |
| TSK-11         | -0.140   | .377    | -0.300  | .054    |
| 6 mo           |          |         |         |         |
| PCS            | -0.311   | .043*   | -0.463  | .002*   |
| TSK-11         | -0.087   | .578    | -0.186  | .234    |
| 1 y            |          |         |         |         |
| PCS            | -0.493   | .001*   | 0.487   | .001*   |
| TSK-11         | -0.318   | .031*   | -0.317  | .032*   |

HOS-SS, Hip Outcome Score-Sports Subscale; PASS, Patient Acceptable Symptom State; PCS, Pain Catastrophizing Scale; SCB, substantial clinical benefit; TSK-11, Tampa Scale for Kinesiophobia-11.

* Indicates significance at P < .05.
pathologies such as osteoarthritis, and it is plausible that greater levels of pain catastrophizing would negatively affect therapy following hip arthroscopy for the treatment of FAI. As the intensity of physical therapy increases beginning at 6 weeks and progressively intensifies until RTS, it is no surprise that patients who are able to better perform in physical therapy would be more likely to RTS and achieve clinical improvement. These patients are likely able to prevent muscular imbalance and gait abnormalities associated with weakness in the operative extremity and feel more comfortable performing in sports-related activity than those who could not fully participate.

Further studies are necessary to determine how to improve physical therapy and ultimately patient-reported outcomes and RTS for patients with pain catastrophizing and kinesiophobia. Moreover, it is important to discern interventions that may address or change these psychological traits to improve outcomes.

Limitations

There are some limitations in this study. First, multiple factors other than kinesiophobia and pain catastrophizing can affect patient-reported outcomes and RTS following hip arthroscopy. While there were no significant differences in age, ex, and BMI between the groups returning and failing to RTS, other confounding variables that may affect RTS were not controlled for. Second, all of the surgical procedures were performed by a single high-volume, fellowship-trained surgeon with extensive experience in hip arthroscopy, and the outcomes of this study may not be generalizable. In addition, a majority of patients failing to RTS cited physical limitation including hip pain, which was self-reported. Not all patients who did not to RTS were examined, and therefore, it is difficult to conclude whether their failure to return was due to real physical limitation or if it was a perceived or psychological limitation. Furthermore, there was no standardized assessment of patients’ activity level with an objective instrument, and we relied on patients’ self-reported levels of function.

Conclusions

Patient kinesiophobia and pain catastrophizing at 1-year follow-up were negatively correlated with RTS and achievement of a CSO in sport related activities at 2-year follow-up.

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