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Research

Activity preferences, lifestyle modifications and re-injury fears influence longer-term quality of life in people with knee symptoms following anterior cruciate ligament reconstruction: a qualitative study

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KEY WORDS

Return to sport
Knee injuries
Psychological adaptation
Fear of re-injury
Osteoarthritis

ABSTRACT

Questions: How do people with knee symptoms describe their quality of life and experiences 5 to 20 years after anterior cruciate ligament reconstruction (ACLR)? What factors impact upon the quality of life of these people? **Design:** Qualitative study. **Participants:** Seventeen people with knee symptoms 5 to 20 years after ACLR and high (n = 8) or low (n = 9) quality of life scores were recruited from a cross-sectional study. **Methods:** Semi-structured telephone interviews were conducted and transcribed. The data obtained from the interventions underwent inductive coding and thematic analysis. **Results:** Four consistent themes emerged from the interviews as common determinants of quality of life following ACLR: physical activity preferences; lifestyle modifications; adaptation and acceptance; and fear of re-injury. All participants described the importance of maintaining a physically active lifestyle and the relationship between physical activity and quality of life. Participants who avoided sport or activity reported experiencing reduced quality of life. Participants who suppressed or overcame re-injury fears to continue sport participation described experiencing a satisfactory quality of life while taking part in sport despite knee symptoms. For some participants, resuming competitive sport resulted in subsequent knee trauma, anterior cruciate ligament re-rupture or progressive deterioration of knee function, with negative impacts on quality of life following sport cessation. Participants who enjoyed recreational exercise often adapted their lifestyle early after ACLR, while others described adapting their lifestyle at a later stage to accommodate knee impairments; this was associated with feelings of acceptance and satisfaction, irrespective of knee symptoms. **Conclusion:** Activity preferences, lifestyle modifications and fear of re-injury influenced quality of life in people with knee symptoms up to 20 years following ACLR. People with a preference for competitive sport who do not enjoy recreational exercise might be at heightened risk of poor quality of life outcomes and could benefit from support to facilitate a transition to a physically active, satisfying lifestyle. **[Filbay SR, Crossley KM, Ackerman IN (2016) Activity preferences, lifestyle modifications and re-injury fears influence longer-term quality of life in people with knee symptoms following anterior cruciate ligament reconstruction: a qualitative study. *Journal of Physiotherapy* 62: 103–110]**

Introduction

Anterior cruciate ligament (ACL) rupture most commonly occurs in adolescents and young adults during competitive sport participation.[1–3] Estimates of the prevalence of ACL reconstruction (ACLR) in Australia are alarmingly high, exceeding other countries with a rate of 52 per 100 000 inhabitants.[1,3–7] Optimising longer-term quality of life following ACLR is important, considering the potential for persistent physical and psychological difficulties and the high rates of early-onset knee osteoarthritis after ACL injury.[8–12] As many as one in five people who undergo ACLR require subsequent knee surgery within 6 years.[13] Furthermore, one in four people who undergo ACLR experience an ACL graft rupture or contralateral ACL rupture within 15 years.[14] Subsequent knee surgery, including revision ACLR and contralateral ACLR, is associated with worse patient-reported outcomes, including reduced longer-term quality of life.[15–21] A recent systematic review reported impaired knee-related quality of life 5 to 20 years after ACLR,[22] but no studies investigating the impact of return to sport on longer-term quality of life following ACLR were identified. This is despite less than half of non-elite sports participants returning to competitive sport after ACLR,[11] which contrasts most patients' expectations of full return to sport within 1 year of surgery.[23] Young, active people undergoing ACLR commonly have unrealistic expectations (including a low likelihood of ongoing pain or instability and a

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low risk of developing post-traumatic osteoarthritis)[23] and these may impact on their quality of life outcomes.

Current patient-reported measures of quality of life have limited ability to capture individual expectations and do not specifically evaluate the importance of knee-related impairments to the individual.[24,25] Despite the breadth of quantitative literature about ACL injury, qualitative studies exploring personal perspectives following ACLR are rare and no qualitative studies have investigated quality of life following ACLR. Previous qualitative studies have focused on return to sport following ACLR.[26–29] One study identified fear, a change in life priorities, and personality traits as factors that influenced people's decision to return to sport after ACLR.[26] Two small studies of five rugby players[27] and five elite adolescent alpine skiers[28] identified high confidence in the injured knee as a key facilitator and low confidence as a key barrier for returning to sport.[27,28] Similarly, a study interviewing 17 female handball players described confidence in the capabilities of one's body as a key factor influencing decisions to return to sport after ACLR.[29] While several qualitative studies have investigated factors influencing the decision to return to sport after ACLR, it is unclear how these factors affect longer-term quality of life, particularly among people with ongoing knee symptoms or limitations.[26–29] Qualitative research could enhance the understanding of factors that impact negatively on quality of life after ACLR and provide information with which to guide management strategies in order to optimise outcomes following ACL injury.

Therefore, the research questions for this qualitative study were:

1. How do people with knee symptoms describe their quality of life and experiences 5 to 20 years after ACLR?
2. What factors affect quality of life in people with knee symptoms 5 to 20 years following ACLR?

Methods

Design

Interviews were conducted from August to October 2014, after obtaining informed verbal consent from each participant. Two pilot interviews were conducted to refine the broad themes, structural order and outline of the interview. A single investigator (SRF) performed the semi-structured telephone interviews and transcribed the audio recordings. This interviewer had no involvement with the clinical care of any study participant. All transcripts were de-identified, and each participant was assigned an alias for use in data transcription and reporting. Interview durations ranged from 16 to 41 minutes.

A standard interview schedule (Appendix 1 on the eAddenda) provided the framework for each interview, which covered four broad areas. Questions about perioperative experiences addressed: ACL injury and initial management; satisfaction with surgery and healthcare providers; ACLR preparation, expectations and experience; and postoperative experiences. Questions about sport and exercise addressed: return to sport; experiences of sport and exercise participation; and physical activity priorities, motives and importance across the lifespan. Questions about psychological impacts addressed emotions, fears and confidence in the injured knee. Questions about current experience addressed: current knee symptoms and function; lifestyle modifications; management strategies; knowledge; and information. Participants were also given the opportunity to contribute any additional information at the end of the interview.

Participants

Participants were purposively sampled from a larger cross-sectional study of 162 people who had undergone ACLR 5 to 20 years previously.[30] The eligibility criteria for this cross-sectional study required all participants to be aged 18 to 55 years; have received an ACLR or revision surgery 5 to 20 years previously; and report knee symptoms or functional limitations on the Knee Injury and Osteoarthritis Outcome Score (KOOS), determined by a predefined cut-off criterion.[30] This cut-off criterion required reporting less than optimal scores for at least 50% of questions on any two KOOS subscales, corresponding to cut-off values of $\leq$ 86.1 (pain), $\leq$ 85.7 (symptoms), $\leq$ 86.8 (activities of daily living), $\leq$ 85.0 (sport/recreation), and $\leq$ 87.5 (quality of life). Recruitment details and participant characteristics for the cross-sectional study have been reported previously.[30] These 162 participants completed a battery of questionnaires including the KOOS and the Anterior Cruciate Ligament Quality of Life questionnaire (ACL-QOL), which are valid and reliable for use in people who have undergone ACLR.[31–33] Demographic, lifestyle and return-to-sport data were also collected and relevant questionnaire responses from the cross-sectional study were presented for each participant (Table 1).

To enable comparisons between people with high and low knee-related quality of life, those with high or low ACL-QOL scores were sampled specifically. The ACL-QOL scores were ranked and the first people selected for the qualitative study were those with ACL-QOL scores in the tenth and ninetieth percentiles, followed by those with the next highest and lowest ACL-QOL scores, respectively. In total, 16 people with high ACL-QOL scores

Table 1
Participant characteristics.

Alias	ACL-QOL score *(0 to 100)*	Age *(yr)*	Time since last ACLR *(yr)*	Gender	Body mass index category	Return to sport	ACLR type
Lucy	25	33	6	female	normal	lower	primary
Flynn	26	44	16	male	obese	no	revision x 2
Sue	26	41	18	female	obese	no	primary
Claire	27	34	6	female	obese	no	primary
Will	27	50	12	male	normal	lower	primary
Kate	28	26	12	female	obese	lower	primary
Jack	29	41	11	male	overweight	lower	contralateral
Nick	29	25	6	male	obese	yes	contralateral
Hugh	30	32	6	male	overweight	lower	revision + contralateral
Zara	83	50	13	female	obese	yes	primary
Ross	83	35	6	male	overweight	yes	primary
Beth	86	49	5	female	normal	yes	primary
Amy	87	28	10	female	normal	lower	primary
Mary	87	42	18	female	normal	yes	revision
Emma	88	23	8	female	normal	lower	primary
Tina	90	33	5	female	normal	lower	primary
Guy	92	38	8	male	overweight	yes	primary

ACL-QOL = Anterior Cruciate Ligament Quality of Life questionnaire (0 = worst, 100 = best), ACLR = anterior cruciate ligament reconstruction.
For 'Return to sport', participants selected one of the following options: *I returned to competitive sport at the same or higher level than before ACL injury* = Yes; *I returned to competitive sport at a lower level than before ACL injury* = Lower; *I did not return to competitive sport after my ACL reconstruction* = No.
The horizontal line separates those with low ACL-QOL scores (above) from those with high ACL-QOL scores (below).

(score range 82 to 92) and 14 people with low ACL-QOL scores (score range 25 to 30) were sent an email invitation to take part in a telephone interview. Of these, five declined due to other commitments (four with high ACL-QOL scores and one with a low ACL-QOL score) and eight did not respond (four from each group). All people who agreed to take part were interviewed for the study, resulting in 17 interviews (eight with a high ACL-QOL score and nine with a low ACL-QOL score). To ensure an appropriate sample size, recruitment was stopped when no new themes emerged over two consecutive interviews for participants with high ACL-QOL scores and for participants with low ACL-QOL scores.

Data analysis

The first stage of data analysis involved general inductive analysis, where multiple readings, reviewing and data interpretation were undertaken to identify themes arising from the data.[34] Inductive coding was supported by commercial software[a].[35] This coding process resulted in the identification of key themes and sub-themes. The coding structure was revised and refined throughout the data interpretation process to reduce redundancy, identify new emerging sub-categories and incorporate new themes and insights. A hierarchical approach to coding was used, linking themes with a commonality or causal relationship to assist with pattern recognition.[35] Following a minimum of two rounds of coding and analysis by a single investigator (SRF), a second investigator coded a random sample of six interview transcripts (INA) and any contrasting opinions in identified themes were discussed. Where possible, conceptual maps were developed to assist with data interpretation and provide potential explanations for key themes.

Results

Participants

Interview data were available from 17 participants. People with low ACL-QOL scores had a mean age of 36 years (SD 8, range 25 to 50), 56% were male, 78% were overweight or obese and these participants had received their most recent ACLR an average of 10 years (SD 5, range 6 to 18) previously. In comparison, those reporting high ACL-QOL scores had a similar mean age of 37 years (SD 10, range 23 to 50), 38% were male, fewer were classified as overweight or obese (38%) and they had a similar mean of 9 years (SD 5, range 5 to 18) since ACLR was reported. Participant characteristics are presented in Table 1 and patient-reported outcomes are described in Table 2.

Key themes

Four key themes emerged from the interviews: physical activity preferences; lifestyle modifications; adaptation and acceptance; and fear of re-injury (Table 3). These themes and related sub-themes are described with supporting quotes from the interviews in the following sections. Additional quotes supporting each theme are provided as an online appendix (Appendix 2 on the eAddenda).

Physical activity preferences

Within the theme of physical activity preferences, two contrasting sub-themes were apparent from the interviews. The first involved 11 people who described a strong preference for participation in competitive sports in comparison to recreational exercise:

> *I do love netball. I hate the gym. Absolutely hate it. It makes it pretty hard when you can't play the sports that you love, which I don't consider to really be exercise, and you've got to find alternatives to exercise which I can't stand. (Claire)*

The contrasting sub-theme comprised a group of six people who preferred, enjoyed or were satisfied taking part in non-competitive recreational exercise. While some of these people had participated in team sports in the past, they did not display a strong preference for returning to competitive sport and described satisfaction with being physically active through recreational exercise:

> *Oh look I probably could have played, but to me that was a fairly major injury that had me off for a long time from doing exercise, and the exercise that I like doing (recreational exercise), and I said I didn't want to risk doing it a second time. (Beth)*

Table 2
Patient-reported outcomes.

Alias	Most important activity	Limitation in most important activity *(0 to 100)*	Current knee satisfaction	KOOS Pain *(0 to 100)*	KOOS Symptoms *(0 to 100)*	KOOS QOL *(0 to 100)*	Trouble with knee confidence	Lifestyle modification
Lucy	weightlifting	12	yes	75	50	38	severe	mild
Flynn	AFL football	0	yes	69	50	31	mod	total
Sue	running/gym	10	yes	83	68	44	mod	mod
Claire	netball	0	yes	75	75	31	severe	severe
Will	running	0	no	53	39	25	severe	severe
Kate	running	0	no	83	68	38	severe	mod
Jack	soccer	0	no	67	54	31	severe	severe
Nick	rugby	6	yes	83	54	50	mod	mod
Hugh	skiing	15	no	58	57	44	mod	mod
Zara	dancing	70	yes	86	54	75	mild	none
Ross	running	100	yes	89	79	75	none	mod
Beth	running	93	yes	94	79	88	none	mild
Amy	yoga	80	yes	92	79	75	mild	none
Mary	AFL football	88	yes	83	75	69	none	mild
Emma	netball	100	yes	83	89	75	mild	none
Tina	running	77	yes	100	71	69	mild	mild
Guy	soccer	100	yes	86	54	81	none	none

AFL = Australian Football League, KOOS = Knee-injury and Osteoarthritis Outcome Score (all domains: 0 = worst to 100 = best).
'Most important activity' was identified by question 19 on the ACL-QOL – *most important sport or recreational activity that you do or wish to do.*
'Limitation in most important activity' was rated by *how limited are you in playing that number one sport or activity?* from 0 = totally limited to 100 = not limited at all.
'Current knee satisfaction' was asked by *Taking into account your level of pain and also your functional impairment, if you were to remain for the next few months as you are today, would you consider that your current state is satisfactory*?.
'Trouble with knee confidence' was rated by Item 3 of the KOOS-QOL subscale, *How much are you troubled with lack of confidence in your knee?*, with answers restricted to not at all (none), mildly (mild), moderately (mod), severely (severe) and extremely.
'Lifestyle modifications' was rated by Item 2 of the KOOS-QOL subscale, *Have you modified your lifestyle to avoid potentially damaging activities to your knee?*, with answers restricted to not at all (none), mildly (mild), moderately (mod), severely (severe) and totally.
The horizontal line separates those with low ACL-QOL scores (above) from those with high ACL-QOL scores (below).

Table 3
An overview of common themes related to quality of life.

Theme	Sub-theme	Low ACL-QOL (n)	High ACL-QOL (n)
Physical activity preferences	Preference for competitive sport	9	2
	Enjoys recreational exercise	0	6
Lifestyle modifications[a]	Negative lifestyle modifications	6	1
	Positive lifestyle modifications	3	7
Adaptation and acceptance	Early adaptation	0	5
	Delayed adaptation	7	1
	No adaptation	2	2
Fear of re-injury[b]	Fear accommodation	5	4
	Fear suppression	4	2
	Fear avoidance	5	4

ACL-QOL = Anterior Cruciate Ligament Quality of Life questionnaire.
Note, some participants described transitioning between sub-themes over time:
[a] Within the theme of lifestyle modifications, four participants made negative lifestyle modifications for years but had made positive lifestyle modifications at the time of interview;
[b] Within the theme of fear of re-injury, six described fear suppression or avoidance behaviours for years but had developed fear-accommodation behaviours at the time of interview.

Lifestyle modifications

Ten participants reported having modified their way of life because of their knee in ways that had improved their quality of life (positive knee-related lifestyle modifications), while seven people had made modifications that impacted negatively upon their quality of life (negative knee-related lifestyle modifications) (Table 3).

A conceptual diagram summarising the concepts of activity preferences and lifestyle modifications with potential impacts on quality of life is presented in Figure 1. Six people with a preference for competitive sport described transitioning to an inactive lifestyle after sport cessation. For several participants, this resulted in weight gain, exacerbation of knee symptoms and a reduced motivation to exercise with negative impacts on quality of life:

> *You know, I'm disappointed that I didn't go back, and I'm disappointed that I swapped the lifestyle instead of keeping up with the sporting lifestyle. I went to a social lifestyle, and started putting the weight on, because now I'm at the stage where I've got too much weight. I've got worse knee issues. I'm not helping it by being overweight. It certainly made me change my lifestyle. (Sue)*

In contrast, the six people who enjoyed recreational exercise were often able to make positive lifestyle modifications. This tended to manifest in a sense of satisfaction with their current knee function and quality of life:

> *I started doing dancing; that's helped a lot. Now I do Pilates regularly, so that's helped with the movement and kept it going, so I do have fairly good movement now, and I have a fairly active lifestyle. (Zara)*

Adaptation and acceptance

A strong theme of personal adaptation and acceptance also emerged from the interviews. Five people described having adapted their lifestyle with ease following ACLR; while eight people took years to adapt their lifestyle in line with their knee's abilities and this delayed adaptation often resulted in a later improvement in satisfaction and quality of life. The remaining four people did not describe any knee-related lifestyle adaptations during their interview.

Early adaptation

A sub-group of five people described adapting their lifestyle within a short period of time following ACLR and attaining a state of satisfaction with their knee. For people with a preference for

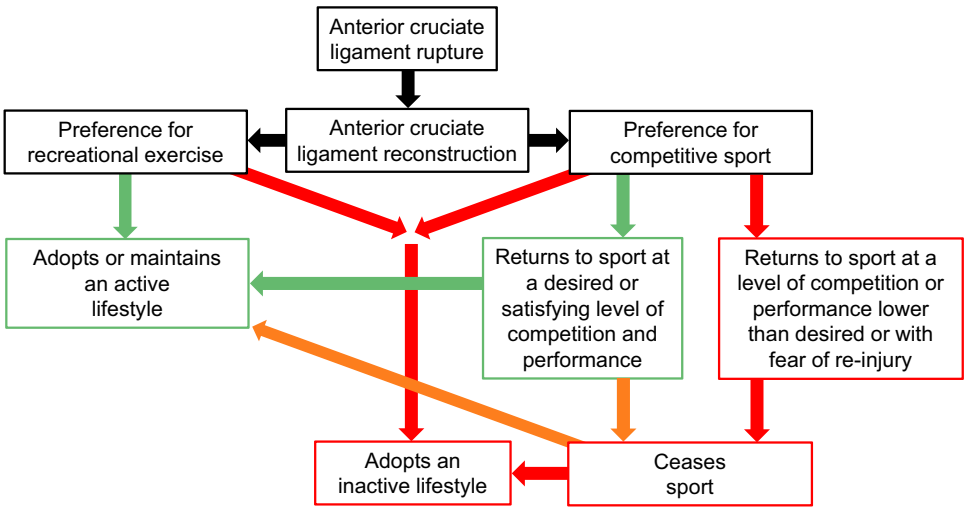

Figure 1. A conceptual diagram portraying common interactions between activity preferences, lifestyle modifications and quality of life.
Red boxes and arrows represent a current state with a tendency towards poor knee-related quality of life. Green boxes and arrows represent a current state with a tendency towards satisfactory knee-related quality of life. Orange arrows represent periods of transition between green and red states.
Note: arrows represent common paths of transition described by study participants. An individual may remain in a given state (box) without transitioning. The directions of arrows represent the most common pathways.

recreational exercise, a short transitional period (indicated by orange arrows in Figure 1) was more frequently described:

> *I was quite happy to give up netball and touch football because I just was not going to go through that again and didn't want to do it again, and switched to cycling and running. (Beth)*

Delayed adaptation

Eight people described knee-related difficulties after surgery, but acknowledged that they had grown to accept their current knee state having adapted their lifestyle over a period of years:

> *I was about 90 kilos, I was very, very overweight, and like I'm 53 kg now. I just started exercising again, and eating well. Since I lost weight, my knee has never locked again. I just decided one day that that was enough and I just started exercising. I've gone from what I feel like 10% quality of life, to 100% quality of life, for me, being active is everything. (Lucy)*

Fear of re-injury

The final key theme related to a fear of re-injury, which all participants reported they had experienced at some point after ACLR. Participants described their knee-related fears, how these fears changed over time, and how fear had impacted on their activity choices and quality of life. Three common sub-themes emerged in relation to fear of re-injury: fear accommodation, fear suppression, and fear avoidance. Figure 2 provides a conceptual diagram summarising the most common fear of re-injury behaviours in the context of physical activity preferences, lifestyle modifications and potential impacts on quality of life.

Fear accommodation

A subgroup of participants, over time, had become mindful of their knee-related fears and modified their movement patterns or activity choices to minimise risk of subsequent knee injury. These accommodations enabled people to maintain an active lifestyle and participate in desired activities, resulting in satisfaction with current knee function and quality of life (Figure 2). Three participants made early accommodations after ACLR, while six made delayed accommodations after years of fear-avoidance behaviour (n = 3) or after experiencing subsequent knee trauma following return to unrestrictive competitive sport (n = 3). This subsequent trauma resulted in increased fear of re-injury, which led to activity modifications that reduced perceived risk of re-injury:

> *I had the opportunity to keep going through but then, I was just like well you know, I've already had two, I'm 18 years of age, you know, what sort of future have I got if I blow it out again at 18.... so I went yeah, no I'm just going to go play back at state level and leave it, and yeah, just walked away. (Flynn)*

Fear suppression

Six participants with a strong desire to continue participating in high-impact competitive sport described an ability to overcome or suppress initial fear of re-injury in order to continue sport participation. While continuing sport participation, these people experienced a satisfactory quality of life, irrespective of the presence of physical knee symptoms. However, participating in unrestrictive competitive sport often resulted in subsequent knee trauma, ACL re-rupture or a progressive exacerbation of knee symptoms. As outlined in Figure 2, this resulted in one of two transitions: increased knee awareness, delayed activity adaptation and satisfactory quality of life (n = 3); or reduced knee function and adoption of an inactive lifestyle with negative impacts on quality of life (n = 3):

> *I adapted my game. I ran in straight lines. I played like that for a long time, for many years, until, umm, I couldn't really run at all, and I was having trouble just walking anywhere, so it had got quite bad. (Will)*

Fear avoidance

Nine people described ceasing sport participation due to a fear of re-injury. Of these, five people remained physically active in recreational exercise, despite ceasing competitive sport, and this had minimal impact on their quality of life, while four people transitioned to an inactive lifestyle, with further negative impacts on their quality of life (Figure 2). All people who described

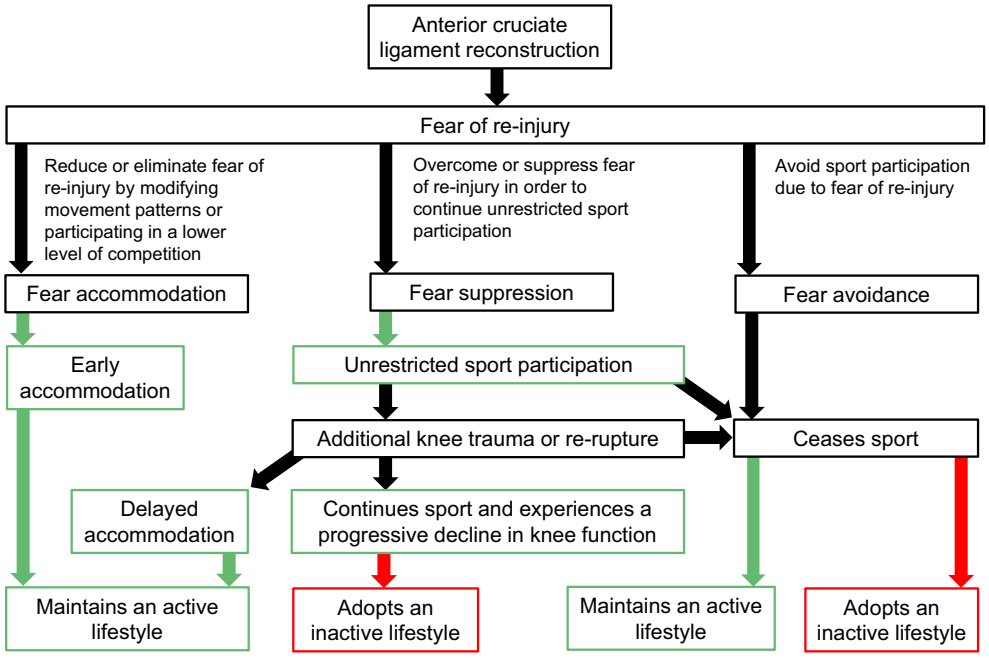

Figure 2. A conceptual diagram portraying described experiences of fear of re-injury and relationships with lifestyle modifications and quality of life.
Red boxes and arrows represent a current state with a tendency towards poor knee-related quality of life. Green boxes and arrows represent a current state with a tendency towards satisfactory knee-related quality of life.
Note: arrows represent common paths of transition described by study participants. An individual may remain in a given state (box) without transitioning.

fear-avoidance behaviours and a strong preference for competitive sport over recreational exercise described a transition to an inactive lifestyle:

> *So what sport or exercise do you do now? (Interviewer)*
> *At the moment, pretty much, nothing. I'm always a bit cagey still. I'm always, it's always in the back of my mind, watch your knee, watch your knee. (Sue)*

Discussion

This is the first study to explore the impact of the ACLR on longer-term quality of life using a qualitative approach. The obtained data highlighted the contribution of physical activity preferences, lifestyle modification, and fear of re-injury to quality of life and overall satisfaction in people with knee symptoms after ACLR. For many people, ACL rupture marked the beginning of persistent knee difficulties that required ongoing self-management and consideration. A shift toward this realisation was accompanied by acceptance, adaptation and improvement in quality of life. However, the period of transition was variable. While some people achieved this relatively quickly, others required more than a decade to do so and some people remained dissatisfied with their knee state at the time of interview. A unique perspective was gained into the trajectories of quality of life over time that has not been identified in previous ACLR studies. This allowed identification of key points of transition, where intervention to facilitate positive lifestyle modifications could be most beneficial.

Fear of re-injury and psychological readiness are common barriers to returning to pre-injury sport after ACLR.[10,12,36–39] In fact, the contribution of psychological factors to an individual's decision to return to sport may be of greater importance than physical limitations such as pain and instability.[40–42] Tanner et al[43] investigated the importance of knee-specific questionnaire items to people with an ACL rupture and found that fear of re-injury was considered most important to patients before and after ACLR. Additionally, a recent qualitative study by Tjong et al[26] interviewed 31 people who underwent ACLR at least 2 years previously and found that fear was the most commonly reported reason for patients not to return to sport. Similar to our findings, a sub-group of people in that study described overcoming initial fears in order to return to sport.[26] However, due to the shorter follow-up time, the study by Tjong and colleagues was unable to evaluate longer-term consequences and outcomes. Although fear of re-injury is commonly perceived as an unfavourable consequence of ACLR, our data suggest that, for some people, this could actually serve as a protective mechanism for optimising future knee function. However, large longitudinal studies would be required to reliably test this hypothesis.

It is possible that the experience of undergoing ACLR and the subsequent postoperative period contributed to the fear of re-injury described by participants in the present study. On average, similar knee-related quality of life has been reported between ACL-reconstructed groups and non-operatively managed groups 5 to 20 years after ACL injury.[44] However, comparisons between psychological traits, behaviours and re-injury fears in those who report poor quality of life after ACLR and non-operative management have not been performed and may prove a fruitful area for future research. Our data indicate that people with a strong preference for competitive sport who do not enjoy recreational exercise and display fear-avoidance behaviours might be at risk of poorer quality of life outcomes. Negative impacts on quality of life became apparent, irrespective of physical activity preferences, when fear-avoidance behaviours extended beyond sporting activity to recreational exercise and activities of daily living. These relationships are supported by quantitative study findings, where fear-avoidance beliefs were related to function in sport and activities of daily living[45] and a high fear of re-injury was associated with poor knee-related quality of life after ACLR.[46] Identifying people with strong activity preferences displaying fear-related patterns following ACLR may enable clinicians to facilitate the transition to a satisfying, physically active lifestyle, with the potential to improve knee-related quality of life. Irrespective of sport or recreational exercise preference, maintaining enjoyable regular physical activity appears to be paramount in optimising quality of life following ACLR. Further research is needed to develop and evaluate strategies that physiotherapists and other healthcare professionals can utilise to improve longer-term quality of life following ACLR.

Participation in regular physical activity and sport is associated with less depressive symptoms, reduced rates of obesity and better health-related quality of life.[47–49] Weight gain was described as a consequence of reduced physical activity by 65% of participants and this became a key feature in a cycle involving exacerbation of knee symptoms, reduced motivation, increased fear of re-injury and poor quality of life. Notably, some people reported being inactive and having impaired quality of life for more than 10 years before reaching a state of acceptance and satisfactory quality of life. Participants described a number of self-management strategies that facilitated their transition to a state of acceptance; the most common strategies involved reducing their expectations to allow participation in lower risk physical activity, adapting their goals to accommodate knee impairments, accepting a revised sporting role such as coaching or refereeing, or shifting focus to other aspects of life, including work or family life. This state of acceptance and adaptation resulted in a satisfactory quality of life, irrespective of physical knee symptoms. People who were able to transition reasonably quickly after ACLR to a satisfactory state were often those who enjoyed recreational exercise, or those who described early fear-accommodation behaviours. As depicted in Figure 1, there appear to be clear periods of transition where the implementation of management strategies could be beneficial for facilitating an active lifestyle with minimal impact on quality of life.

Interestingly, 29% of participants were satisfied with their knee function, despite reporting: very low KOOS-QOL and ACL-QOL scores; high levels of pain and symptoms; moderate to severe trouble with knee confidence; and extreme limitations taking part in their most important sport or activity (Table 2). This mismatch may reflect these people having reached a state of acceptance and adaptation, irrespective of knee impairments. Considering the high rates of osteoarthritis development that have been reported as early as 10 years following ACLR[50] and the chronic nature of osteoarthritis, understanding ways of optimising quality of life and satisfaction in people with knee symptoms after ACLR is of great value. Exploring differences between people who are satisfied and dissatisfied with their knee, despite reporting impaired patient-reported outcomes, could provide information that may be useful in developing strategies to optimise quality of life in people with persistent knee symptoms after ACLR.

A strength of the study was the purposive sampling strategy, which enabled the identification of common and contrasting experiences amongst people with high and low knee-related quality of life scores. Another strength was the ability to use multiple patient-reported outcome measures collected as part of a larger cross-sectional study to aid in the interpretation of findings.[30] The semi-structured interviews were devised to capture the full array of personal experiences from ACL injury to the time of interview, providing insights into changes in quality of life over time that have not previously been captured using traditional quantitative measures. A limitation of the study was the possibility of recall bias, given the time period since ACL injury. As all participants were English-speaking Australians it is not known whether these findings are generalisable beyond this setting. As with all qualitative research, our cohort of participants was unlikely to be representative of all people who have undergone ACLR, particularly given that study participants all experienced a degree of knee symptoms or activity limitations and were specifically recruited with high or low quality of life scores. Future quantitative research could assist in further exploring the

themes identified and evaluating long-term (> 20 year) quality of life outcomes after ACLR.

What is already known on this topic: Anterior cruciate ligament rupture is common. Knee symptoms and impairment of quality of life may persist for decades after anterior cruciate ligament reconstruction.
What this study adds: Among people with knee symptoms after anterior cruciate ligament reconstruction, quality of life appears to be influenced by their physical activity preferences, lifestyle modification and fear of re-injury. Those who find a way of returning to some form of exercise, such as by replacing competitive sport with recreational exercise, tend to report better quality of life than those who do not exercise.

Footnotes: [a]NVivo version 10, QSR International Pty Ltd, Melbourne, Australia.

eAddenda: Appendices 1 and 2 can be found online at doi:10.1016/j.jphys.2016.02.011

Ethics approval: The University of Queensland Institutional Human Research Ethics Committee provided ethical approval. All participants gave informed verbal consent before data collection began.

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