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SHORT COMMUNICATION

A DEDICATED AMPUTEE SPORTS PROGRAMME IMPROVES PHYSICAL FUNCTIONING AND SPORTS PARTICIPATION

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Objective: **People with a lower-limb amputation often have a sedentary lifestyle and increasing physical activity is important to optimize their health and quality of life. To achieve this the Amputee Parateam programme was developed. Amputee Parateam is a sports programme that addresses important physical, environmental, and social barriers for sports participation. This programme was evaluated in terms of various aspects of physical functioning and health.**
Design: **Repeated measures design.**
Patients: **Thirteen participants with a lower-limb amputation, with a median age of 51 (interquartile range (IQR) 40–63).**
Methods: **Measurements were performed at T0 (baseline), T1 (after 6 weeks) and T2 (follow-up after 12 months). Outcome measures were walking ability, functional mobility, daily activity, health-related quality of life, and adherence to sports at follow-up.**
Results: **Walking ability and functional ability significantly improved between T0 and T1. Adherence to sports at follow-up was high, with 11/13 participants still practicing sports weekly. There were no significant changes in daily activity or health-related quality of life.**
Conclusions: **The Amputee Parateam programme successfully improved walking ability and functional mobility and resulted in a high adherence to sports among the participants. However, these improvements in physical capacity did not lead to less sedentary behaviour in daily life.**

Key words: amputees; sports; physical fitness; mobility; participation; sedentary behaviour.

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LAY ABSTRACT

People with a lower-limb amputation often have a sedentary lifestyle. Increasing physical activity is important to optimize their health and quality of life. We developed the Amputee Parateam: a sports programme that addresses the most important barriers for sports participation. Thirteen people (median age 51) with a lower-limb amputation participated. They were evaluated before, during and after the programme. The participants showed significant improvements in walking ability and functional mobility as a result of the programme. Furthermore, sports participation increased, as 11/13 participants still practiced sports weekly 1 year after the start of the programme. However, daily physical activity and health-related quality of life did not improve. This study shows that the Amputee Parateam is successful for improving walking ability, functional mobility, and sports participation, but clinicians should be aware that these improvements do not lead to less sedentary behaviour in daily life.

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Rehabilitation after lower limb amputation is aimed at regaining mobility and improving performance of daily life activities (1, 2). However, many amputees still experience limited mobility (3, 4) and physical activity, as they generally undertake low levels of physical activity and sports participation after rehabilitation (5). Increasing physical activity is important to optimize health, quality of life (6) and life expectancy (7) within this population, as they already have a high prevalence of lifestyle related comorbidities, that is, obesity, vascular

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and heart disease, diabetes and chronic obstructive pulmonary disease (COPD) (8).

Physical inactivity can be reduced by increasing physical activity in daily life (i.e. reducing sedentary behaviour) and/or by increasing sports participation. People with a lower-limb amputation perform mostly "domestic activities" of low to moderate intensity (5) and daily activity is negatively associated with vascular amputations and unemployment (5). This physical inactivity occurs more among people with vascular amputations and people who are unemployed (5). Sports participation is also low, with only 15% of Dutch amputees regularly practicing sports (9), compared with 54.7% of all Dutch adults. Sports participation is negatively affected by physical barriers (health status and lack of energy), environmental barriers (lack of possibilities and inadequate facilities), and social barriers (lack of peers and a feeling of shame practicing sports among able-bodied individuals) (9, 10).

To address these physical, environmental, and social barriers for sports participation, we developed a sports intervention called the "Amputee Parateam." The "Amputee Parateam" intervention consisted of 2 parts. The first part took place in a rehabilitation centre and was aimed at lowering experienced physical barriers by improving the physical fitness. The second part took place at the training facility of a premier league Dutch soccer club and other regional sports facilities. This part was aimed at lowering environmental and social barriers, by allowing participants to experience a variety of (para)sports within a group of fellow amputees. To stimulate adherence to the intervention, participants officially signed a contract with the soccer club at the start of the intervention.

The aim of this study was to evaluate the effect of the Amputee Parateam on primarily walking capacity, and secondarily functional mobility, daily activity, health-related quality of life and adherence to sports. We hypothesized an increase in walking capacity and functional mobility after the first part, which would remain or further improve after the second part. In addition, daily physical activity and health-related quality of life were expected to increase during the complete intervention (6).

METHODS

Design and participants

This study had a repeated measures design and was carried out at the Sint Maartenskliniek (Ubbergen, The Netherlands) between August 2019 and July 2021. We included 13 adults with a lower-limb amputation who participated in the Amputee Parateam (groups of 2019–2020 and 2020–2021). Exclusion criteria were inability to walk indoors before the intervention and participation in other sports or physical therapy. Participants were recruited for research participation after applying for the Amputee Parateam. All signed an informed consent form prior to the measurements. This study was considered exempt of ethics review by the CMO Regio Arnhem-Nijmegen (reference number 2019-5609) and was registered at Clinicaltrials.gov (identifier NCT04756752).

Amputee Parateam programme

The Amputee Parateam programme comprised 2 parts. The aim of the first part was to improve the participants' physical capacity and thereby lowering the experienced physical barriers for sports participation. This part lasted 6 weeks and consisted of 3 training sessions per week (fitness, swimming, and sports & play) combining strength training and cardiovascular training. The aim of the second part was to maintain the physical gains from the first part and explore various (para)sports. This part lasted 8 months and consisted of a weekly 1-h (para) sports clinic, including a large variety of sports such as soccer, sitting volleyball, wheelchair basketball, boxing, and golf. Prior to the start of the intervention, participants visited a sports physician to ensure safe participation and their treating prosthetist to prevent problems with their prosthesis when increasing their activity level. All training sessions and sports clinics were guided by 2 sports therapists. The Amputee Parateam was designed as an annual programme with a fixed group, because social support and contact with peers are important factors in sports participation among people with an amputation (9).

Outcome measures

The primary outcome was walking capacity, measured with the overground Two Minute Walk Test (2MWT). Secondary outcomes were functional mobility, daily activity at home, health-related quality of life (HRQoL) and sports participation at follow-up. Functional mobility was measured with the L test, Four Square Step Test (FSST) and Amputee Mobility Predictor with Prosthesis (AMPPRO). Daily activity was defined as mean time standing and walking during 24 h of 5 consecutive days. HRQoL was measured with the Rand-36 questionnaire (2012), which evaluates 8 aspects of quality of life: physical functioning, social functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, pain, and general health. Finally, sports participation was defined as practicing sports at least once a week.

Data collection

Measurements took place before the start of the Amputee Parateam (T0), after the first part (T1, 6 weeks) and after the second part (T2, 8–12 months, depending on the COVID-19 restrictions).

Clinical tests (2MWT, L test, FSST and AMPPRO) were administered by a clinician as part of the programme and the data were shared with the researcher. Daily activity and health-related quality of life (HRQoL)

Table I. Demographic information of the participants.

Age (years) *(median (IQR))*	51 (40–63)
BMI (kg/m²) *(median (IQR))*	26.3 (24.4–32.8)
Time since amputation (m) *(median (IQR))*	12 (12–21)**
Cause of amputation	
Diabetes	3
Tumour	1
Trauma	2
Atherosclerosis	5
Intoxication	1
Elective	1
Level of amputation	
Below the knee	5
Above/through the knee	8
Unilateral/bilateral amputation	12/1
Walking aids	
Walker	1
Crutch(es)	5
Cane(s)	4
No aids	3
MFCL* 0/1/2/3/4	1/0/5/5/2

*Medicare Functional Classification Level at T0.

were measured for research purposes only. Daily activity was measured with an Activ8 sensor (Activ8, Valkenswaard, The Netherlands) (30 × 32 × 10 mm) which contains a 3D-accelerometer, a real-time clock and memory for data storage (11). Activ8 data were recorded at 12.5 Hz. The sensor was placed by the researcher on the anterior side of the upper (sound) leg. Participants wore the sensor continuously during 5 consecutive days (Wednesday–Sunday).

Adherence to sports was administered during a routine follow-up consult by the sports therapist of the Amputee Parateam 1 year after the start of the programme.

Data analysis

Activities were classified as lying, sitting, standing, walking, running, and cycling using the Activ8 classification algorithm (11), with as output a summation of time spent in different activities per minute. From this data, the total minutes standing and walking were summed per day, and the mean over 5 days was calculated.

Statistical analysis

A Wilcoxon signed rank test was used to examine the differences between T0 and T1. Descriptive statistics were used to present the differences between T1 and T2, because there was considerable missing data at T2 due to the COVID-19 pandemic restrictions in 2020 and 2021. Furthermore, differences between T0 and T1 were compared between the 2019–2020 and the 2020–2021 group with a Mann–Whitney U Test.

RESULTS

Participants' characteristics

Demographic information of the participants is presented in Table I. Eight participants took part in the first group (2019–2020) and 5 took part in the second group (2020–2021). Seven participants were excluded from the T2 measurements: 1 dropped out due to loss of interest, 1 dropped out due to additional amputations, and 5 participants of the 2020–2021 group were not measured at T2 because of COVID-19 restrictions. Due to the COVID-19 restrictions, several training stops occurred or were replaced by online sessions.

Clinical tests

Significant improvements were found between T0 and T1 on the 2MWT, L test, FSST and AMPPRO (Table II). The Medicare Functional Classification Level (MFCL), determined by the AMPPRO, increased 1 level in 5/13 participants. No differences were found between the 2019–2020 group and the 2020–2021 group in their improvements between T0 and T1. Table II shows the median values for the clinical tests at T0, T1 and T2.

Daily activity

The median time spent standing or walking per day was 113 min (IQR 87–164) at T0, 109 min (IQR 91–175) at T1, and 150 min (IQR 102–206) at T2. There was no significant difference between T0 and T1 (Table II). Between T1 and T2, 3/5 participants showed an increase of more than 10 min and 1 participant showed decrease.

Health-related quality of life

There we no significant changes on any of the subscales of the RAND-36 questionnaire between T0 and T1 (Table II).

Sports participation at follow-up

Of the 13 participants, 11 participants continued to practice sports 1 year after the start of the Amputee Parateam programme. Ten of them kept exercising as a group and 1 chose to practice sports with able-bodied peers.

DISCUSSION

This study evaluated the Amputee Parateam programme: a sports intervention including people with a lower-limb amputation. The Amputee Parateam programme consisted of 2 parts: the first part (6 weeks) aiming to improve physical fitness and the second part (8 months) aiming to improve sports participation. Walking capacity and functional mobility improved significantly during the first part of the Amputee Parateam programme. Furthermore, adherence to sports was high 1 year after the start of the intervention, as 11 of the 13 participants still practiced sports weekly. Unfortunately, no significant changes in daily activity and health-related quality of life were found.

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Table II. Change scores on clinical tests, daily activity, and health-related quality of life between T0 and T1, and between T1 and T2.

Clinical tests*	Change score T0–T1 ($N = 13$)	p	Change score T1–T2 ($n = 5$)
2MWT (m)	10 (6–22)	0.003	11 (-15–11)
L test (s)	-4.1 (-7.8 – -1.2)	0.04	.4 (-3.1–2.7)
FSST (s)	-4.5 (-6.4 – -3.3)	< 0.001	0.2 (-0.4–1.2)
AMPPRO	2 (1–5)	0.002	0 (0–0)
Daily activity			
Standing and walking (min)	7.8 (-10.1–29.8)	0.70	10.6 (3.8–15.2)
Health-related quality of life (0–100)**			
PF	5 (-5–10)	0.11	0 (-5–0)
SF	12.5 (-3.2–18.8)	0.23	0 (-12.5–12.5)
RLPH	25 (0–25)	0.21	0 (-25–25)
RLEH	0 (0–33.3)	0.09	0 (0–0)
EWB	0 (-9–4)	0.75	4 (0–4)
E/F	0 (-5–10)	0.64	-5 (-10–0)
P	0 (-2–22.5)	0.51	-22.5 (-30.6 – -2)
GH	-5 (-13.8–0)	0.09	5 (-5–20)

All values are presented as median (IQR). A positive value indicates an improvement for all outcome measures except the L test and FSST.

*Abbreviations clinical tests: 2MWT, Two minute walk test; FSST, Four Square Step Test; AMPPRO, Amputee Mobility Predictor with Prosthesis.

**Abbreviations health related quality of life: PF, physical functioning; SF, social functioning; RLPH, role limitations due to physical health; RLEH, role limitations due to emotional health; EWB, emotional well-being; E/F, energy/fatigue; P, pain; GH, general health.

Better strength and aerobic capacity are related to better walking ability (12), especially within the amputation population because of the increased metabolic costs of prosthetic walking. As the first part of the Amputee Parateam consisted of strength and cardiovascular training, we expected an improvement in walking capacity and functional mobility. Indeed, all outcome measures related to walking capacity and functional mobility improved significantly, with 5 of the 13 participants even reaching a higher MFCL level.

Adherence to sports improved significantly due to the Amputee Parateam. Before the intervention none of the participants practiced sports, while 1 year later almost all participants still practiced sports weekly, despite of a 3-month period during which sports participation was not regulated. Furthermore, adherence to the Amputee Parateam intervention itself high as well, as only 1 participant dropped out because of loss of interest. Many of the participants expressed that exercising with peers was an important incentive for their adherence to the programme, which is reflected in the continued sports participation as a group after the end of the intervention.

As the Amputee Parateam programme targeted more aspects than just physical capacity, a positive influence on daily activity and quality of life was expected as well. However, the improvements in physical capacity during the first part of the programme did not lead to significant changes in these areas. While several cross-sectional studies have shown a relation between walking capacity and daily activity (2), it is not clear if this relation is a causal one. This study shows that a short-term intervention to improve capacity does not necessarily improve daily activity. However, it is still possible that 6 weeks is too short to elicit these behavioural changes and that they will occur later. Unfortunately, there was too much missing data at T2 to confirm this. For rehabilitation professionals and physical therapists, our results imply that focusing on just physical fitness or walking capacity may not directly lead to improvements in lifestyle. A recent review on sedentary behaviour reduction shows that behavioural change techniques such as self-monitoring, restructuring the social environment, and behavioural substitution do successfully lead to a decrease in sedentary time (13). Combining an intervention such as the Amputee Parateam with these types of techniques may both improve people's physical capabilities, while simultaneously eliciting behavioural change on a daily basis (13, 14).

LIMITATIONS

The most important limitation was the missing data at T2 due to the COVID-19 pandemic restrictions. Therefore, based on the data in this study, no conclusions can be drawn about the long-term effects of the Amputee Parateam programme. It is unclear to what extent the positive results of the Amputee Parateam programme found within these 2 groups are generalizable to a larger population, other diagnosis groups or people with an amputation with other demographics. Participants were included in this study after they applied for the Amputee Parateam programme, which could have led to a selection bias and thereby positively influencing the effect of the programme. Furthermore, the Amputee Parateam programme was designed as a group intervention, and therefore only those participants applied who enjoy practicing sports with peers. This has probably positively influenced the adherence to the programme and this type of group intervention may be less effective among those who consider practicing sports with peers as a barrier instead of a facilitator (9). Finally, the heterogeneity within the group did cause some participants to feel less confident as they compared themselves with other higher-functioning participants. This may have negatively affected their HRQoL scores.

In conclusion, the Amputee Parateam intervention, consisting of strength and cardiovascular training and participation in (para)sports among peers, resulted in short-term improvements in walking capacity and functional mobility, and a long-term increase in sports participation.

Conflict of interest statement

The authors have no conflicts of interest to declare.

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