NuroKor®
BioElectronics

Perception and impact of real-world use of NuroKor KorOS technology

Report on customer survey studies 2021

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Background

Musculoskeletal (MSK) conditions represent a global burden affecting at least 1.71 billion people worldwide.[1,2] The leading MSK condition is low back pain, followed by joint (e.g., arthritis), neck pain and other injuries.[1] Pain associated with MSK can be particularly burdensome, impairing a person's ability to participate in their everyday activities. This disruption to daily activities and disability may also contribute to mental health burdens.[2,3] Access to adequate pain relief is important to minimise losses due to work absence and presenteeism, in addition to the healthcare-related costs of management.[2,4]

The preferred first-line approach to MSK pain relief is non-drug treatment. These may include self-management strategies, exercise therapy, and psychosocial interventions. Pharmacological interventions such as non-steroidal anti-inflammatory drugs (NSAIDs), antidepressants, muscle relaxants, corticosteroid injections and opioids may provide some relief, but carry the potential for adverse effects.[5] In particular, overuse of opioids is an emerging problem in MSK pain care, carrying the risk of misuse and abuse. Their use has been discouraged in widespread conditions such as low back pain and there is a desire for alternative treatment options.[6]

There is growing evidence for the effectiveness of electrotherapy in tissue healing and pain relief. Biotechnology company, NuroKor®, has developed wearable physical-therapy technology that use proprietary KorOS® technology to help relieve pain and aid muscle recovery. NuroKor KorOS technology incorporates three clinically proven technologies:[7-9]

Microcurrent Stimulation (MCS)

provides a low level of subsensory electrical current (<1000 μA) to support endogenous bioelectrical activity and normalise the electrical environment of cells and tissues following injury. Studies have reported numerous mechanisms and benefits for MCS, including increased ATP synthesis, upregulation of angiogenesis, downregulation of inflammation, and signalling of the healing cascade by inducing cell proliferation and migration to facilitate tissue healing repair processes.[7]

Peripheral Nerve Stimulation (PNS)

delivers electrical impulses through the skin to nerve endings in the affected pain area. This suppresses the perception of pain by preventing the transmission of pain signals from reaching the central nervous system. PNS may also help to modulate the biochemistry of injured cells through the regulation of neurotransmitters, endorphins, and local inflammatory mediators.[8]

Neuromuscular Stimulation (NMS)

delivers high-intensity electrical currents to the muscle to evoke muscle contractions. Regular use may be beneficial in strength training and rehabilitation to improve muscle mass and function. NMS may also increase muscle blood flow and metabolite washout, resulting in accelerated muscle kinetics during and after exercise.[9]

NuroKor KorOS technology is delivered in the hand-held NuroKor mitouch device (with MCS, PNS and NMS), and the smaller, ultra-wearable NuroKor mibody device (with PNS and NMS). Unlike conventional pain-relief medications, NuroKor KorOS technology alleviates pain without introducing foreign substances into the body or risk of addiction.[5]

This two-part, retrospective report reviews the effect of NuroKor KorOS technology on MSK pain in 1) working professionals with MSK conditions using the NuroKor mibody device; and 2) customers with MSK conditions using the NuroKor mibody and/or mitouch devices.

Perception and impact of NuroKor in working professionals with MSK conditions.

Study Design

While the prevalence of MSK pain increases with age, it can cause disruption to people during their 'working years'.2 MSK pain can create a loss of function in the workplace, decrease productivity and reduce an employee's ability to participate in workplace activities, resulting in absenteeism, workforce shortages, and further costs to the workplace.[2,3]

In 2021, NuroKor provided mibody devices to Microlink, a UK-based company that provides assistive support to manage disabilities in workplace and educational facilities. Microlink employees* with self-reported MSK pain were invited to participate in a survey to assess the real-world performance and satisfaction of NuroKor KorOS technology. Participants completed questionnaires before and after using the NuroKor mibody device. Survey questions were focussed on pain, device use, quality of life and functional outcomes. Data was collected from 1 April 2021 to 31 May 2021 with no predefined treatment window.

**The occupations of study participants varied, and included roles in legal counsel, marketing, human resources, technical services, finance, workplace support and project management.*

Results

Baseline participant characteristics

The study recruited 16 employees during the period, with one patient excluded from the analysis for not completing the post-treatment survey. Participants had a mean age of 41.5 years and were mostly female (62%). Table 1 shows participants reported pain across a variety of locations in the lower limbs, back, upper limbs and neck, caused by previous surgery or injury (50%), or pain-related conditions (38%).

Table 1: Participant Baseline Charecteristics

Baseline characteristics	N = 16
Age	41.5 years
Gender	
Female	10 (62%)
Male	6 (38%)

Baseline characteristics	N = 16
Medical condition diagnosed	
Yes	7 (44%)
No	8 (50%)
Not answered	1 (6%)
Type of diagnosis	
MSK pain	5 (31%)
Psychological condition	3 (19%)
Not answered	8 (50%)
Pain-related condition	6 (38%)
Pain caused by previous injury/surgery	8 (50%)
Pain area*	
Back	6 (38%)
Upper limbs	5 (31%)
Lower limbs	7 (44%)
Neck	3 (19%)
Type of pain	
Pain radiation	12 (75%)
Pain episodes	10 (62%)
Continuous pain	12 (75%)
Mechanical pain component†	14 (88%)
Pain severity (NRS)	
Mean worst pain	8.1
Mean least pain	2.8

**Pain was not always isolated to one area. †Pain caused by movement. MSK=musculoskeletal. NRS=numerical rating scale.*

A majority (75%) of participants described their pain as continuous and/or radiating, and 62% experienced episodic pain. Half of the respondents reported their pain as having a negative impact on their quality of life and/or ability to work, and 62% reported that the pain affected their hobbies/activities.

Most participants were currently or had previously treated their pain, most commonly through exercise, a physiotherapist and/or chiropractor/osteopath, and 44% had taken pain-relief medication. Further details on participant characteristics is given in Appendix Table S1.

Device use

On average, participants used the NuroKor mibody device for 7 weeks (range 2–13 weeks), several times per day (53%) or per week (40%). The average duration of each session was 27.7 minutes (standard deviation (SD): 7.1 minutes).

Pain outcomes

All participants (100%) reported a decrease in pain intensity following treatment with NuroKor mibody, and 80% responded 'yes' to having a reduction in frequency or duration of pain at the time of survey response. The average numerical rating scale (NRS) score for the worst pain improved from 8.1 to 6.7. A majority (60%) of participants also decreased their use of pain relief medication following treatment with the device.

Quality of life outcomes

Most participants (87%) reported an improvement in their quality of life (QoL) to some degree. When asked if there had been improvements across various domains of QoL after using the NuroKor mibody device, participants responded 'yes' to improvements in mobility (73%) and mood (57%). 100% of participants who experienced difficulties with sleep at baseline (n=5) reported improvements in sleep after using the device [Figure 1].

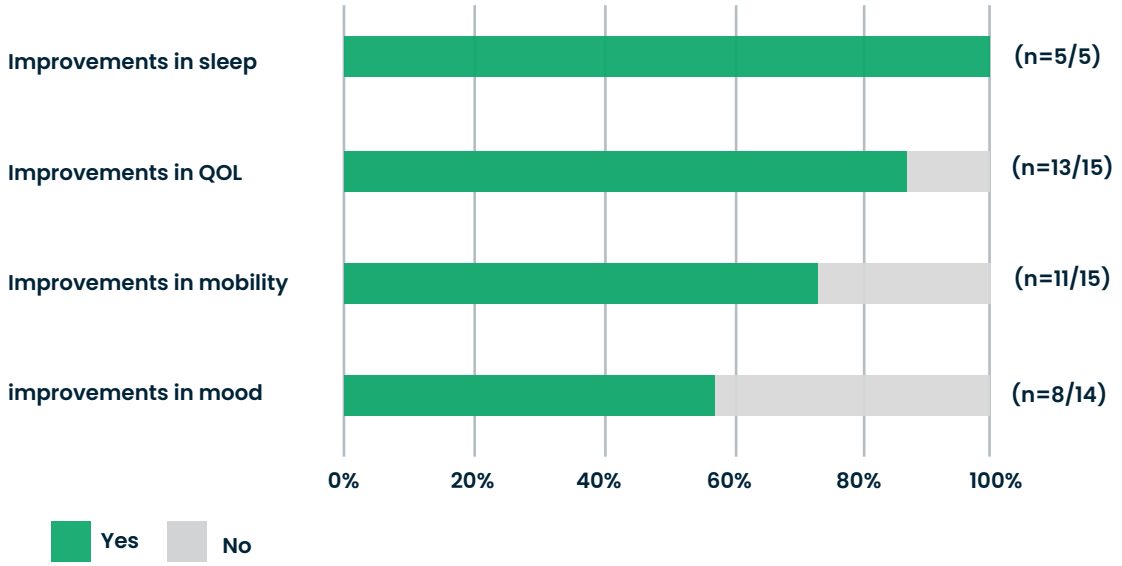


Figure 1. *Improvements in sleep, QoL, mobility, and mood. Improvements in sleep were reported by 100% of participants who experienced difficulties in sleep at baseline (n=5). QoL=quality of life.*

Functional outcomes

Most participants reported an improvement in their activity levels/need for rest (64%) following treatment with the NuroKor mibody device. Almost half (47%) of participants found that they were able to partake in hobbies or activities they were previously unable to do. Most participants also reported an improved ability to work or do their job (79%) [Figure 2].

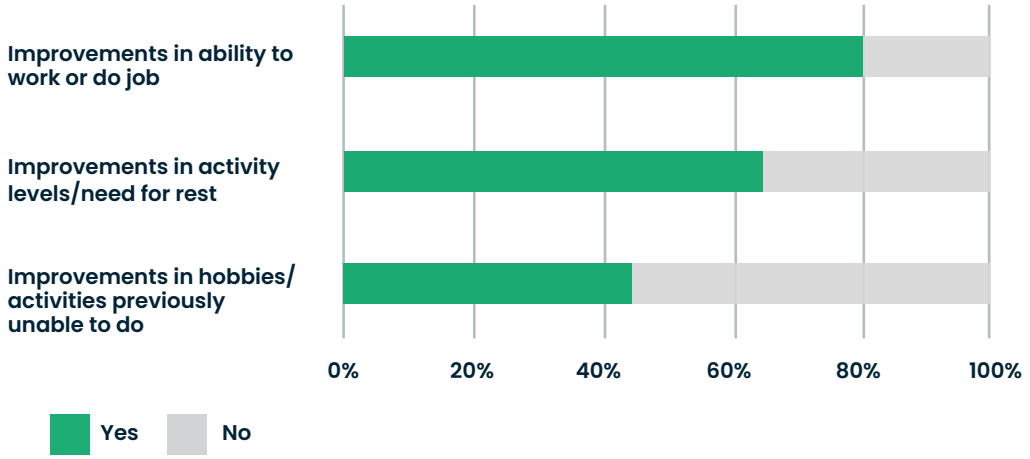


Figure 2. *Improvements in work, activity and hobbies.*

Satisfaction

Participants gave an average NRS score of 8.1 (SD: 1.9) when asked how beneficial they found the treatment with NuroKor (NRS 10 = very satisfied). They rated the overall experience of the device as 8.6 (SD: 1.3), and the ease of setting up and using the device as 8.7 (SD: 1.5). All participants would recommend NuroKor KorOS technology to others (67% very likely and 33% likely) [Appendix Table S2].

Discussion

This observational, survey-based study demonstrated that NuroKor KorOS technology provides effective pain relief for working professionals with MSK conditions. Before using NuroKor KorOS technology, most participants experienced continuous and/or radiating MSK pain that was very severe at times (NRS 8.1). Participants reported that the pain negatively impacted their quality of life and their ability to work and engage in hobbies/activities. Most participants had attempted to alleviate their pain using a variety of methods, including at-home remedies to consulting specialists and trying alternative therapies.

NuroKor KorOS technology reduced pain intensity for 100% of participants in this survey, reducing the need for other pain medication in 60% of cases. This is consistent with the proposed action of NuroKor PNS technology, which may provide pain relief by blocking pain signals from reaching the brain and regulating the production of endorphins.[8] When using the NuroKor mibody device for an average of 27 minutes, several times a day or week, participants were able to reduce the severity of their pain by around 60%. As a result, the majority found they were more able to work and perform the duties of their jobs. It is in this way that the NuroKor NMS technology is designed to work, helping to speed up recovery and increase muscular strength and function.[9]

Whilst the results are promising, there are limitations to this study. The population size was limited at 15 participants completing the survey. Additionally, some survey questions may be open to interpretation and could have been interpreted differently amongst participants.

In summary, NuroKor KorOS technology provided highly beneficial pain relief to working professionals with MSK conditions. The technology alleviated pain in a convenient, medication-free, and non-invasive device resulting in high satisfaction and recommendation scores amongst working professionals and better enabling them to perform their usual work duties.

Perception and impact of NuroKor KorOS technology in customers with MSK conditions

Study design

The aim of this study was to assess the performance and satisfaction of NuroKor KorOS technology across various pain occasions in real-world cases.

NuroKor customers were contacted through social media and invited to complete a voluntary, anonymous survey about their experience using the NuroKor mitouch and/or NuroKor mibody devices. Data was collected from 22 June 2021 to 18 August 2021.

Results

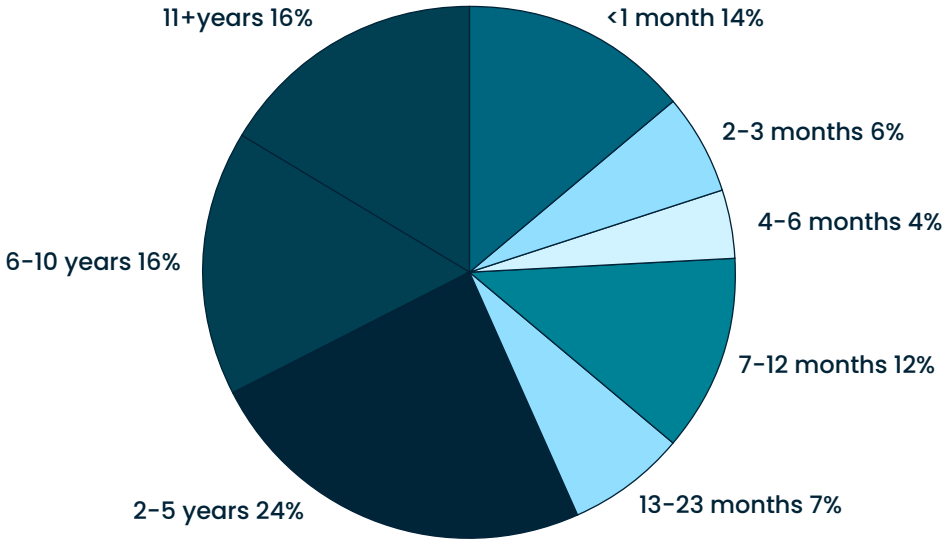
Baseline characteristics

The study recruited 112 customers during the period. Most participants resided in the UK (64.8%) and were aged between 45–64 years [Appendix Table S3].

Appendix Figure S1 shows participants reported pain across a variety of locations in the back, shoulder, neck, and knee. The main causes of pain reported were due to joint issues (35.9%), spinal disc problems (25.0%), strain (23.9%) and arthritis (21.7%). Most participants had attempted to alleviate their pain using other methods, including massage, pain medication, heat, and exercise. Some respondents (29.0%) felt that their previous pain-relief methods had not been very successful.

Figure 3 shows that most participants experienced pain lasting 2–5 years on some (41.9%) or most (36.6%) days.

A.



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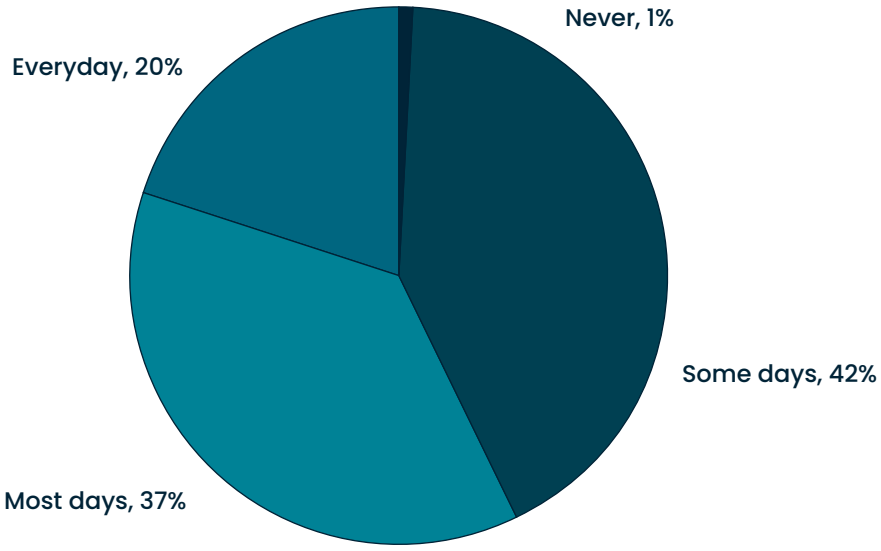

Figure 3. *Pain-related baseline characteristics. A) Duration of pain before using NuroKor KorOS technology (94/112 participants); B) Frequency of pain before using NuroKor KorOS technology (93/112 participants).*

Device use

Participants used the NuroKor mitouch (44.4%), NuroKor mibody (33.3%) or both devices (22.2%). Most participants used their device for more than once a week (31.8%) and for an average of 37.3 minutes (SD: 18.2 minutes) [Appendix Figure S2]. The most used programme for both mitouch and mibody was Pain+ (33% and 47.1%, respectively) [Appendix Figure S3].

The most common reason for using the device was for pain management or other health-related conditions (e.g., joint pain, arthritis, back pain, etc.). The participants reported their main goals for NuroKor KorOS technology were for relieving aches and pains (84.6%), recovery following sports activity (73.1%), injury healing (55.8%) and to strengthen muscles (17.3%) [Appendix Figure S4].

62.0% of participants used their NuroKor device while working or doing their daily activities, and 21.2% wore the device while exercising. Participants gave an average rating of 7.9 to the wearability of their NuroKor device. The most used accessory was the Korband (36.2%), followed by the KorShoe (29.5%) and KorGlov (13.3%). 51.4% of respondents (105/112) did not use any NuroKor accessories.

Pain intensity

Pain intensity was rated using a scale of 0–10, where 0 = no pain and 10 = the worst imaginable pain. Figure 4 shows that the average pain intensity score improved from 6.4 to 2.6 after using NuroKor KorOS technology, indicating a 60% improvement.

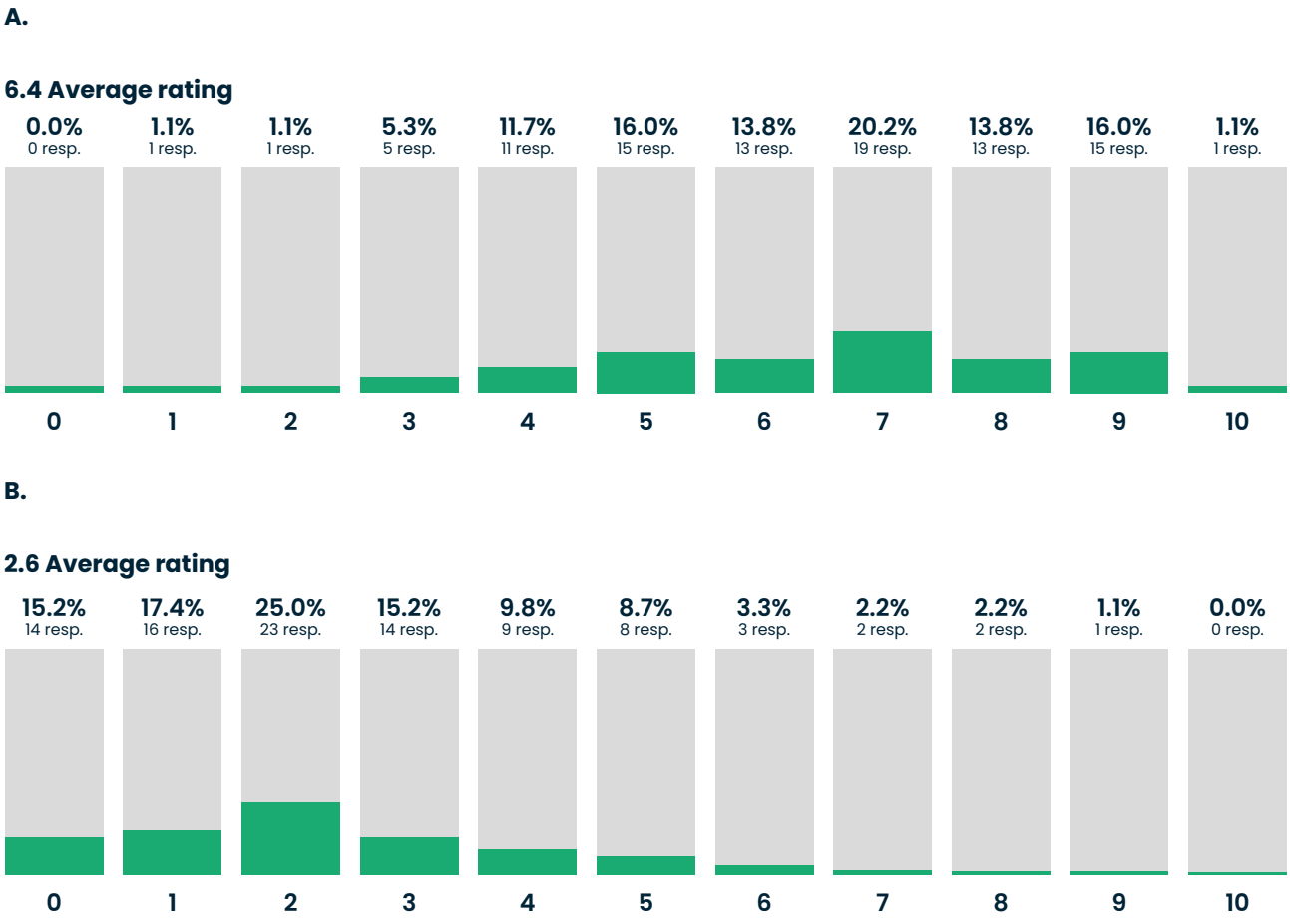

Figure 4. *Pain intensity A) before using NuroKor KorOS technology; B) with using NuroKor KorOS technology.*

A sub-analysis demonstrated that the improvement in pain intensity was consistent across the most common areas of pain – the back (58%), shoulder (59%), neck (60%), and knee (63%) [Appendix Figure S5].

Most participants found that their pain relief with NuroKor KorOS technology lasted approximately 6 hours (26.9%) and their use of pain-relief medication was reduced (35.8%) or eliminated entirely (38.8%) [Appendix Figure S6].

Activity levels

The average activity of daily living score increased from 7.8 to 9.2 when using NuroKor KorOS technology, indicating an improvement of 18% [Appendix Figure S7]. A sub-analysis demonstrated that activity levels improved in participants who experienced back, shoulder, neck and knee pain [Appendix Figure S5].

Satisfaction

Participants rated their NuroKor device as 9.0 out of 10 (SD: 1.4) indicating a 'very satisfied' score. 7.4% of participants experienced some discomfort with the device [Appendix Figure S8], but 97.2% of participants would continue using NuroKor KorOS technology and 98.1% would recommend NuroKor KorOS technology to others (1.9% were undecided).

Figure 5 shows that most participants were satisfied with the functional improvements they experienced with NuroKor KorOS technology. Participants were mostly satisfied with the improvements in quality of life (90%), mood (85%), walking distance (71%) and sleep (71%).

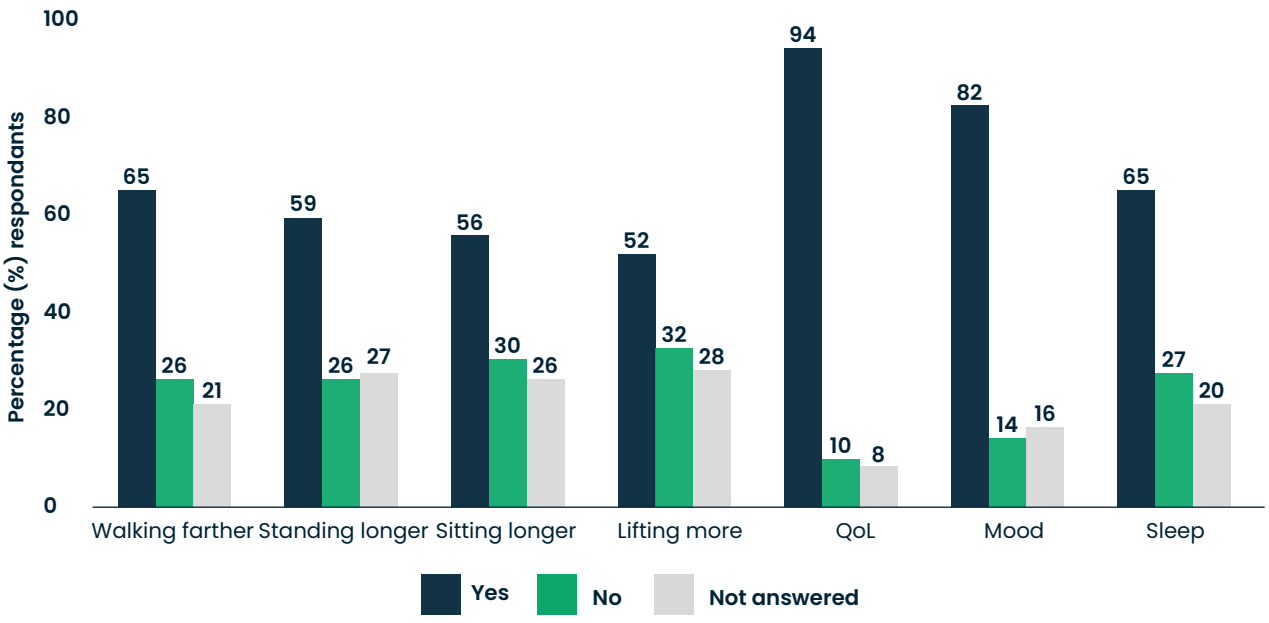

Figure 5. *Participant satisfaction with improvement across various functional domains following NuroKor KorOS technology.11*

Discussion

This survey illustrated the chronic burden of MSK conditions, with 57% of participants suffering from MSK pain for over 2 years. As per current evidence, the most common area of pain was in the back, supporting the notion that low back pain is the leading cause of disability worldwide.[2] Most participants had attempted to alleviate their pain using a variety of methods, however 29% felt that their previous pain relief methods had not been very successful.

The most common reason for using NuroKor KorOS technology was for pain management. In general, pain relief is considered successful and clinically significant if there is a 30% improvement in pain.[10] NuroKor KorOS technology improved pain intensity across the most common areas of pain, including back (by 58%), shoulder (by 59%), neck (by 60%), and knee (by 63%). Activity levels were improved by 18% and were also consistent across multiple areas of pain, demonstrating that NuroKor KorOS technology may benefit a range of MSK conditions.

NuroKor's PNS technology is believed to block pain signals from reaching the brain and stimulates the production of endorphins, resulting in reduced pain intensity.[8] In this study participants reported not only pain relief, but an improvement in activity. This may be where NuroKor's NMS and MCS technology (for NuroKor mitouch users) may play a role through muscle repair and effects on inflammation.[7,9]

Most participants reported their pain relief with NuroKor KorOS technology lasted up to 6 hours, which may be competitive with pharmacological dosing windows of 4–6 hours.[11] However, unlike pharmacological management, NuroKor technologies are medication-free, are not absorbed into the body and have not been shown to be addictive.[12,13]

The highly rated wearability and availability of accessories meant that the majority participants were able to use their NuroKor device while working or doing their daily activities. Therefore, users do not have to take absence from work for pain relief with NuroKor KorOS technology, potentially minimising the burden of MSK pain on productivity.

The limitations of this study include a small population size of 112 participants. Since this survey was conducted over a short period, the duration of improvement could not be assessed. There was also the possibility that participants misunderstand the survey questions or interpreted them differently to other participants.

Conclusions

These survey-based studies demonstrated that NuroKor KorOS technology can provide effective pain relief, with a return to regular activities across a variety of MSK conditions. Participants reported improvements in quality of life, activity levels and functional outcomes following NuroKor KorOS technology with PNS for pain relief, NMS for muscle strength and function, and MCS for tissue healing and recovery (in the NuroKor mi-touch device).[7-9]

NuroKor KorOS technology is delivered as a convenient, medication-free, and non-invasive therapy with no known addiction risks that can be easily trialled. The high satisfaction levels and recommendation scores suggest that NuroKor KorOS technology could be considered a viable treatment option in the management of MSK pain.[7-9]

References:

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SUPPLEMENTARY APPENDIX69

Perception and impact of NuroKor KorOS technology in working professionals with MSK conditions

Table S1: Baseline characteristics – activity limitations, interventions and therapies

Baseline characteristics	N = 112
Hobbies/activities affected due to pain	
Yes	10 (62%)
No	3 (19%)
Did not answer	3 (19%)
Pain negatively impacting QoL	
Yes	8 (50%)
No	5 (31%)
Did not answer	3 (19%)
Pain affecting ability to work	
Yes	8 (50%)
No	5 (31%)
Did not answer	3 (19%)
Currently taking pain medication	
Yes	7 (44%)
No	6 (38%)
Did not answer	3 (19%)
Type of pain medication used	
Paracetamol	4
Co-codamol (codeine/paracetamol)	3
Ibuprofen	2
Pregabalin*	1
Amitriptyline*	1
Duloxetine*	1
Currently or previously on pain treatment	
Yes	10 (62%)
No	4 (25%)
Did not answer	2 (13%)
Types of current/previous pain treatment used†	
Exercise (core, yoga, stretch, sports)	3
Physiotherapist:	4
Chiropractor/Osteopath	4
Surgery	1
Acupuncture	1
Podiatrist	1
Massage	1
Pain management used at home	
Yes	13 (81%)
Did not answer	3 (19%)
Type of pain management used at home	
Cold or hot application	9
Stretching	7
Movement breaks	4
Gel	2
Massager	1
TENS	1
Exercise	1

**Pain medication used for neuropathic pain but also anxiety/depression. †Multiple answers possible (free text).*

Table S2: Satisfaction scores

Survey question	Participant response
Overall, how beneficial did you find the treatment programmes? (NRS)*	Avg: 8.1
How would you rate your overall experience of the device? (NRS)*	Avg: 8.6
How easy did you find it to set up and use the device? (NRS)*	Avg: 8.7
How likely would you be to recommend a NuroKor device to others?	
Very likely	67%
Likely	33%

**NRS 10=very satisfied.*

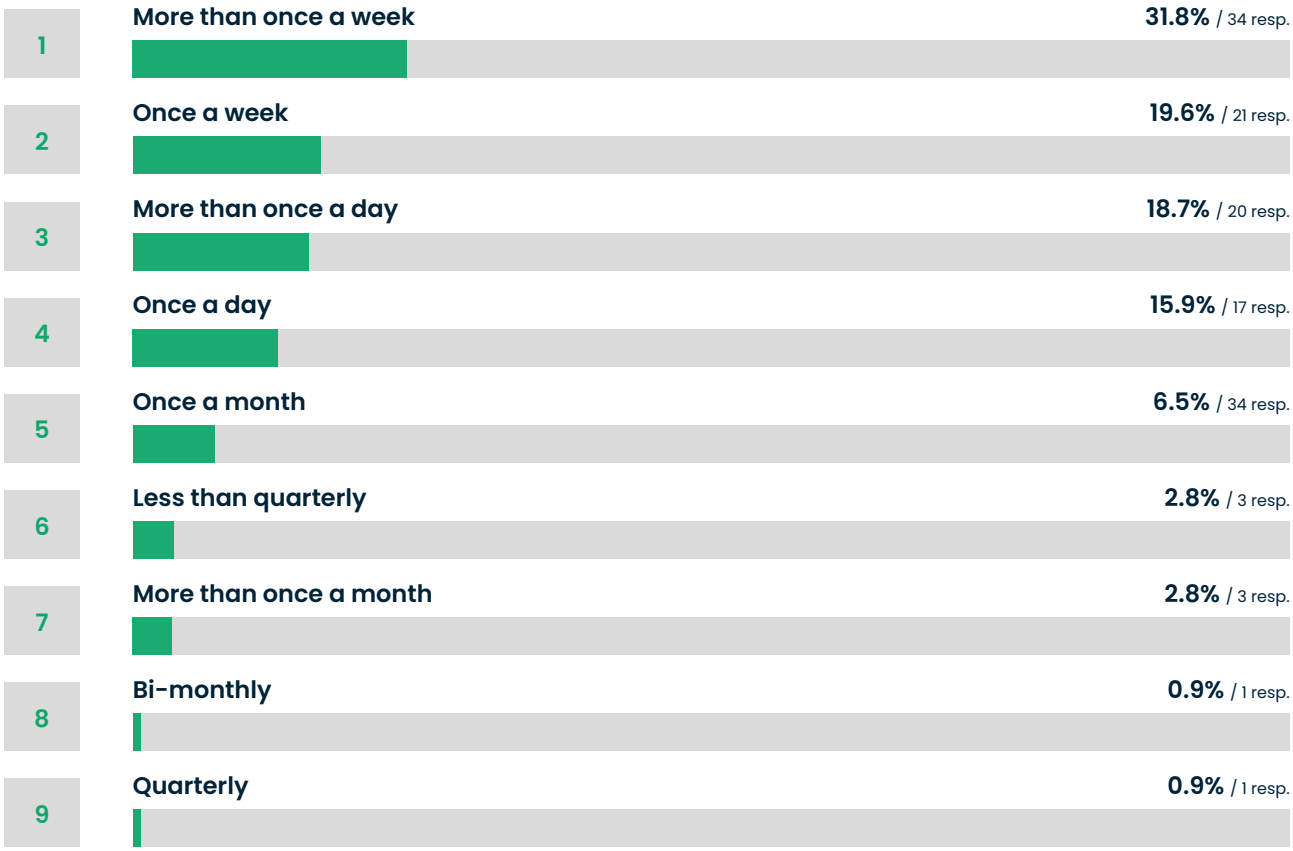
Perception and impact of NuroKor KorOS technology in customers with MSK conditions

Table S3: Baseline characteristics (N=108/112)

Baseline characteristics	Participant response
Gender	
Female	58.3%
Male	41.7%
Age group	
45–54	23.6%
35–44	22.7%
25–34	20.9%
55–64	20.9%
65+	8.2%
18–24	3.6%
Country of residence	
United Kingdom	64.8%
Australia	17.6%
United States of America	13.9%
France	1.9%
Dominican Republic	0.9%

Figure S1. *Baseline demographics – pain related and previous treatments. A) Site of pain (N=108/112); B) Cause of pain (N=92/112); C) Other methods, remedies or treatments tried for pain relief (N=94/112).*

A.



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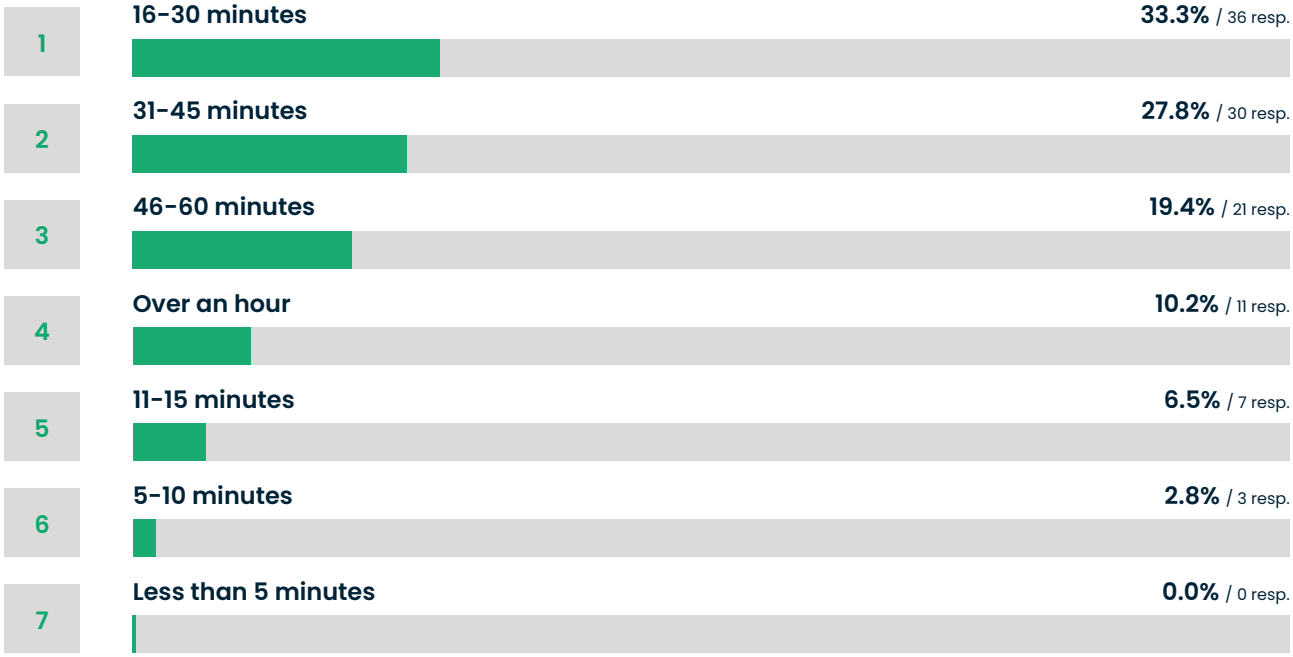
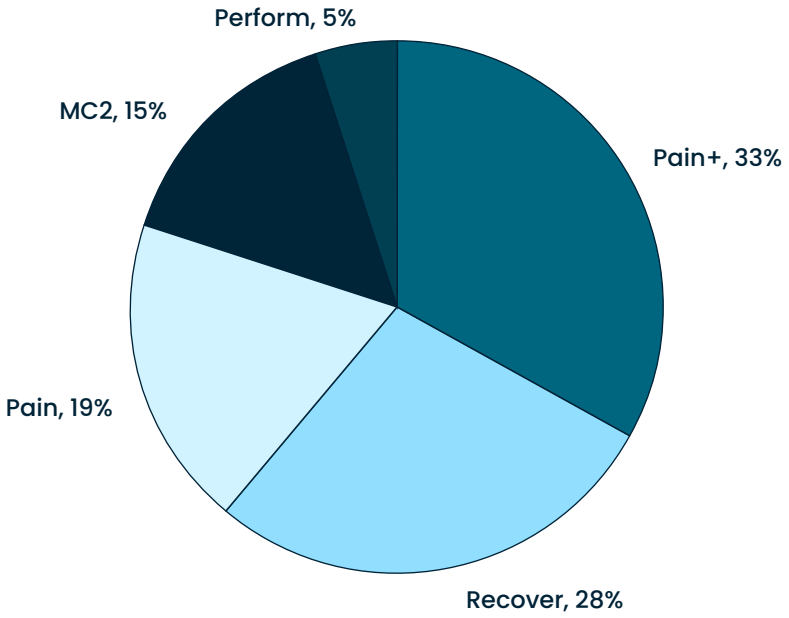


Figure S2. *Responses to the questions: A) How often do you use NuroKor KorOS technology? (N=107/112); B) What is your average duration of each session? (N=108/112).*

A.



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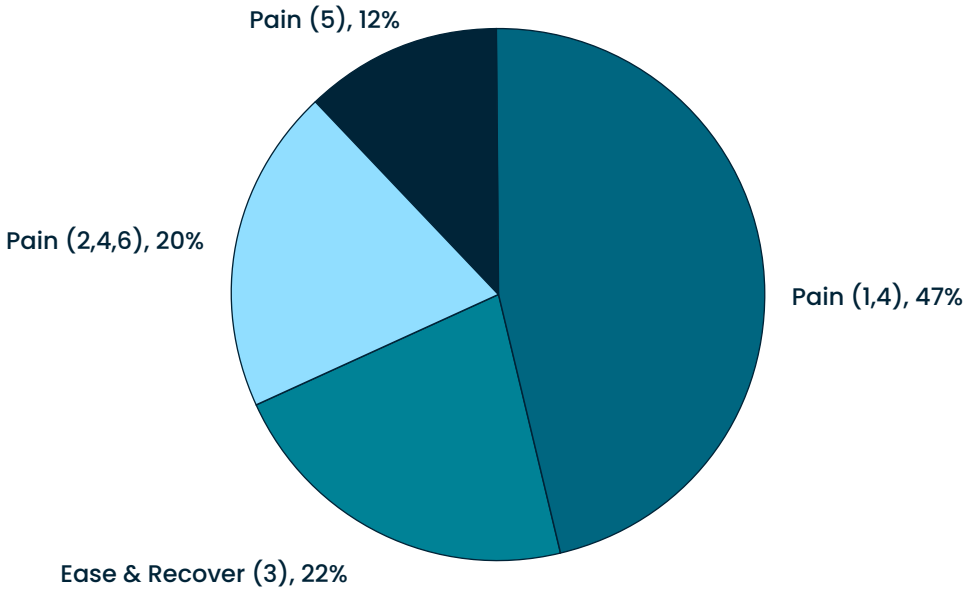
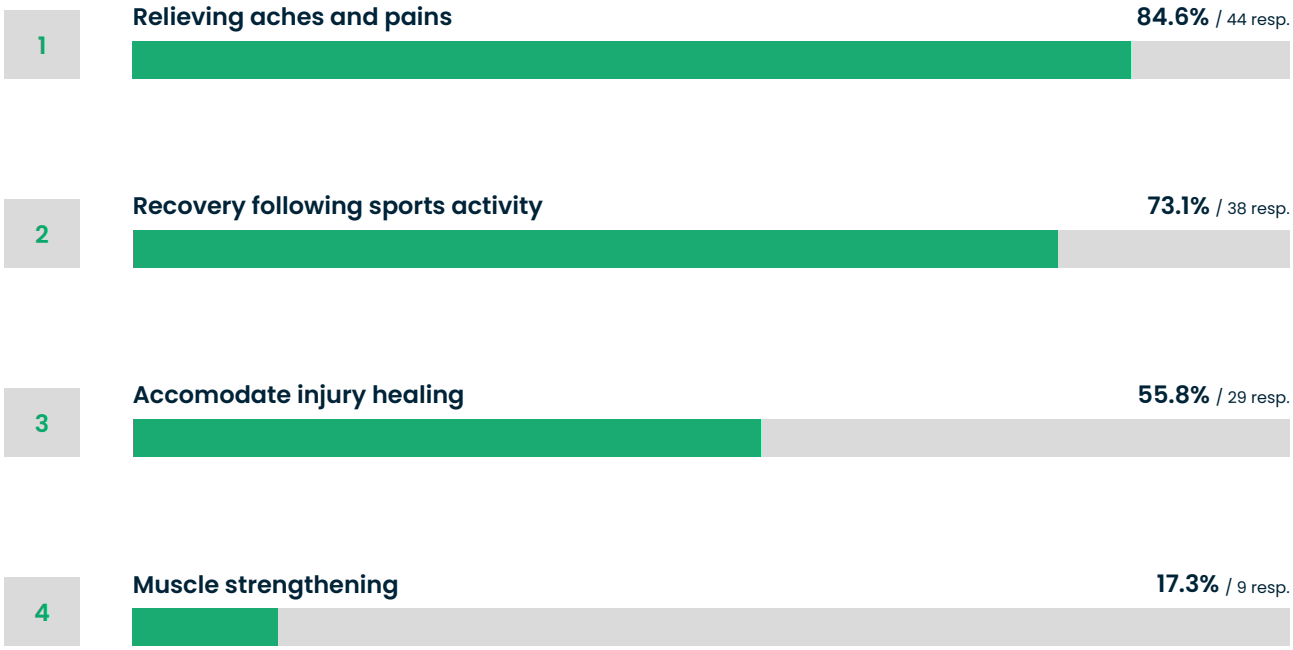


Figure S2. *Responses to the questions: A) How often do you use NuroKor KorOS technology? (N=107/112); B) What is your average duration of each session? (N=108/112).*

A.

How are you leveraging NuroKor to achieve your goals?

52 out of 112 answered



B.

What do you use your NuroKor device for?

109 out of 112 answered

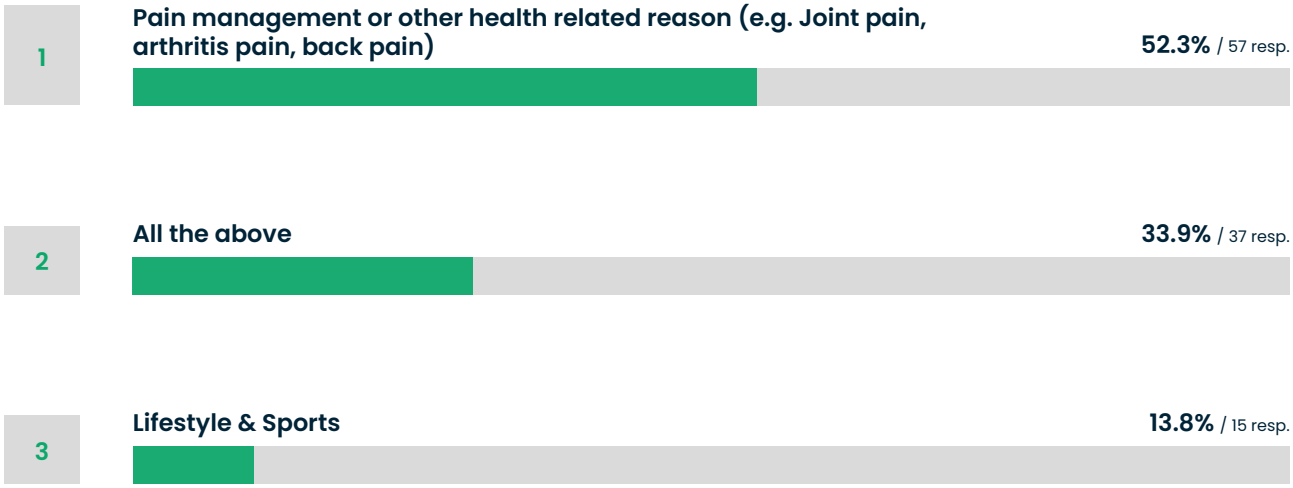


Figure S4. *Responses to the questions: A) How are you leveraging NuroKor KorOS technology to achieve your goals? (N=52/112); B) What do you use your NuroKor device for? (N=109/112).*

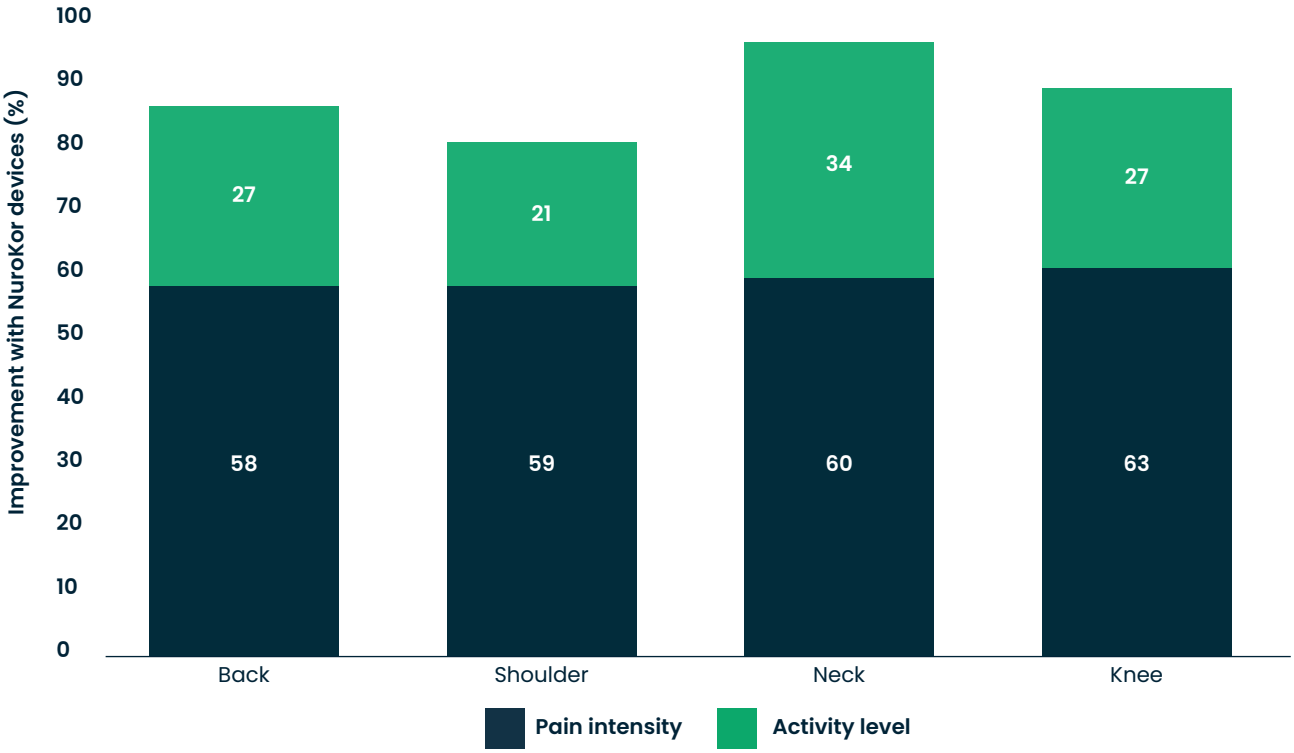


Figure S5. *Sub-analysis of improvement in pain intensity and activity levels, per pain area.*

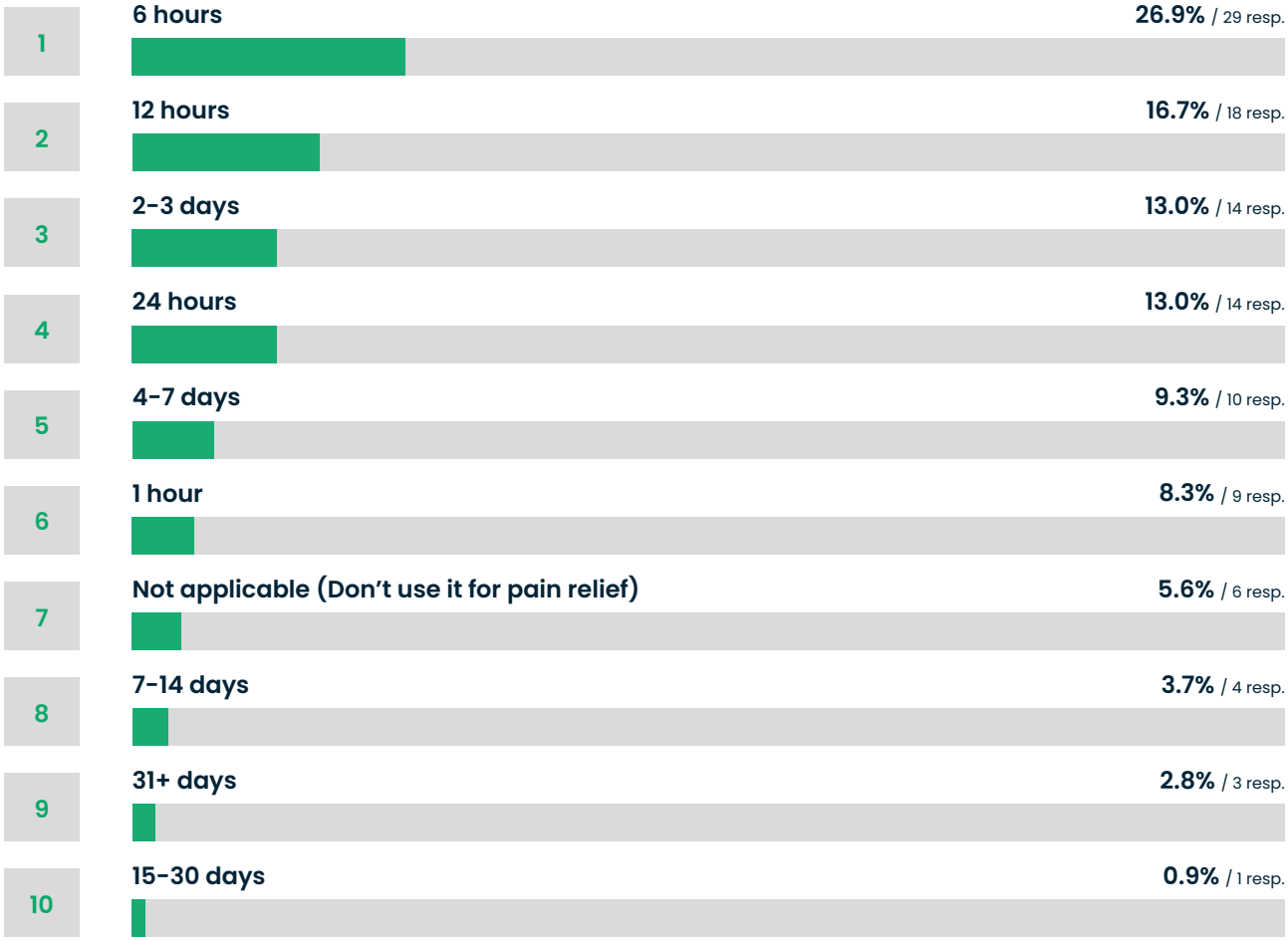
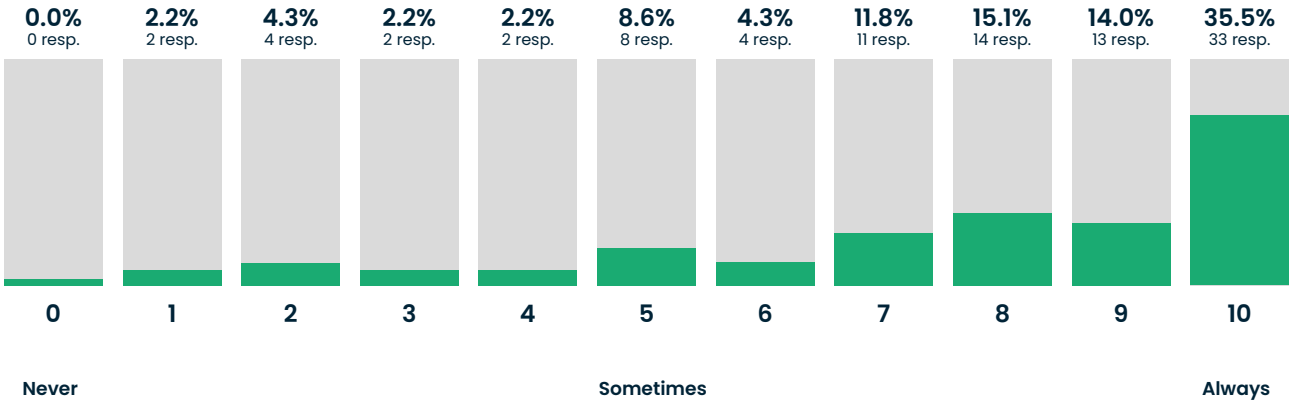


Figure S6. *Responses to the question: After using your NuroKor device, approximately how long does your pain relief last? (N=108/112).*

A.

7.8 Average rating



B.

9.2 Average rating

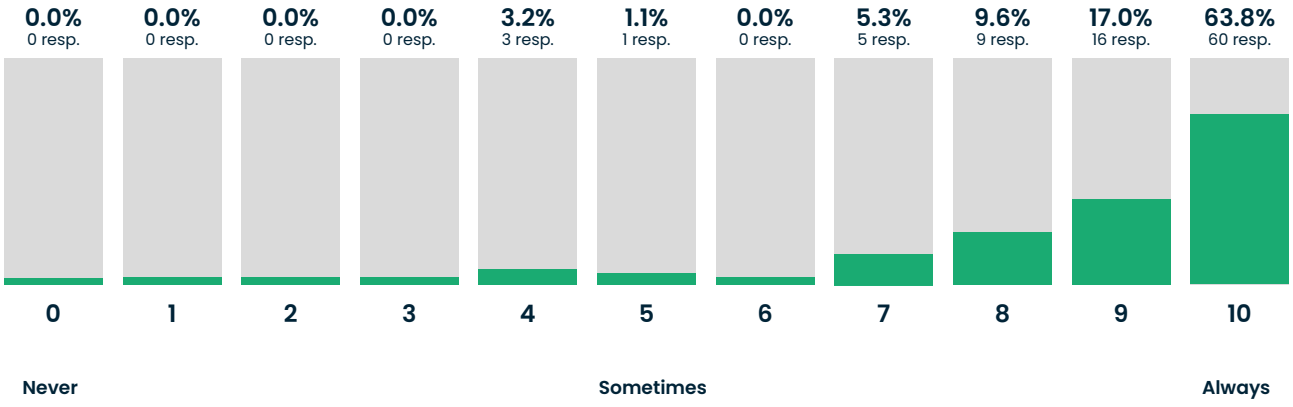


Figure S7. *Activity levels A) before using NuroKor KorOS technology; B) with using NuroKor KorOS technology.*

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