Symptomatic knee osteoarthritis is associated with worse but stable quality of life and physical function regardless of the compartmental involvement: Data from the OAI

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ABSTRACT

Objective: To test whether combined patellofemoral and tibiofemoral osteoarthritis (OA), in addition to symptoms, is associated with greater changes in quality of life and objective physical function measures when compared with asymptomatic isolated tibiofemoral osteoarthritis.

Design: Of the 4796 participants in the Osteoarthritis Initiative, 577 were categorized into four groups based on the presence of symptoms (asymptomatic and symptomatic) and the structural involvement within the knee, where tibiofemoral OA was graded with the Kellgren and Lawrence scale, while patellofemoral OA was based on the Magnetic Resonance Imaging Osteoarthritis Knee Scoring cartilage loss feature. Knee-related quality of life was examined using the Knee Injury and Osteoarthritis Outcome Scale quality of life subscale, and objective physical function was examined by the 20 m Walk Test, 30-s Chair Stand Test, and isometric knee strength. These outcomes were measured at Baseline, Year 2, and Year 4. Mixed effects models were fit to test whether the change in outcome, and the Baseline scores, differed based on group.

Results: Quality of life worsened for the asymptomatic combined group but improved for the symptomatic combined group. However, these quality of life changes and changes in other outcomes were all within measurement error. Large between-group differences were found at Baseline, whereby individuals with symptoms had worse quality of life and physical function test scores.

Conclusions: Quality of life and physical function are largely stable over four years. However, having symptoms is strongly associated with worse quality of life and physical function, regardless of structural disease distribution within the knee.

1. Introduction

Knee osteoarthritis (OA) is a globally prevalent and serious disease [1], which accounts for most of the OA-related disease burden [2]. In North American adults, knee OA prevalence has significantly increased in the last century [3] with current estimates ranging from 12 to 19% [4,5]; although, recent data suggests these values are conservative [6]. This increase is, in part, a result of the growing prevalence of risk factors like obesity, physical inactivity, and joint injuries [7]. While the economic and societal impact is large, the disease can have substantial and long lasting effects on the individual [8].

Knee OA presents with multifaceted symptoms and disruptions to daily life. Individuals with symptomatic knee OA report significantly worse function and overall health-related quality of life compared to age-matched healthy adults [9]. Knee pain is the primary complaint of those with knee OA [10] and is associated with worse physical function [11], quality of life [12], and periarticular knee muscle function [13]. Moreover, quality of life, physical function, and muscle function are
interrelated [11,14], where worse scores in one of these variables is associated with worse scores in another. This points to the detrimental effect of pain on the individual.

The influence of pain on quality of life and physical function is not equivocal across knee-OA subgroups. While data from the Osteoarthritis Initiative (OAI) show that most people with knee OA report stable quality of life and physical function over 7–8 years of follow up, more than 1 in 4 people significantly worsen over this timeframe [15,16], the presence of knee pain being a primary predictor of who was more likely to exhibit worsening quality of life, though structural distribution was not assessed [16]. Accordingly, an important research objective is to identify subgroups that are more likely to experience this worsening. Doing so can assist with allocating resources and researcher priorities to treatments specifically targeting the subgroups with increased risk of worsening. Unfortunately, much of this earlier work focused on radiographic or clinically defined tibiofemoral OA (TFOA), while the involvement of the patellofemoral joint is often not considered. As a result, the implications of patellofemoral OA (PFOA) in addition to TFOA, and how pain influences these subgroups, remain unclear.

The patellofemoral joint is frequently affected by OA and has largely gone underrecognized in the literature [17]. One half of those with knee pain or symptomatic knee OA present with structural signs in the patellofemoral joint [18]. Indeed, symptomatic knees with combined PFOA and TFOA on magnetic resonance imaging may actually be more prevalent than compartmentally-isolated OA, while this difference may not be true for asymptomatic knees [19]. Moreover, people with isolated PFOA are 5.8 and 2.1 times more likely to develop structural signs of OA in multiple compartments seven years later, compared to those without any cartilage degeneration or isolated TFOA at baseline, respectively [20]. Isolated PFOA negatively affects quality of life [21] and may increase the risk of knee pain over and above isolated TFOA [22]. However, individuals with combined PFOA and TFOA report higher pain severity, worse physical function [23,24], and lower health-related quality of life [21] compared to those with compartmentally-isolated signs. Symptoms, physical function, and knee-related quality of life were also worse in a group with radiographically confirmed combined-compartment OA when compared to isolated OA, 15–22 years after meniscectomy [25]. Taken together, the presence of radiographic PFOA may have a more substantial impact on the individual when compared to TFOA alone, the addition of symptoms may magnify this effect, and radiographically combined compartment OA could be worse yet.

Given the potential influence pain has on different radiographic subgroups of knee OA over and above radiographic findings alone, and the need to understand the additive effect of radiographic signs of OA in the PF compartment compared to isolated TFOA, an analysis of these subgroups combined and apart is necessary. Therefore, the objectives of this study were to examine baseline differences in quality of life and physical function, as well as changes over the course of 4 years, between four groups with TFOA. The groups were defined by the combination of the presence or absence of symptoms (asymptomatic versus symptomatic) and the presence or absence of radiographic PFOA (isolated TFOA or combined PFOA and TFOA). Using asymptomatic TFOA as the reference group, we hypothesized that the presence of symptoms and/or combined PFOA and TFOA group would show lower overall quality of life and physical function, and greater worsening in these outcomes over time.

2. Methods

2.1. Study design

Data were retrieved from the OAI publicly available database (n = 4796). This multicenter, longitudinal observational project was approved by the Committee on Human Research at the University of California, San Francisco (approval 10–00532) and all participants provided informed consent. Study details and the database itself are publicly available at https://nda.nih.gov/oai.

Participant data were selected from the overall OAI dataset (Fig. 1) for the current study based on several criteria which provided well-
defined groups based on isolated TFOA or combined PFOA and TFOA, plus the presence or absence of symptoms. Symptom and radiographic assessment data were included in the OAI dataset and used in our study to arrive at the final sub sample. First, all participants were required to have at least one knee with radiographic evidence of OA in the tibiofemoral compartment at the Baseline assessment, based on a Kellgren and Lawrence (KL) scale grade ≥2 [26] (semi-quantitative assessment of osteoarthritis features on radiographs from 0 = no signs to 4 = severe). Within the sample of radiographically-confirmed TFOA knees, we only included those with patellofemoral grading outcomes at Baseline, which allowed us to determine if the knee had isolated TFOA or combined PFOA and TFOA. Features of PFOA were graded using the Magnetic Resonance Imaging Osteoarthritis Knee Scoring (MOAKS), where a score ≥2 for the cartilage volume loss feature in either medial or lateral patellofemoral compartment was used to define the presence of PFOA [27,28], in addition to the previous confirmed TFOA. Scoring of the patellofemoral compartment has shown high reliability coefficients (kappa = 0.85-0.92) [29]. Finally, the separation of the symptomatic vs. asymptomatic knees was first determined from the Baseline self-reported answer to the binary (yes/no) question of “having pain, aching or stiffness on most days of a month, within the past twelve months” [30]. However, there were instances of conflicting data in the incidence sub-cohort of the OAI, such that some knees were reported as having no pain, aching or stiffness on most days of a month within the past twelve months but were also scored low on the Knee Injury and Osteoarthritis Outcome Score (KOOS) pain subscale (suggesting they were not asymptomatic). Thus, we opted to remove any knees that were designated as asymptomatic on the binary (yes/no) question but scored <80 on the KOOS pain subscale due to this conflicting data. No symptomatic knees scored 80 or above. Only a single study knee was included per participant. Therefore, if symptoms (and structural signs) were present in both knees, the knee with more severe symptoms (based on KOOS questionnaires completed for each knee independently) was selected as the study limb. If neither knee was symptomatic, the right was selected as the study limb. Additional exclusions are shown in Fig. 1, including if participants reported any knee surgery between the Baseline and Year 4 assessment. This exclusion of surgery was made to avoid potential influence on the outcome measures.

Therefore, the classification of participants from this subset of the larger dataset was based on the presence of isolated TFOA, or combined PFOA and TFOA (COMB) in the study knee; and whether this knee was asymptomatic (AS) or symptomatic (S). From this, four subgroups were defined: (1) asymptomatic isolated TFOA (AS-TFOA; n = 111), (2) symptomatic isolated TFOA (S-TFOA; n = 59), (3) asymptomatic combined TFOA and PFOA (AS-COMB; n = 212), and (4) symptomatic combined PFOA and TFOA (S-COMB; n = 195). Response variables were measured at Baseline, Year 2, and Year 4 timepoints.

2.2. Variables of interest

All variables of interest were collected as part of the OAI protocol [30]. The primary outcome of this study was the KOOS quality of life subscale (KOOS-QOL). The KOOS-QOL subscale consists of 4 questions which are scored on a Likert scale (0–4), summed and converted to percent total score. The questions address domains related to awareness of, and lifestyle changes due to, knee OA [31]. A higher score indicates increased the explained variance to 74%. The AS-TFOA group scores accounted for 43% of the variance. The addition of a random intercept and interaction effects were significant at Year 2 (mean change [95% CI] = 3.74 [0.56, 6.92]; p = 0.022) and regressed at Year 4, such that they were no longer significantly different from Baseline (2.16 [-1.02, 5.33]; p = 0.185). The AS-COMB showed significant worsening compared to the AS-TFOA group at Year 2 and Year 4 (-4.7 [-8.62, -0.78]; p = 0.019 and -4.03 [-7.96, 3.51]).

3. Results

Based on the inclusion criteria described above, a subset (n = 577) from the total OAI was included in the present study. Demographic variables are included in Table 1.

3.1. KOOS quality of life

Quality of life scores based on group and time variables are illustrated in Fig. 2. Modeling of the KOOS-QOL (Table 2) found that both the individual and interaction effects were significant (group $\chi^2 = 633.5$, $p < 0.001$; time $\chi^2 = 12.4$, $p < 0.001$; interaction $\chi^2 = 27.6$, $p < 0.001$), accounting for 43% of the variance. The addition of a random intercept increased the explained variance to 74%. The AS-TFOA group scores significantly improved at Year 2 (mean change [95% CI] = 3.74 [0.56, 6.92]; p = 0.022) and regressed at Year 4, such that they were no longer significantly different from Baseline (2.16 [-1.02, 5.33]; p = 0.185). The AS-COMB showed significant worsening compared to the AS-TFOA group at Year 2 and Year 4 (-4.7 [-8.62, -0.78]; p = 0.019 and -4.03 [-7.96, 3.51]).
-0.11); p = 0.045). Conversely, the S-TFOA group significantly improved from Baseline to Year 4 (7.23 [1.84, 12.63]; p = 0.009). The S-COMB group did not differ compared to the AS-TFOA group at Year 2 or Year 4. At Baseline, symptomatic groups had significantly lower quality of life compared to the AS-TFOA group (S-TFOA: -32.92 [-38.50, -27.33] and S-COMB: -35.43 [-39.56, -31.31]; p < 0.001). While the symptomatic groups had significantly worse quality of life compared to asymptomatic groups, the variability between participants was evident when examining Fig. 2. Moreover, there was 70% increased odds of worsening quality of life (Table 3) over the four years based on having asymptomatic combined OA, though these changes over time are well within error (Table 2). The between-participant variability was formally tested by the random intercept standard deviation, which was significant (SD [95% CI] = 12.96 [11.97, 13.93], LRT = 456.5, p < 0.001).

### 3.3. Leg strength

As with the 20 m walk and chair stand tests, Group and Time, but not the interaction, effects were significant for flexion (χ² = 15.7, p < 0.001; χ² = 93.6, p < 0.001; χ² = 7.4, p = 0.282, respectively) and extension strength (χ² = 26.5, p < 0.001; χ² = 30.7, p < 0.001; χ² = 3.6, p = 0.738, respectively). The fixed effects only accounted for 4% of the variance and 72% with the random intercept included. The AS-TFOA group exhibited a significant reduction from Baseline to Year 2 and Year 4 for knee flexion (-24.83 N [-33.9, -15.77]; p < 0.001 and -23.16 N [-32.35, -13.96]; p < 0.001) and extension (-21.36 N [-36.14, -6.59]; p = 0.004 and -25.52 N [-40.51, -10.54]; p < 0.001). All other groups did not significantly differ from the AS-TFOA group trajectory, suggesting all groups exhibited significant worsening of muscle strength. The only significant between-group difference was the lower knee flexion and extension strength scores for those in the S-COMB group compared to the AS-TFOA group (-16.23 N [-30.80, -1.65]; p = 0.03 and -51.14 N [-79.9, -22.38]; p < 0.001, respectively). Between participant variability for knee flexion (SD [95% CI] = 52.1 N [46.8, 55.6], LRT = 769.1, p < 0.001) and extension strength (SD [95% CI] = 109.9 N [102.9, 116.7], LRT = 1123.8,
### Table 2

Fixed effects derived from linear mixed effects models accounting for random variability of the intercept (participant factor).

| Group Factor          | S-TFOA | AS-COMB | S-COMB | S-TFOA | AS-COMB | S-COMB | S-TFOA | AS-COMB | S-COMB |
|-----------------------|--------|---------|--------|--------|---------|--------|--------|---------|--------|
| **Intercept**         | 82.10  | -32.92  | -1.36  | -35.43 | 3.74    | 2.16   | 1.77   | -4.70   | 0.38   |
| **Time Factor**       |        |         |        |        |         |        |        |         |        |
| **Year 2**            |        |         |        |        |         |        |        |         |        |
| **Year 4**            |        |         |        |        |         |        |        |         |        |
| **Interaction**       |        |         |        |        |         |        |        |         |        |
| **Year 0 - Year 2**   |        |         |        |        |         |        |        |         |        |
| **AS-COMB**           |        |         |        |        |         |        |        |         |        |
| **S-COMB**            |        |         |        |        |         |        |        |         |        |
| **S-TFOA**            |        |         |        |        |         |        |        |         |        |
| **Model**             |        |         |        |        |         |        |        |         |        |
| **Parameter**         |        |         |        |        |         |        |        |         |        |
| **95% CI**            | [78.81, 85.39] | [38.50, 27.33] | [-5.42, 27.1] | [-39.56, 31.31] | [0.56, 6.92] | [-1.02, 5.33] | [-3.63, 7.16] | [-6.82, 0.78] | [-3.60, 4.37] |
| **p-value**           | <0.001 | <0.001  | 0.514  | <0.001 | 0.022   | 0.185  | 0.522  | 0.019   | 0.851  |
| **Model**             | 82.07  | -32.94  | -1.34  | -35.39 | 3.71    | 2.25   | 1.88   | -4.67   | 0.37   |
| **Parameter**a        |        |         |        |        |         |        |        |         |        |
| **95% CI**a           | [78.45, 85.49] | [38.30, 27.37] | [-5.65, 27.8] | [-39.62, 31.46] | [0.38, 7.27] | [-0.80, 5.73] | [-3.80, 7.60] | [-5.82, -0.67] | [-3.96, 4.44] |
| **p-value**           | <0.001 | <0.001  | 0.514  | <0.001 | 0.022   | 0.185  | 0.522  | 0.019   | 0.851  |
| **Model**             | KOOS QOL |        |        |        |         |        |        |         |        |
| **Parameter**         |        |         |        |        |         |        |        |         |        |
| **95% CI**            | [78.45, 85.49] | [38.30, 27.37] | [-5.65, 27.8] | [-39.62, 31.46] | [0.38, 7.27] | [-0.80, 5.73] | [-3.80, 7.60] | [-5.82, -0.67] | [-3.96, 4.44] |
| **p-value**           | <0.001 | <0.001  | 0.514  | <0.001 | 0.022   | 0.185  | 0.522  | 0.019   | 0.851  |
| **Model**             | Chair Stand Pace |        |        |        |         |        |        |         |        |
| **Parameter**         |        |         |        |        |         |        |        |         |        |
| **95% CI**            | [78.45, 85.49] | [38.30, 27.37] | [-5.65, 27.8] | [-39.62, 31.46] | [0.38, 7.27] | [-0.80, 5.73] | [-3.80, 7.60] | [-5.82, -0.67] | [-3.96, 4.44] |
| **p-value**           | <0.001 | <0.001  | 0.514  | <0.001 | 0.022   | 0.185  | 0.522  | 0.019   | 0.851  |
| **Model**             | Max Knee Flexion Strength |        |        |        |         |        |        |         |        |
| **Parameter**         |        |         |        |        |         |        |        |         |        |
| **95% CI**            | [130.30, 154.15] | [5.52, 36.75] | [-10.04, 17.97] | [-31.30, 16.7] | [-34.01, 15.71] | [-32.96, 14.17] | [-6.19, 27.20] | [-4.41, 17.36] | [-0.22, 22.62] |
| **p-value**           | <0.001 | <0.001  | 0.514  | <0.001 | 0.022   | 0.019  | 0.851  | 0.019   | 0.851  |
| **Model**             | Max Knee Extension Strength |        |        |        |         |        |        |         |        |
| **Parameter**         |        |         |        |        |         |        |        |         |        |
| **95% CI**            | [327.83, 374.52] | [32.59, 45.68] | [-10.04, 17.97] | [-31.30, 16.7] | [-34.01, 15.71] | [-32.96, 14.17] | [-6.19, 27.20] | [-4.41, 17.36] | [-0.22, 22.62] |

Abbreviations: S-TFOA, symptomatic tibiofemoral osteoarthritis; AS-COMB, asymptomatic combined tibiofemoral and patellofemoral osteoarthritis; S-COMB, symptomatic combined tibiofemoral and patellofemoral osteoarthritis; Y0, Baseline; Y2, Year 2 follow up; Y4, Year 4 follow up; 95% CI, 95% confidence interval.

a Parametric bootstraps parameter estimates and percentile-based 95% confidence intervals based on 1000 iterations.
4. Discussion

The most notable finding in this study is the overall stability of all groups over time, across all outcomes examined. While there were significant changes in outcomes over the four year follow up, and in several cases these changes differed between groups, the changes were almost entirely within known error, and likely not clinically significant. These results did not support our hypothesis regarding greater worsening in the combined OA groups. However, the results do suggest that quality of life and the secondary physical function measures are significantly worse in individuals with knee OA symptoms, regardless of the distribution of structural signs within the knee, supporting our second hypothesis. Overall, we found that the presence of symptoms is more important than the distribution of OA within the knee compartments, when determining quality of life and physical function.

Structural signs of OA generally progress with time, but patient-reported outcomes, like quality of life, seem to remain stable for most patients. Törmälehto et al. [16] found that two thirds of people with mild knee OA or those at risk of developing knee OA (n = 3053 from the OAI dataset) did not report a minimally important change in quality of life over eight years. Also using data from the OAI, people with symptomatic knee OA, Han and Gellhorn [45] found that both low and moderate quality of life groups (68% of the sample) did not significantly change over eight years. Our results add to this, by including those with PFOA in addition to TFOA. Although three of the four groups in our study (AS-TFOA, S-TFOA, AS-COMB) statistically improved, the magnitude of the differences were less than minimum clinically important changes [31] and minimum detectable changes [32]. Statistical significance was likely a product of the relatively large sample size, not due to the presence of a clinically meaningful effect.

The 20 m walk test and 30 s chair stand test, which are assessments of knee function, also remained stable. These results mirror previous six-year 20 m walk test performance stability from the Multicenter Osteoarthritis Study and the OAI [15]. Similarly, data from the Mechanical Factors in Arthritis of the Knee study showed that chair stand test (rate of 5 successive stands) performance didn’t change in 44% of participants with knee OA (only TFOA was confirmed) over three years [46]. Moreover, a synthesis of 45 studies involving people with knee OA showed that physical function did not significantly change over 0.5–8 years [47]. Unlike the movement-based functional assessments, knee strength significantly worsened in the current study’s AS-TFOA group. Meanwhile, the interaction effects were not significant, which suggests that the other three groups experienced a similar decrease in strength, though these changes were again within minimum detectable change [37].

The measures of quality of life and physical function included in this study largely remained stable over the four years. This lack of progression in the OAI cohort may be, in part, a result of concurrently stable knee pain [48], a tendency for outcomes from large cohort studies to differ from the general population (e.g. volunteer bias) [49], or that people living with knee OA find strategies to cope with their disease over time (e.g. response shift). Moreover, treatment can improve quality of life in those with PFOA [21], and it is unclear if participants in our dataset received treatment over the four year timeframe. The small changes, as seen in the present study and others [15,45] may also reflect regression to the mean. These results are certainly encouraging and should be an important point to communicate to patients when discussing typical knee OA prognosis.

While the present study did not find meaningful changes over time in our outcomes of interest, groups did significantly differ in their scores at Baseline. The observed differences were driven by the presence of symptoms not structural distribution, where people with symptomatic knees reported worse outcomes compared to those with asymptomatic knees. With respect to KOOS-QOL, symptomatic and asymptomatic groups differed by over 30 points. These findings are supported by previous work examining quality of life, which showed that symptom status significantly differed in their scores at Baseline. The observed differences were driven by the presence of symptoms not structural distribution, where people with symptomatic knees reported worse outcomes compared to those with asymptomatic knees.
We observed a similarly lower quality of life in the S-COMB compared to S-TFOA, but we did not test this directly nor was the difference clinically meaningful. Taken together, our results and other previous work [51], shows that the presence of pain alone is a good indicator of quality of life in patients with knee OA, regardless of compartment-specific imaging findings.

Physical function is also sensitive to the presence of knee pain. Previous research using the OAI dataset showed that higher pain severity, was related to worse chair stand and 400 m walk test performance [52]. Additionally, those with radiographic knee OA and pain were found to have slower 20 m walk test speeds and were more likely to decline in speed over time compared to healthy controls [53]. Our data further confirm that the presence of pain can independently and negatively influence physical function test performance. This relationship is likely influenced by the person's perceptions of pain [54] or kinesiophobia behaviour due to knee pain [55]. In our data, the addition of PFOA to a knee with TFOA was not a significant factor in the models, again suggesting that symptoms are more important than structural distribution of OA, in determining physical function. Consequently, rehabilitation strategies should focus on improving knee OA-related symptoms regardless of whether the patellofemoral joint is involved or not.

Lower knee muscle strength is associated with the presence of pain [56]. The structural consequences of OA are also thought to play a role, particularly in quadriceps weakness, due to abnormal afferent sensory information [57]. From previous reports of the OAI dataset, individuals with symptomatic knee OA presented with 11–13% lower knee extension strength and 7–16% lower knee flexion strength compared to asymptomatic participants [13]. The Beijing Osteoarthritis Study examined knee strength across groups with different compartmental involvement and reported that the strongest odds of having weak quadriceps was for the group with combined PFOA and TFOA [58]. Our data also showed the lowest knee extension force in the S-COMB group. Knee flexion strength exhibited a similar pattern, though the differences were far smaller, partly a product of the smaller overall values. These results point to the additive effect of pain and combined knee compartment involvement on knee strength, and that knee strength may be more sensitive to compartmental involvement compared to the KOOS-QOL and measures of physical function. Moreover, those in the S-COMB group are uniquely positioned to benefit from quadriceps strengthening given its protective effect on disease progression and pain [59].

Our study has limitations that must be considered when interpreting the results. The variables of interest in our study were limited to the follow-up timepoints available, thereby limiting any conclusions we can make beyond four years. We also separated groups based on the presence of TFOA or PFOA. However, the structural signs of OA and the distribution within one compartment of the knee (e.g. medial versus lateral patellofemoral joint) may affect pain and quality of life [60]. Examining subgroups based on the location and severity of structural and symptomatic disease characteristics may better inform quality of life outcomes [61], given that structural disease severity relates to knee pain in later-staged disease [62]. Defining TFOA and PFOA by MRI features may allow for inclusion of those with earlier knee OA and broaden the sample. As our data show, pain is an important factor in estimating quality of life and physical function. Readers must keep in mind that we only examined unilateral pain, while previous data from the OAI shows that bilateral pain may have a greater effect on quality of life [51]. While we focused on factors related to pain and structural signs of OA, psychological factors certainly play an important role in quality of life [55]. Lastly, we categorized participants based on MRI readings performed by OAI project groups. These projects selected participants either randomly or based on additional criteria to address their study question (e.g., presence vs. absence of KL grade progression, medial TFOA vs. lateral TFOA), meaning our dataset is not a truly random sample. Nevertheless, none of these projects assessed the presence or absence of PFOA, and as such, we are confident that the data do not contain any biases that relate to the specific purpose of our study.

Osteoarthritis does not always affect the tibiofemoral joint alone, and the influence of concurrent PFOA is becoming clearer. For clinicians, treating knee OA can be complex and identifying the likely prognosis may be difficult. The present study's results suggest that, for the most part, knee-related quality of life, physical function, and knee strength remain stable in the short to medium term (out to four years). This is important to convey when consulting with patients. However, it may be helpful to identify who is likely to have lower quality of life and physical function overall, as these individuals are in greater need of focused rehabilitation to improve these outcomes. Our findings show that individuals with lower quality of life and physical function can largely be identified based solely on the presence of symptoms, regardless of the distribution of structural OA within the knee.

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Author contributions

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Drafting of the article: JMC, MAH.
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Final approval of the article: JMC, JFE, DK, DT, MAH.
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Declaration of competing interest

None to report.

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