A comparison of the attitude of paraplegic individuals to the Walkabout Orthosis and the Isocentric Reciprocal Gait Orthosis

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This study compared the attitude of paraplegic individuals to the Isocentric Reciprocal Gait Orthosis (IRGO) and the Walkabout Orthosis (WO), after they had been given the opportunity of using both. Ten complete T_{9–12} paraplegic patients participated in this randomised cross-over design. Initially the subjects learned to walk with the first orthosis before taking it home for a 14 week home trial period. The same process of training and trialing the orthosis at home was then repeated with the second orthosis. Attitudes to specific aspects of the orthoses were assessed by an 18 point questionnaire and overall attitudes were inferred after determining the amount of time that subjects used the orthoses at home and determining which orthosis the majority of subjects wanted to keep at the end of the study. The main finding was that subjects did not perceive any significant differences between the two orthoses. That is: (i) the questionnaire did not detect significant differences in attitudes to the two orthoses; (ii) there was no significant difference in the number of subjects that preferred one orthosis to the other, at the end of the study, and (iii) subjects did not derive more use from one orthosis than the other over the two 14 week home trial periods. In addition, it was found that few subjects wore either orthosis more than once every 2 weeks and that subjects were primarily using the orthoses for therapeutic purposes. This latter finding was supported by the results of the questionnaire that revealed that subjects found both orthoses to be useful for standing but not useful for performing more purposeful tasks. It was concluded that when subjects are primarily using the WO and IRGO for therapeutic purposes, they do not readily perceive differences between the two.

Keywords: gait; orthoses; paraplegic individuals; walkabout orthosis; isocentric reciprocal gait orthosis; ambulation

Introduction

Hip–knee–ankle–foot orthoses (HKAFOs) are widely prescribed to enable otherwise wheelchair bound paraplegic individuals to ambulate. One of the most common HKAFOs prescribed for this patient group is the Isocentric Reciprocal Gait Orthosis (IRGO).^{1,2} More recently an alternate type of HKAFO, the Walkabout Orthosis (WO), has become available. The WO comprises two KAFOs joined to a medial linkage system and it is claimed that it can provide reciprocal gait for people who are paraplegic without the bulk and inconvenience of the thoracolumbar corsets associated with more conventional types of HKAFOs.^{3–5} An additional and demonstrated advantage of the WO is that its users have less difficulties with standing up and sitting down than

users of the IRGO.⁶ These advantages are offset by the slow and energy consuming gait provided by the WO.^{4,7}

However, an analysis of the advantages and disadvantages of the WO and the IRGO would be incomplete without an analysis of the users' attitudes towards the two orthoses. Therefore, after giving the subjects the opportunity of trialing both orthoses, their attitudes to specific aspects of the orthoses were formally assessed by a questionnaire. In addition, their overall attitudes were inferred from the amount of time that subjects used the orthoses at home and by determining which orthosis the majority of subjects wanted to keep at the end of the study.

Methods

Paraplegic individuals who were either personally approached or who had responded to advertisements,

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were asked to participate in this study. From interested volunteers, ten subjects who expressed a strong commitment to orthotic ambulation were selected. They had all sustained motor complete lesions between T₉₋₁₂, had no significant lower limb musculoskeletal contractures, were medically fit for standing and walking (eg had adequate bone mineral content), and had not previously used any type of HKAFO. The study was approved by the hospital's Human Ethics Committee and subjects gave informed consent before participating, in accordance with procedures prescribed by the National Health and Medical Research Council of Australia.

A randomised cross-over design was used whereby all subjects trialed one orthosis before trialing the second. To minimise any carry-over effects, there was a 2 month 'washout' period of non-orthotic use between the trialing of the two orthoses. With each orthosis, subjects were first trained to walk (ie, training period) before being sent home with the orthosis for 12 to 18 weeks (mean = 14 weeks; home trial period). The training schedule and details of the level of mobility subjects attained can be found in a previous communication.⁶ In summary, the majority of subjects were independent at walking with either orthosis in conjunction with elbow crutches.

A self report questionnaire was administered at the completion of each training and home trial period. The questionnaire consisted of 18 statements (Figure 1) about the orthoses and required subjects to rank their responses on a Likert Scale where a score of one indicated strong disagreement and ten strong agreement. Medians and interquartile ranges were used to summarise this data and responses to the two orthoses were then compared using Wilcoxon Signed Rank Tests.

The usage pattern of the two orthoses was monitored over a 14 week home trial period. The subjects were instructed to use each orthosis as they wished but were required to complete a brief summary sheet each time the orthosis was worn. The summary sheet required subjects to detail when (ie, date, time of day), where (ie, inside, outside, in the car), and for what purpose (ie, domestic duties, work, study/training, social, recreational, exercise/stretching, practice, access, long term benefits or other) the orthosis was worn. In addition, subjects were required to score the usefulness of the orthosis for the intended purpose, on a scale of 1 (=not at all useful) to 5 (=extremely useful). The number of times subjects used each orthosis was then compared using paired *t*-tests. Throughout the home trial period, subjects were regularly contacted by phone to encourage them to accurately record their pattern of usage. In addition, subjects were aware that step counters had been attached to their orthoses in order to check the accuracy of their record keeping. However, unbeknown to the subjects, some of the step counters malfunctioned and therefore the data is not reported. At the end of the home trial period subjects were

Figure 1 The number of subjects that preferred the WO as opposed to the IRGO, at the start of the study and then at the completion of the study. *Indicates a significant difference between the number of subjects preferring one orthosis to the other

verbally asked why they did not use their orthosis more often.

A questionnaire was administered at the beginning of the study and at the end in order to determine which orthosis subjects preferred. Binominal probability distributions were then used to determine if a significant number of subjects preferred one to the other, either at the beginning of the study or at the end. In addition, a Fischer Exact test was used to determine whether subjects' preferences changed over the course of the study.

Results

Nine of the ten subjects were male. The mean age, body mass, and height ($\pm$ SD), of subjects was 37 years ($\pm$ 8.4), 70 kg ($\pm$ 11.1), and 175 cm ($\pm$ 6.0), respectively. The mean time since injury was 10 years ($\pm$ 6.4) and six subjects were in paid employment. Whilst none had prior experience with any type of HKAFO, all had some standing experience in KAFOs. One subject predominantly mobilised with KAFOs and walking sticks rather than a wheelchair. The remaining nine subjects were dependent on wheelchairs for everyday mobility, but had undertaken standing or gait training with KAFOs during their initial period of in-patient rehabilitation. Following in-patient rehabilitation, only two of the nine subjects had continued to either stand or walk with the use of parallel bars. Four subjects had no spasticity, two had moderate to severe spasticity and four had mild spasticity.

Subjects' responses to each orthosis did not significantly differ on any of the 18 statements

comprising the questionnaire, either after training or after the home trial period. In addition, their responses to each question did not change from their first to second testing (ie, over each home trial period). The power of each statistical test was then calculated, in order to ensure that these results were not a reflection of insufficient power. The median power of the tests was 0.86 (interquartile range = 0.75–0.96), indicating that there was a high probability of detecting a three point change in attitude if it existed. We were therefore confident that subjects' attitudes to the two orthoses, as measured by the questionnaire, were not different. Therefore, all data were pooled in order to reflect subjects' attitudes to both orthoses across the two testing periods. The response to each question was then ranked from the most positive to the least positive (see Table 1).

Figure 1 shows subjects' preferences for the two orthoses. At the commencement of the study, significantly more subjects preferred the WO ($P=0.02$), whilst at the end of the study, there was no significant difference in subjects' preferences for the two orthoses ($P=0.17$). However, there was a significant change in subjects' preferences over the course of the study ($P=0.02$).

The home usage data are shown in Figure 2. There was no significant difference in the number of times that the two orthoses were used. During the home trial period no subject wore either orthosis for more than 2 h at any one time. One subject did not use either

orthosis and five subjects did not use the second orthosis that was trialed. The two keenest subjects wore both orthoses about once every 2 weeks. Subjects wore the first orthosis more than their second, this being the preferred orthosis at the end of the study for all but one subject.

Two subjects used the IRGO for domestic duties, however one of these subjects ranked it with a 1 out of 5 (ie, not at all useful) each time, whilst the other ranked it with either a 3 (ie, moderately useful) or a 4 (ie, very useful). On one occasion a subject used the WO for domestic duties and ranked it with a 3 (ie, moderately useful). One subject used the IRGO for work, study and training but each time scored it with a 1 (ie, not at all useful). Both orthoses were occasionally used for social and recreational purposes by different subjects. However, by far the most common reasons for using either orthosis were for exercise, practice or for the long term benefits, with most subjects scoring both orthoses with between 3 (ie, moderately useful) and 5 (ie, extremely useful).

Of the six subjects that used the WO at home, only one subject reported needing assistance. However, with the IRGO, four of the seven subjects using this orthosis needed assistance, primarily with getting to and from sitting. Whilst three subjects regularly wore the WO under clothes, no subjects wore the IRGO under clothes. Both orthoses were worn indoors and outside by most subjects. Whilst all subjects could sit in their wheelchair with the WO on, no subjects could with the IRGO.

When subjects were asked why they did not use their orthoses more often, the most common response was because they had been 'too busy'. Alternatively, subjects replied that they did not use the orthoses more often because using the orthoses prevented them from engaging in productive activities around the

Table 1

Rank	Question	Median (inter-quartile ranges)
1	Usefulness for standing up in	8.2 (7–10)
2	Reaction of others	7 (5–8.5)
3	Comfort level while standing	6.9 (5–9)
4	Confidence while walking	6.7 (5.5–8.5)
5	Abilities to walk indoors	6.6 (5–9)
6	Ease of putting on and taking off	6.2 (5–9)
7	Comfort level while walking	6.1 (5–7.5)
8	Abilities to walk out of doors	5.6 (4–8)
9	Comfort level while sitting	5.4 (4–6.5)
10	Amount of effort required to use	4.9 (3.5–6)
11	Improvement in overall quality of life	4.8 (3–7)
12	Improvement in self esteem	4.4 (3–6)
13	Benefit at social functions	3.9 (1–5.5)
14	Closeness to normal walking	3.8 (2–6)
15	Usefulness for carrying out home duties	3.7 (2–5.5)
16	Conspicuousness of device	3.6 (1–6)
17	Benefit for vocational purposes	3.6 (1–5)
18	Ease of emptying bladder with the device	3.3 (0–5.5)

The median (and inter-quartile range) response to each of the 18 questions comprising the questionnaire, after the data was pooled for both orthoses and across both testing periods. The responses are ranked from the most positive (rank no. 1) to the least positive (rank no. 18)

Figure 2 The extent of usage that each subject derived from the WO and IRGO over the two 14 week home trial periods. There was no significant difference between the number of times that the two orthoses were used by subjects

house since their hands were unavailable whilst holding onto the elbow crutches.

Discussion

Ultimately, the success of an orthosis is determined by the patients' attitudes to them. For this reason we measured subjects' attitudes to different aspects of the WO and IRGO. It was found that attitudes to the two orthoses did not differ on any of the 18 issues examined in the questionnaire. Results from the home usage data and subjects' final choice of orthoses support the conclusion that subjects did not perceive significant differences between the WO and IRGO.

Subjects' attitudes to both orthoses, as measured with the 18 point questionnaire (see Table 1) were generally negative, with only one question scored greater than eight of 10, and 50% of questions scored less than five. Subjects found both orthoses useful for standing (median score = 8.2), but not for performing home duties or for pursuing vocational goals (median score of four out of 10 for both tasks). These perceptions were reflected in the pattern of home usage. The main reason for using either orthosis was for exercise, stretching or for the prevention of long term medical complications, even though the majority of subjects used their orthoses too infrequently to obtain any of these therapeutic benefits. Subjects rarely used their orthoses for any other purpose. Others have also found that adult paraplegic individuals were primarily using orthoses (RGO, ParaWalker and Advanced RGO) for therapeutic purposes.^{8–11}

One of the main reasons subjects gave for not using their orthoses more frequently was because they had been 'too busy'. This may indicate a failure of the orthoses to enhance subjects' mobility or improve their ability to complete purposeful tasks. In accordance with this hypothesis, subjects complained that the two orthoses prevented them doing anything other than standing and walking whilst their hands were occupied holding onto crutches – a limitation that has been observed previously.¹¹ Interestingly, one subject commented that he may have been able to work at a benchtop without his crutches had the orthoses allowed him to walk sideways. In addition, our subjects commented that whilst the orthoses gave them greater access to things placed up high, this advantage was offset by the difficulties they had with reaching things placed down low.

The most enthusiastic walker did not use his orthosis for more than 2 h every 5 days and the majority did not use their preferred orthosis for more than 2 h every 2 weeks. This is far less than has been previously reported with various type of HKAFOs^{1–8,11} and may be due to many reasons. First, subjects were required to record each time the orthosis was worn. They believed that these details were to be later checked against the results obtained from electronic step counters mounted on their orthoses, encouraging

them to accurately document their usage patterns. We believe this method of data collection may be more accurate than the more commonly used retrospective estimations of patterns of usage.

An alternate explanation for subjects' lower rates of orthotic usage is that they were less motivated than the subjects of previous studies. However, the subjects of this study were chosen from a large group of possible participants because of their desire to ambulate with an orthosis. Their commitment was subsequently demonstrated by their willingness to commit the large amounts of time and effort required for training with the two orthoses and their willingness to finance both their own transport and their missed time from work. We therefore believe that our subjects were highly motivated to use a device which offered a useful form of ambulation.

An additional difference between the subjects used in this study and those of previous studies is time since injury. The mean time since injury of subjects used in this study was 10 years, whilst it was less than 5.5 years in the subjects of previous studies. It is possible that recently injured paraplegics derive greater use from orthoses because they place a higher psychological importance on walking than their counterparts who have been paraplegic for longer and are better adapted to a wheelchair. These latter patients, like those used in this study, may be less inclined to use orthoses for their psychological benefits and more inclined to use them as a means of enhancing their mobility and level of function. Therefore, it may be that our subjects' pattern of orthotic usage is more a reflection of their perceptions of the day to day usefulness of orthotic ambulation, rather than a reflection of the psychological benefits they derive from walking.

Subjects did not perceive differences between the two orthoses, nor did they use one orthosis more than the other, despite the fact that they attained different levels of function with them.^{6,7} For example, subjects walked with the WO at half the speed,^{6,7} and more than two times the energy cost (ml kg m^{-1}) of walking with the IRGO.⁷ Subjects may not have perceived some of these differences because they were primarily using their orthoses for therapeutic purposes and consequently these and other differences may have been inconsequential. Had subjects been using their orthoses as a form of mobility or for more purposeful tasks, differences may have been perceived. It is also possible that subjects did not detect differences between the two orthoses because they were inadvertently comparing both orthoses to the mobility and function offered by their wheelchairs.

It was of interest to note that whilst subjects did not prefer one orthosis over the other at the end of the study, 90% of subjects preferred the WO at the start. This reflects a significant change in attitude to the two orthoses over the course of the study. Subjects' initial enthusiasm for the WO may reflect their unrealistic expectations of this orthosis, perhaps partly due to the

intense media coverage the WO has received in Australia.

In conclusion, people with long standing paraplegia do not perceive differences between the WO and the IRGO, despite the fact that significant differences have been previously demonstrated.^{6,7} Subjects' may have failed to detect differences because they inadvertently compared both orthoses to the mobility and function provided by their wheelchairs. Alternatively, differences may not have been detected because subjects were primarily using their orthoses as a form of exercise rather than for performing purposeful tasks.

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