

# Usability Study Report

Biosysco Ltd – Aquaneuro Bath Usability Study

## PROJECT DETAILS

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## CLIENT BRIEF

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Biosysco Ltd is a start-up company based in Aylesbury, Buckinghamshire who have approached HDTI for support in the validation of their innovative therapeutic sports and recovery Aquaneuro system.

The CE medically approved Aquaneuro provides a complete and effective ‘full body’ workout that effortlessly exercises opposing muscle groups. It claims to turn off the sensory nerves and fires up the blood supply aiming to accelerate recovery from injury and surgical procedure, re-educate damaged nerve pathways and help with muscle regeneration and toning. In comparison to the Transcutaneous Electrical Nerve Stimulation (TENS) system it uses a lower analogue voltage, higher frequency, and provides a number of variable frequencies which allows the practitioner greater targeted control over its use. It also produces little or no adverse sensation when used.

The Aquaneuro system is patented both in the US and the UK and is currently being trialled at a professional rugby club for use in the rehabilitation of its injured players.

In order to assist the company in their further sales, marketing and income generation activities for the future development and promotion of the product, HDTI has been asked to undertake research based on the current use of the system at the rugby club. This report describes the findings of the usability study undertaken.

## PROCEDURE

### Objective

To explore the experience, effectiveness, and perceived benefit of the Aquaneuro system in relation to the rehabilitation of professional rugby players from sports injuries.

### Research Design

The research design was qualitative. Semi-structured interviews were conducted to provide data for thematic content analysis.

### Participants

Participants were recruited via the rugby club where the bath is currently situated. Permission to approach the players and staff was sought from the management team at the club. Consent to take part in the research was gained in advance of the study taking place, and participants were assured that taking part in the research was voluntary, that they would not be identified through either the process or the final report and that withdrawal from the study would not impact upon them in any way. In total, six rugby players and three rehabilitation professionals were interviewed. Details of the injuries treated for each of the six players are included in the table below.

| Player  | Injury details  |
|---------|---|
| Player1 | Osteitis pubis  |
| Player2 | Hamstring   |
| Player3 | Groin   |
| Player4 | Recovering from surgery on Medial Collateral Ligament |
| Player5 | Lower leg   |
| Player6 | Knee injury   |

*Table 1: Player profiles*

### Procedure

The one-to-one interviews were held at the rugby training ground and were audio recorded. During the interview, the researcher asked participants questions (approved by the client) to explore experience, effectiveness, and perceived benefit of the Aquaneuro system. Data collected from the interviews were transcribed and analysed using thematic content analysis.

A £15 'High Street' gift voucher was given to participants in recognition of their contribution to the study.

## **Ethics**

Ethical approval was obtained through the Coventry University Ethics approval procedure.

## RESULTS

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Following transcription of the interviews, the data were analysed using thematic content analysis and comprehensively coded to identify recurring and important themes within the text. From the analysis, the following dominant themes emerged:

1. Experience with electrical physical therapy devices
  - a. Previous experience
  - b. Comparison of other devices with the Aquaneuro bath
2. The Aquaneuro bath experience
  - a. Comfort and enjoyment
  - b. Ease of use
  - c. Temperature
3. How is the Aquaneuro bath used?
  - a. Where is the bath used?
  - b. Who is the bath used with?
  - c. How often is the bath used?
  - d. When is the ideal time to use the bath?
  - e. Filling the bath
  - f. How long does it take to use the bath?
  - g. Is the bath used with or without jets?
4. What is the Aquaneuro bath used for?
  - a. What injuries are the bath used for?
  - b. Is the bath being used for reasons other than treatment of injury?
  - c. When has the bath worked well in practice?
  - d. When has the bath not worked well in practice?
  - e. Contraindications and precautions
5. Benefits of the Aquaneuro bath
  - a. Perceived overall benefits after treatment?
  - b. Physical effects
  - c. Psychological effects
  - d. Expectations of effect
  - e. Effect on 'Return to Play' time
6. Disadvantages and improvements
7. Further applications and research
  - a. Further applications within sport
  - b. Further applications outside of sport
  - c. Further research

Each of the themes is discussed in more detail below.

## 1. Experience with electrical physical therapy devices

### a. Previous experience

The rehabilitation staff had prior experience with a range of electrical physical therapy devices, including; Compex, ultrasound, low intensity pulsed ultrasound, shortwave diathermy, and TENS. The players also had experience with using a range of these devices. The Compex device was mentioned in particular, as this was often used as part of the rehabilitation package offered by the rugby club:

*“I’ve used ultrasound, I’ve used low intensity pulsed ultrasound ...I’ve used short wave diathermy, I’ve used Compex, which is electrical muscle stim, and I’ve used TENS.” (Rehab1)*

*“We use the Tecar and the...We use the LIPUS (Low Intensity Pulsed UltraSound) which is like an ultrasound kind of one, and the dry steam system.” (Rehab2)*

*“Tecar, ultrasounds, shockwave.” (Rehab3)*

*“Yes we use Compex, and I’ve been on AlterG as well.” (Player 4)*

### b. Comparison of other devices with the Aquaneuro bath

Participants compared the bath favourably against other electrical physical therapy devices. The rehabilitation staff felt that bath had an advantage over other devices in that players were able to use the bath alone, rather than having to have a member of staff present each time:

*“I find the bath very straightforward to use. A lot of the lads just get in it themselves and that to me demonstrates the ease of it. If the lads found it difficult then they wouldn’t use it. But the fact that quite a few lads just take it upon themselves just to jump in...” (Rehab1)*

*“All [are] slightly different, all obviously different forms of energy to treat the players. I think the bath is the one that the players sort of are more receptive to because they can go and do it themselves; it’s not something that we need to be there and do.” (Rehab2)*

The players similarly preferred the bath as they were able to use it without a member of the rehabilitation team present:

*“Obviously with me and when you are not injured it is fine, you can just jump straight in because obviously you have to climb into it.” (Player1)*

*“Oh, I think you’ve got to be [stupid] if you can’t use it ...the first morning [the rehab team] showed me how to do it but now I just jump in on my own and use it myself.” (Player2)*

*“Yes [it’s easy to use], just jump straight in.” (Player6)*

It was also felt that the bath was more of an ‘overall’ treatment for the neuromuscular system, in comparison to other devices (such as Tecar), which were viewed as specifically localised treatments:

*“Each of these modalities [other devices] is quite local so it’s quite focused on a certain area. The beauty with the bath is that I think it gets the whole neuromuscular system. I think it provides a much more overall treatment rather than a localised treatment such as the others.” (Rehab1)*

*“[The players] seem to get more of a full body response out of it rather than me just sticking the LIPUS on their ankle.” (Rehab2)*

The players also valued the ability of the bath to get their ‘whole muscles working’:

*“And when I first got in it you are like ‘this is the worst feeling ever’ because it contracts more than one part of your muscles as opposed to a Compex, that will just do your quad or it will just do your calves and all that. But with this you get a contraction through your whole leg so it is just completely different.” (Player1)*

*“I suppose I think it is more comfortable actually because it is spread out over a larger part of your body as opposed to the Compex that is just more focused on one part of you.” (Player2)*

*“I like the fact, like the Compex is only in one area, whereas when you are in the bath it is everywhere, so that’s good.” (Player4)*

*“Well obviously the Compex is the same sort of thing but it is quite, it is just focused on one muscle whereas the bath*



*gets to all of it, comfort, probably the Compex is better but it doesn't get your whole muscles working." (Player6)*

One of the rehabilitation team felt that the bath compared well to other devices in terms of its immediate and overall physical affect upon the players:

*"The ultrasound and the shockwave don't give such immediate results. But the bath tends to give more physical results and physical improvement." (Rehab2)*

## **2. The Aquaneuro bath experience**

### **a. Comfort and enjoyment**

The players' views on the comfort of the bath were mixed. Some players found the bath experience very comfortable and enjoyable, and preferable to other electric physical therapy treatments. However, others found the experience uncomfortable – although this did not detract from their use of the bath, as they were able to see the physical benefits:

*"I suppose I think it is more comfortable actually because it is spread out over a larger part of your body as opposed to the Compex." (Player2)*

*"Yeah it's really comfortable to be honest. It's a bit strange the first time you get in, you don't know what to expect but yeah it's good ... Obviously when you first get in you don't know like what to expect and it's a weird sensation because all your muscles are twitching and stuff, but yeah you get used to it... Yes it's fun to use actually, it's a lot better than say your ice baths or something like that, it's good." (Player3)*

*"Yes, comfortable." (Player4)*

*"Yes, it's comfortable." (Player6)*

There was, however, concern from some players that the bath was uncomfortable on their core muscles:

*"It's not too bad, just when you are sitting back, leaning back on that pad, and as it gets harder, you get used to it after a bit, but when you first start off it sort of hurts your core, well not hurts but is like more intensive." (Player4)*

Players who found the bath uncomfortable tended to still use the bath, as they were able to see the benefits of the bath ‘the next day or ten minutes later’:

*“It is not very nice to sit in ...I don’t really enjoy it ...I wouldn’t take a comfort experience from it...Although it is a recovery thing, just like the ice bath I don’t find that comfortable but I appreciate it works ...it works perfectly for what I need ...I enjoy the fact that I get it done and it’s something you can bear and you definitely reap the rewards the next day or ten minutes later.” (Player1)*

*“Sometimes it is like... ‘Oh I went in yesterday ...Do I have to go in it again, do I have to use it again? But I do enjoy it because it works and you can see the benefits of it yes.” (Player2)*

One player described how he liked to use the bath, because it was new technology and different to other therapy devices he had used before:

*“I sometimes look forward to it because it is not normal, do you know what I mean? Because it is so different to everything else. It is just completely new technology isn’t it?” (Player2)*

Rehab1 described how he would keep some treatments ‘short and sharp’ if a patient did not like the feeling of being in the bath. However, other players were happy to sit in the bath and relax for a little longer:

*“It depends on what you’re doing, but I say roughly anywhere between 10, 20 minutes, dependant on the individual and the injury. So some of the lads can see the benefit of it but don’t necessarily like it so I keep the treatment short and sharp, so I like to ...get the benefits and then get them out. If the lads like it, I’m quite happy for them to sit in it a little bit longer until they get bored really.” (Rehab1)*

There was one player who found the bath so uncomfortable he refused to use it:

*“One of the lads, he’s had multiple patella dislocations, three quite serious operations and his quadriceps have atrophied so they’ve wasted away. So my theory was that I wanted to get him in the bath and get as much stimulation through that quad as possible in order to help his rehab and speed it up, but he really didn’t like it. It was too much for him, he didn’t like the feeling that it gave, he*

*point blankly refused to get in it again. Despite me telling him the benefits and how I think it would work, he wasn't keen; he just didn't like the feel of it... Purely personal preference. That injury, it was a big injury, but it was, it's purely on an individual basis that is." (Rehab1)*

The bath was less comfortable for taller players, as it was difficult for them to fully submerge their legs into the bath:

*"The only thing for someone like me because I am quite tall ...because you are quite cramped in it a bit. So if somebody was 6'7", 6'8", they might struggle to get in." (Player2)*

## **b. Ease of use**

As described earlier, the bath was considered superior to other electrical physical therapy devices mainly because of its ease of use, and that it was simple enough for players to use alone after an initial training session with a member of the rehabilitation team:

*"I find the bath very straightforward to use. A lot of the lads just get in it themselves and that to me demonstrates the ease of it. If the lads found it difficult then they wouldn't use it. But the fact that quite a few lads just take it upon themselves just to jump in..." (Rehab1)*

*"We show the boys how to use it once or twice and usually they are quite happy doing it [without us]." (Rehab2)*

*"Yeah, it's easy to use." (Rehab3)*

*"Obviously with me and when you are not injured it is fine, you can just jump straight in because obviously you have to climb into it." (Player1)*

*"Oh I think you've got to be [stupid] if you can't use it ...the first morning [the rehab team] showed me how to do it but now I just jump in on my own and use it myself." (Player2)*

*"Yes [it's easy to use], just jump straight in." (Player6)*

### **c. Temperature**

The rehabilitation team maintain the temperature of the bath to 40°C, with the surrounding room temperature also being maintained at a warm level:

*“The temperature is set at ...well we’ve set it at 40 degrees. I find that the warmer it is the more the lads like it, I don’t know why, I don’t know if that’s a psychological thing ...But they seem to like it the warmer it is, so I keep it pretty warm.” (Rehab1)*

*“It’s above room temperature because it’s in the shower area and there is a Jacuzzi in there, so it’s relatively warm, a couple of degrees above room temperature.” (Rehab1)*

The players were all very satisfied with both the water and the room temperature:

*“[The temperature is] nice, that is my favourite bit about it, because it does get nice and warm. Because I think originally we didn’t know it got warm, so once I sat in it freezing cold and that wasn’t enjoyable, but no, it’s perfect.” (Player1)*

*“Oh yeah, it’s ideal, it’s just like jumping in a bath back home, it’s fine.” (Player3)*

*“I like it, it’s nice and hot.” (Player4)*

*“It’s just like sitting in a spa.” (Player6)*

## **3. How is the Aquaneuro bath used?**

### **a. Where is the bath used?**

The bath is currently used in the shower area of the training ground. It was felt this was the ideal location for the bath, as it was in the wet area, and also provided easy access to the changing rooms and showers:

*“It’s in our shower area, in our wet area because it’s the showers. There’s a Jacuzzi, an ice bath and now obviously the [Aquaneuro] bath, so that’s in the wet area... Yeah, it’s ideal because the lads at the end of the day will go from the changing rooms down to the shower, it’s in the wet area, some of them will jump in the ice bath, then*

*they'll get in the neuro bath, then they've got to get in the Jacuzzi or vice versa, then they'll have a shower up to finish off and then shoot off home.” (Rehab1)*

**b. Who is the bath used with?**

The bath is initially used with both player and rehabilitation staff when the rehabilitation staff guide the player through the settings and their treatment. Once the player is comfortable, and knows what they need to do to conduct their treatment, they are then able to use the bath alone, without a member of the rehabilitation team present:

*“To start off with I used to be with a physio, and then kind of, I am in it every other day. So for the last however long we have had it, so I am quite used to it now, and I know all the settings or most of the settings.” (Player1)*

*“[The rehab staff] will make sure I have gone in, and say ‘Right you are in it’, and then [they] will just leave me to it.” (Player2)*

*“The first morning [the rehab team] showed me how to do it but now I just jump in on my own and use it myself.” (Player3)*

*“The first couple of times I had rehab there but now it's so easy to use, I just go in by myself.” (Player4)*

*“The first few times they told me what to do and everything. After that I pretty much know what to do and everything.” (Player5)*

**c. How often is the bath used?**

The players used the bath frequently after initially being shown how to use it. The rehabilitation staff tended to only use the bath with new players, or players with new injuries. The amount of times per week the bath was used varied from player to player, and varied from twice a week to every other day:

*“I would say that I don't use it that much now because the lads I want to use it on, they know what they're doing with it, so I will get somebody in ...I'll use it maybe once or twice a week, somebody new, a new injury... That's the difficulty because obviously you're so busy here I don't necessarily have the time to sit with somebody for a whole 20, 30 minute treatment, I literally put them in, show them how to use it, tell them the position I want them to get in*

*so I can get the benefit, and then I'll leave them to it, then they'll come and use it as they please.” (Rehab1)*

*“I'd probably put two or three players a week in the bath on a regular basis.” (Rehab2)*

*“Me personally, I don't use it that much... But I will always plan it into [a player's] programme, so if they've got a programme that they're running they will use it most days as a fire up to the lower limbs.” (Rehab3)*

*“I am in it every other day...[Except] I am going through a weird injury at the moment so I have kind of kept off it at the moment, I am going through an injury... So in terms of when I am in rugby, full fighting rugby, I would certainly get in it every other day if not every day. It is kind of a routine based thing now.” (Player1)*

*“About three or four times a week.” (Player2)*

*“Twice a week maybe.” (Player3)*

*“I would say three times a week.” (Player4)*

*“Probably twice a week, three times a week.” (Player5)*

*“Four times a week.” (Player6)*

Further, all of the players were happy with their level of use of the bath, and did not want to reduce or increase their use, although Player6 stated that he would maybe use it more as he preferred to use the bath at the end of the day prior to having a shower:

*“No I think the way I use it is comfortable for me [every other day]. The more recovery you do, the better I suppose but it seems to work perfectly well when I am not injured, for a recovery programme every other day is perfect for me.” (Player1)*

*“I reckon that is about right [3-4 times a week].” (Player2)*

*“It's about right [twice a week], depending on if I have an injury, I'd probably use it more.” (Player3)*

*“That's about right really [2-3 times]. I can go in it whenever I want.” (Player4)*

*“Yes, that's about right for me [2-3 times].” (Player5)*

*“I wouldn’t mind using it more [than four times a week], it’s just I use it at the end of the day when I’m ready to go home, just before I jump in the shower.” (Player6)*

#### **d. When is the ideal time to use the bath?**

The ideal time of day to use the bath varied depending on the players’ individual rehabilitation plans or injuries, and personal preferences. Some players used the bath before training or playing to ‘fire up’ their neuromuscular system, whereas others used it post-match or after training as a recovery tool. The bath was also used alone as a rehabilitation tool in its own right, or as part of an overall rehabilitation session:

*“...I think that depends on the nature of the player, the injury and the purpose ...So [one player] who had the ACL [anterior cruciate ligament] reconstruction, I would get him in the bath first thing, so before he did anything he’d come in, he’d use the bath, ...get as much muscular activation as I could throughout the whole system ...then I’d move onto his rehab and his strength and conditioning. I’ve found I got quite good benefit that way. Whereas some of the lads ...really like the bath as a recovery tool, so they use it at the end of the day. ....[it] depends on ... what you’re trying to achieve.” (Rehab1)*

*“I think it’s very dependent. I’ve had players that use it pre-treatment session and pre-rehab; to fire them up and get them going. We’ve also had players use it at the end of the day when they’ve been training, they’ve done their weights, they’re done their massage and then they want to get in the bath, almost as a final thing for the day and to get them fresh in the morning.” (Rehab2)*

*“It depends....whether we’re using it as part of a rehab programme or whether it’s part of an ongoing sort of in-player management programme. Or whether we’re using it in recovery. So we have to decide at what stage we’re using it. So as an injury or rehabilitation tool we may use it as a session, a standalone session. We would use it as a pre fire up for a session we were about to do, because ...their [neuromuscular] system will become dampened when they’ve had any kind of injury. So if we can fire them up before they actually do any rehab we get a better quality of session. A bit like the kickers, when they’re not injured they’ll use it as part of their weekly prep anyway. If*

*they're using it for recovery they use it post session.”  
(Rehab3)*

Rehab3 pointed out that players were only able to use the bath if they had used it previously, and were aware of how to operate the bath. However, once they knew how to use the bath they were able to access the bath whenever they liked, as long as another player was not already in the bath:

*“Yeah, I come in, first thing in the morning, the first thing I do is switch the bath on. It probably takes about 20 minutes to heat up, obviously the water gets cold overnight and then you switch it on at the mains and it heats back up. So I switch it on for probably half seven, by ten to eight it's good to go.” (Rehab1)*

*“As long as someone else isn't in it, yeah.” (Rehab2)*

*“Yes, if they've used it previously.” (Rehab3)*

One of the players confirmed this accessibility of the bath, stating that you would only have to wait 10 to 15 minutes if another player was already using the bath:

*“...Sometimes it is not easy to go and get a massage obviously, if you have to wait for physios. So accessibility is brilliant, you just jump in the bath because usually it is free, if not you are waiting ten or fifteen minutes at the most.” (Player1)*

#### **e. Filling the bath**

The current bath set up at the training ground means that the bath is not plumbed in, and requires filling with a hose. It was felt that the bath would be easier to use if it were plumbed in:

*“Maybe for ease [it would be better if the bath were plumbed in, but] well for cost I suppose it's probably easier this way [filling the bath with a hose]. I've devised a system where the hosepipe to the bath doesn't quite reach so I just wedge it on a foam roller and a chair and I time 20 minutes, I come back and it's filled. So I suppose if it was plumbed in [yes it would be easier], yes you'd just obviously leave the tap running, but I've just had to be innovative.” (Rehab1)*

*“It would be easier [if it were plumbed in], sometimes when we're all really busy in the morning it will get to 11*



*o'clock and someone wants to use the bath and it's not full and then it's not warm, so yeah, if it was just a lot easier to do that without having to stretch the hose across the changing room and stuff, it would be good." (Rehab2)*

The bath is emptied and refilled every three to four days, and is kept clean with bromine tablets in the interim:

*"I fill it.. I will empty, refill it, clean it, once every three or four days. There's bromine tablets in there which reduces the alkaline levels so it keeps it within safe levels. It's checked on a daily basis by our cleaners. If for whatever reason the levels are too high then I'll change it, I'll change it there and then. But as a rule it's three or four days... It takes 25, 30 minutes to empty the bath."*

**f. How long does it take to use the bath?**

On average, a treatment in the bath would take about twenty minutes:

*"It depends on what you're doing, but I say roughly anywhere between ten, twenty minutes, dependant on the individual and the injury. So some of the lads can see the benefit of it but don't necessarily like it so I keep the treatment short and sharp, so I like to ...get the benefits and then get them out. If the lads like it I'm quite happy for them to sit in it a little bit longer until they get bored really." (Rehab1)*

*"20 minutes ...We tend to try and stick to a 20 minute window ...That's been based on trial and error and from some of the information we were given when we were taught the first time around. But it's been trial and error really." (Rehab3)*

*"If I said half an hour including drying and everything, yes so kind of obviously five minutes getting changed, jump in the bath, takes me six or seven minutes to get up to my setting [on the bath], I used to have it on like 4/30 or so, so it takes me a bit to get it up to that level, hold it for ten or fifteen minutes, then come back down slowly, obviously get out, dry and go." (Player1)*

*"I would say 25 to 30 minutes [altogether] but I'm normally in for about 15 minutes." (Player4)*

*“I’m not sure because I normally use it after training so I just take my time pretty much, so I’m not too sure. I would say I sit there for about 20 minutes...” (Player5)*

**g. Is the bath used with or without jets?**

The jets were seen to be a personal preference by the rehabilitation team. Rehab2 preferred to use the bath without the jets, as she was able to see the contraction of muscles when she was overseeing a treatment. However she also conceded that when alone the players would use the jets so they could enjoy their bath:

*“Personal preference. If they’re new to it then yes I will, just because of that psychological... you know you tend to sit in a Jacuzzi at say a health club or a gym and it’s quite a nice feeling, it’s quite a nice sensation to have the jets and a bit of bubbly water. So yeah, if they’re new to it then yes I will put the jets on ... There’s no rehabilitation difference, it’s just the nice bubble sensation I suppose.” (Rehab1)*

*“I tend to use it without, the players will have them on just as a little bit of an added thing, they like the lights on and they like to enjoy themselves. But from a treatment point of view, I probably use it without, just so I get more of an idea of what’s actually going on in there... Yeah, I can see better, I can see the contraction of the muscles, I can see whether we need to sort of pick one leg out or down a little bit more, get my hands in a little bit better if I need to handle them in any way.” (Rehab2)*

**4. What is the Aquaneuro bath used for?**

**a. What injuries are the bath used for?**

The bath is used at the training ground for a wide variety of injuries, including muscular, ligament, and capsular injuries:

*“A whole host of musculoskeletal injuries. We’ve been using it for anything from a calf strain to a ...reconstruction to enable repair in the shoulder. We’ve used it for a whole host of injuries. We’ve also used it like I say, post-operatively as well, so not just conservative treatment, but post-op treatment as well.” (Rehab1)*

*“All sorts, muscle injuries, so muscle strains, ligament injuries. As I say, post-operative treatments as well ...All sorts of soft tissue injuries, as I say whether that’s muscular, ligaments, capsular... From a treatment point of view any sort of inhibited stuff that we’re picking up, hamstrings, quads especially, is what I tend to use it for. So any neural, hamstrings, anything where they’re a little bit inhibited and can’t quite fire properly, so we’ll put [the bath] in the treatment plan... At the minute, the main two injuries that I’m using the bath for is for a shoulder dislocation that we had and the recovery from that and hamstring tendonopathy, so an old hamstring tear that was just being a little bit niggly and not quite right.”*  
(Rehab2)

*“Post-operative knees, ankles, mainly lumbar discs or neural related lumbar problems.”* (Rehab3)

*“I’ve had surgery on my MCL [medial collateral ligament], so I’ve just been using it to try and get the muscles in my left leg working, so I’ve been, when I’ve been sat in it they have been getting me to have my right leg out so all the current it just going through the left leg.”* (Player4)

*“I had a knee injury about a month ago and I’m just using it pretty much every day before I have a shower so just to kind of keep my muscles active because it has been locked in a brace so I haven’t been able to move it.”*  
(Player6)

In particular, the bath was used for lower body injuries, rather than upper body injuries. Players and the rehabilitation staff felt that it was difficult to use the bath for treatment of upper body injuries due to the depth of the water. This is discussed in more detail in the ‘Disadvantages and Improvements’ section.

*“I just use it for lower body purposes so the water is fine, I would say it just gets into my glutes and stuff.”* (Player1)

Participants felt that the device prevented wastage of muscle following an injury:

*“Well with my injury after my operation I lost a lot of mass, the muscles literally just wasted away ...Just to keep my muscles switched on, because ...when I ...I can’t run or I can’t leg press or do leg raises or squat, sitting in the bath I still let my muscle activate.”* (Player2)

One player also described how the bath had alerted him to injuries he thought had healed, yet still were physically present:

*“It kind of brought up injuries I’ve had in the past type of thing, so I’m struggling with... I had a sore knee down the side and I hadn’t really thought about it for a couple of weeks, then I jumped in the bath and I had a sensation down my leg where I had it before. I’ve had a groin injury before and I had it on the pubic bone and I could feel it a lot when I was in the bath.” (Player3)*

**b. Is the bath being used for reasons other than treatment of injury?**

As well as injury, the bath was also used to help players recover from fatigue, and some players preferred to use the bath for this purpose rather than a massage or personal training rub:

*“So from a recovery point of view if any of the players are really tired, feeling a little bit fatigued and heavy, a general blast in the bath can sometimes help them. Some of the players really know that and understand that and how it makes them feel. We’ll use that quite regularly... It helps with their recovery so anything that they can do obviously to make themselves feel better for the next day’s training; they have to be as close to 100% the day after doing three training sessions, as possible. So some of them really benefit from getting in the bath and just having 20 minutes just sort of flushing their system out through there. Some of them will actually prefer that to having a massage or having a personal training rub.” (Rehab2)*

*“We use it for recovery as well, so if the lads are a little bit fatigued ...from the day’s training then we’ll stick them in the bath and they can have almost a recovery flush. That’s been working really quite well as well.” (Rehab1)*

One player had even been using the bath for recovery and relaxation without the knowledge of the rehabilitation staff:

*“There’s one of the lads, I didn’t know he’d been using it, I saw him in it the other day, he’s fully fit, he’s absolutely fine, he’s been playing with no problems. I was like, ‘Oh, what are you doing in it?’ He said, ‘I just feel so much better after it.’ I said, ‘In what way’, he said, ‘Well I just feel as if everything’s fired up and I feel much more alert.’*

*There's nothing clinically wrong with him from the musculoskeletal point of view, he just likes to use it as part of his recovery tool." (Rehab1)*

The bath was also used to 'fire up' the muscles for players currently following a rehabilitation programme, or for post-operative players:

*"Pre neuromuscular fire ups for rehab guys, post-op guys." (Rehab2)*

*"But I will always plan it into [a player's] programme, so if they've got a programme that they're running they will use it most days as a fire up to the lower limbs." (Rehab3)*

One player was also using the bath to 'keep on top of' minor injuries, and to prevent further injuries:

*"I can't say because I haven't ...had a serious injury, I've just had niggles what we're keeping on top of, well preventing injuries, so I can't really say ...but so far yeah, I've found it does help, yeah." (Player3)*

### **c. When has the bath worked well in practice?**

The three rehabilitation staff discussed examples where the bath had worked well as part of the rehabilitation programmes in practice. All three spoke of examples where previous attempts with other electrical physical therapy devices had failed, but including the bath into the rehabilitation programme had produced results. These case studies are described below in more detail:

*"One of our lads, unfortunately he's left us, he left us last year, year, but he had an ACL [Anterior Cruciate Ligament] reconstruction and really struggled to activate his quad and hamstring so he was suffering from arthogenic muscle inhibition. We tried a lot of different things and nothing was really working... he was just really struggling. So what I was doing I was putting him in the bath on a daily basis in the morning so that the theory or the belief that he was getting activated, fired up, we were activating the specific musculature that we needed to. Then we'd go into rehab and then he'd go into his weights and he found quite a significant improvement. We got on even better ... when we used the Compex as well, so he would do the bath, then the Compex then he'd come through to my rehab session and then into the gym. That sequence of events seemed to really help him and push him along nicely." (Rehab1)*

*“The hamstring tendonopathy that I was just saying about, constant sort of ache and niggling pain, the tight tendon and that... we were sticking needles into it, massage, manual therapy, everything, and couldn't quite get rid of that and the bath just seemed to alleviate that pain on him quite nicely. So as I say he's now fit and playing but he will also use the bath twice a week just to sort of make sure everything's going down that action plan.” (Rehab2)*

*“Somebody who has actually just had a chronic groin issue that was affecting his kicking, kicking off the tee. He couldn't really generate the power prior to using the bath. He utilised the bath and within 24 hours he was kicking to full power and didn't really drop off power and then he put it in as part of his maintenance plan throughout the week. We've found that with all the kickers since.” (Rehab3)*

#### **d. When has the bath not worked well in practice?**

When the bath had not worked well was when the players did not like the feeling of the bath, and found it too uncomfortable, rather than the bath not having any physical effect on the player's muscle or injury:

*“One of the lads, he's had multiple patella dislocations, three quite serious operations and his quadriceps have atrophied so they've wasted away. So my theory was that I wanted to get him in the bath and get as much stimulation through that quad as possible in order to help his rehab and speed it up, but he really didn't like it. It was too much for him, he didn't like the feeling that it gave, he point blankly refused to get in it again. Despite me telling him the benefits and how I think it would work, he wasn't keen; he just didn't like the feel of it... Purely personal preference. That injury, it was a big injury, but it was, it's purely on an individual basis that is.” (Rehab1)*

*“Some players seem to think it is quite tiring on their core muscles, so they'll be in the bath and as they get... they want the intensity higher, but they get out and their backs are achy and their ribs are achy and sort of their transverse abdominals are achy and they don't quite like that. So it doesn't work for everyone, they don't like that feeling.” (Rehab2)*

*“We've had a couple of incidences where the bath has not worked but I think mainly it's because they don't like the*

*feeling of the bath and they don't... so if we're using it for lower limb, they don't like the fact that it will make their back and their abs sore before they feel any benefit with their lower limbs. So it tends to be an opt out reason if it's not worked rather than having not worked per se."*  
(Rehab3)

#### **e. Contraindications and precautions**

There were very few identified contraindications for the bath. The rehabilitation staff identified that as long as they had a clear diagnosis of injury, and the player did not have a condition which may increase risk of infection (e.g. open wounds from surgery, skin conditions such as eczema), then they would be able to use the bath. If players had a particularly sore injury, the bath could be used at a lower level:

*"If we didn't have a clear diagnosis for them. So if we have a player that we... I don't know, they have an injury to a certain structure, say a knee, but we don't... it hasn't been clearly defined or accurately diagnosed yet, then I wouldn't put them in. Post-op players, so if they've had open surgery or even keyhole surgery ...I wouldn't stick them in the bath until the scars are fully healed because there's a risk of infection."* (Rehab1)

*"None that I have personally come across. I haven't really found anything that we were like right; no, we're not going to use it on you, definitely not ...You can say 'we're not going to use it on a high level with you, because you're quite sore, or you're quite irritable', but yeah, I don't think I've found anything where I wouldn't use it on the players"*

*"There are a couple of guys that have got skin ... a couple of skin conditions, they have quite bad eczema, I probably wouldn't use it for them."* (Rehab3)

The only precautions with the bath advised by the rehabilitation staff were health and safety concerns, such as transferring into the bath in a wet area, particularly for players who are very injured and may be using crutches. Rehab2 identified that some players feel sleepy after using the bath, but these players were 'very good at knowing when to use the bath' and would not use it prior to a training session:

*"The only thing with one of the blokes I put in the other day, he's obviously on crutches so I have to be very careful when he's... because it's a wet area, I have to get*

*my wheelchair and he has to sit on that and I wheel him through because I don't want him slipping off the crutches. But that's the only precaution.” (Rehab1)*

*“No, I don't think [there are any precautions]. I think they're very good at knowing when to use the bath. So after they've used it a few times sometimes it will affect them and make them quite sleepy, so they wouldn't do that before a training session. But I don't think there's anything obvious that strikes out with everyone.” (Rehab2)*

## **5. Benefits of the Aquaneuro bath**

### **a. Perceived overall benefits after treatment?**

Players spoke of how they felt 'looser' after a treatment in the bath, and felt it was an added extra on top of their usual rehabilitation and physiotherapy treatments:

*“Again, whether it is just in my opinion, when I am just a bit fatigued and a bit tight in areas... it is like no injury ...I am fully fit, sometimes it is not easy to go and get a massage obviously [if there are no] physios [free]. So accessibility is brilliant, you just jump in the bath because usually it is free, if not you are waiting 10 or 15 minutes at the most. And I know I can jump in and I know it has worked, obviously I have tried it many times. And I can feel it straightaway, obviously I wake up and I can tell the difference between not having a bath for some reason and having a bath. So I feel certainly a lot looser, yes, a lot less tight which is good.” (Player1)*

*“Well ...it is brilliant, I am in it every other day like I say ...I think it is superb, it has definitely helped. It has kind of given me an extra thing to do, whether [the effect is psychological]. Where before the bath I would only be in two treatments a day with it being rehab and physio, and now I feel like I can do three, rehab, physio and get in the bath.” (Player2)*

*“It's probably more effective than other things I've used, more effective yes, I think with the Compex needle things it does help but the day after you are still feeling the pain... you have got the delayed onset of muscle*



*soreness so your muscles are still sore. But with a bath you can use it and use it and use it more often and you get the same results out of it I think, yes.” (Player2)*

*“I feel much better afterwards, after a hard day of training, obviously when you are injured or something, you are a bit tired then, that just helps release, loosen it more.” (Player5)*

*“It feels like I have just finished having a massage.” (Player5)*

## **b. Physical effects**

The players described the physical effects they felt may be attributable to the bath. These included: firing up of the nervous system, decreased muscle atrophy, highlighting old injuries which may still be ‘lurking’, loosening up muscles prior to rehabilitation and training programmes, improved confidence regarding injuries, nerve regeneration, and improved range of movement. The players also spoke of how the bath made them feel like they had ‘had a workout’ and ‘you can tell you have done something’:

*“Sometimes I feel brilliant afterwards because I am having trouble with my hamstring... and firing off. What we do at the moment is before treatment for rehab I will go into the bath and hopefully that tries to fire up my glutes and stuff, rather than actually activate my abductor ...which I don’t want to do if that makes sense?” (Player1)*

*“It’s probably more effective than other things I’ve used, more effective yes, I think with the Compex needle things it does help but the day after you are still feeling the pain... you have got the delayed onset of muscle soreness so your muscles are still sore. But with a bath you can use it and use it and use it more often and you get the same results out of it I think, yes... Sometimes it’s like ‘do I have to use it again?’ But I do enjoy it because it works and you can see the benefit of it... it 100% helps. Because if you looked at my muscle before I started using the bath and you looked at it now [...and using the bath my muscle has got bigger and it is much stronger as well.” (Player2)*

*“It kind of brought up injuries I’ve had in the past type of thing, so I’m struggling with ...I had a sore knee down the side and I hadn’t really thought about it for a couple of*

*weeks, then I jumped in the bath and I had like a sensation down my leg where I had it before. I've had a groin injury before and I had it on the pubic bone and I could feel it a lot when I was in the bath.....I've kept using it simply because I've got a tight muscle at the moment, so that's helped loosen it up a bit and it just helps fire up everything and I feel better for using it... Like I said, it helps fire me up and like I said, any niggles I've had before which I haven't really thought about will kind of show up in the bath, but for me personal, my abductor has been tight through kicking ... and that's [the bath] helped loosen them up in the last couple of weeks.”*  
(Player3)

*“I think it's good, I've definitely found that the range of movement [has improved]. I don't know if it's because of the fact that it is a little bit later on, but it seems to have progressed quite quickly after using the bath. I was quite stiff and stuff before but after a couple of times of using the bath it felt a lot better ...A positive effect is definitely like just feeling the muscles working again and then I suppose it is a positive as well but you just get the sense of like all over muscle, sort of fatigue ...like you can tell you have done something, it is actually working as opposed to you just sitting in a bath. It feels like you are actually doing something... [The rehab staff] are really happy with the way I have been going and the bath seems to help the feeling come back into under my kneecap as well because obviously they cut through the nerves... so for like nerve regeneration and stuff, it seems to have helped a lot.”* (Player4)

*“I find it quite good. It works, it seems to like relieve the pain in a way once I've finished using it but yes, from my experience, it has been pretty good, yes. Afterwards I feel quite a lot better. I feel a lot more confident depending on where I've had my injury or whatever it is ...I would say it's improved on the recovery, like it has helped me fire up and a lot of things a lot quicker.”* (Player5)

*“At the end my leg feels a lot better coming out of it than before? Because obviously I wasn't moving it, it felt as if it had actually done something and it wasn't just wasting away. Well I think it has stopped the atrophy in my leg by quite a significant amount just because it has kept the*

*muscle active ...I think it just keeps my normal, my pathways working, stuff like that. Well yes, when I get out it makes me feel as if I've had a workout on that leg and it gets stronger for it.” (Player6)*

The rehabilitation staff felt that the bath's physical effects lay in muscle activation, overcoming muscle inhibition, restoring neural pathways, and reducing muscle atrophy:

*“I think it can help muscle activation, I think it can help overcome arthogenic muscle inhibition, so the pathways following injury or an operation can get a little distorted. I think it can help restore those pathways and help muscle activation and overcome arthogenic muscle inhibition....I don't think it can prevent muscle atrophy but I think it can slow it down. I mean muscle atrophy is going to happen whether we like it or not unfortunately, but I think the bath can just help slow the rate at which we lose the muscle.” (Rehab1)*

*“I think from looking at a player that's inhibited in some way, it seems to really reduce that sort of ...the non-use of the muscles, so a player can't contract all their quad and actually getting them in the bath a few times, getting them to do things in the bath and then out, you get a big increase in that motor unit recruitment and in just the global usage. It seems to wake the muscles up quite nicely.” (Rehab2)*

*“Definitely neuromuscular enhancement and facilitation, which is I think an area that gets lost a lot and it dampens their performance.” (Rehab3)*

With regards to whether or not the bath was having an effect above and beyond any other device or portion of their rehabilitation programme, players were aware that it was difficult to remove the potential effects of the bath from the potential effects that other components of their treatment were having. Because of this, players were keen to see more research:

*“I don't know all the science behind it, but yes I can sit here and say it works.” (Player1)*

*“It's hard to tell because I'm having treatment as well as going in the bath, so yeah, I can't really comment on [whether it is the bath alone having an effect].” (Player3)*

The rehabilitation team broadly agreed with the players, that it was difficult to remove the potential effects of the bath from other components of rehabilitation and treatment; however, they felt that it was a very useful tool to complement a treatment plan:

*“I don’t think it has any superior benefits than any other form of treatment, but as a combination of treatments I think it’s a really nice... it’s another tool in our armoury to use for the players. I think it’s a great, great tool for us to use. I would never use it in isolation, so I would never say ‘right, we’re only going to use the bath’. I would never ignore the rest of the treatments. But it’s another string to our bow; it’s something else that we can use to get the players back quicker and safer.” (Rehab1)*

*“I think it’s the combination. We wouldn’t ever just put the player in the bath without treating them manually and giving other recovery options, so it’s again difficult to say whether that’s making the biggest difference or the best difference. But in conjunction with others, I think it is a very useful tool, yeah.” (Rehab2)*

*“I think it complements other treatments. I think, on its own, you wouldn’t necessarily make massive gains. You’d make gains but not massive gains. I think it facilitates other treatments.” (Rehab3)*

### **c. Psychological effects**

With regards to psychological effects, it was felt that the bath could produce improvements in confidence regarding injuries, have a relaxation effect, and have a placebo effect as a result of players being able to see the physical effect of the bath:

*“I feel a lot more confident depending on where I’ve had my injury or whatever it is.” (Player5)*

*“I certainly feel definitely psychologically that if I am doing rugby I need to get in the bath or I will be increasing my chance of an injury the next day, I definitely would say there is a psychological effect of that.” (Player1)*

Rehab3 felt that the physical improvements potentially caused by the bath had important psychological effects for the players:

*“I don’t think they would understand the physiological, it would have to be psychological for the players. That’s the*

*only thing that's tangible to them. Them being able to perform a single leg balance better, to them it would be more psychologically [beneficial] to them ... They'd get the fact that they can do it now, they couldn't do it before and now they feel better about it." (Rehab3)*

Comments from the players reflected Rehab3's theory, that the physical effects of the bath have an important psychological effect too:

*"Yes [there is definitely a psychological effect] because you can see it working. So you will be sat in the bath and your muscles are contracting and relaxing, contracting and relaxing and it helps, yes." (Player2)*

*"Yea,h psychologically I feel better for it yeah ...A positive effect is definitely like just feeling the muscles working again and then I suppose it is a positive as well but you just get the sense of like all over muscle, sort of fatigue ...like you can tell you have done something, it is actually working as opposed to you just sitting in a bath. It feels like you are actually doing something..." (Player3)*

Rehab2 went further to suggest that there may be a placebo effect increasing the physical effect of the bath, as players are able to see the muscular contractions:

*"Yes, I do think the whole placebo thing and more so in this level of sport, if you can get the players even a fraction of a percentage happier or more comfortable and feel like they're better, then it's worth doing, placebo or not. Psychologically, if they feel like they're doing everything they can, they feel refreshed, they've had a warm bath, you've got the massage element to it, they get to sit and chill out for ten minutes which they don't get anywhere else in the build up. So yeah, I think there is some psychological benefits to it as well, as anything else really." (Rehab2)*

Other players reaped benefit from the relaxing effect of the bath:

*"Like I say, ...[one player], he's got no injury, he just sits in it, maybe three or four times a week whenever he's here and he just really likes it. He can't necessarily tell you why, but he just feels better for it. So yeah, I think there's massive psychological benefits." (Rehab1)*

#### **d. Expectations of effect**

Players were dubious about the bath at first – the rehabilitation staff spoke of how this was often because they were cautious about the use of electricity and water. However, they also stated that they would tend to trust their rehabilitation staff if they were told that it would have an effect. Other than this, there were no expectations of effect:

*“If I’m honest, I think they’re all very dubious sometimes because in their mind water and electricity don’t really go together. So I put one lad in it the other day, he’s just had a very big knee operation and he looked at me...he’s a big bloke ....., I’ve never seen him look so worried in all my life! So he kept saying ‘What am I going to feel?’ I was like, ‘Just tell me what you’re feeling when you’re feeling it’. But now he’s hooked on it and he’s in it pretty much every day. Yeah, I don’t think they really know what to expect. Because we use, the big thing we use here is Compex, and that’s quite a forceful muscle contraction, and that can be quite uncomfortable at times for the lads. So I think they think it’s going to be a bit like that, but then once they get in they find that it’s ever so slightly different. Yeah, on the whole they’re all a bit cautious at first but once they’ve had a few treatments they get used to it.”*  
(Rehab1)

*“Some have no expectations or wonder why you’re putting them in and then they get out and say, ‘Actually, I feel a bit better’. Some think it will be the answer to all their problems after one session in the bath. But I think they just want to feel that little bit better, like I said, that one or two percent better, one or two percent fresher, more recovered, less tight, less sore and that’s what they want from the bath and that’s what they expect from it. If we say it’s going to work, usually they’ll believe us, even if they’re not that happy about getting in a bath full of electricity. They’re a bit like, ‘Oh, really?’. ‘Like, yeah just get in it, it’ll make you feel better.’”* (Rehab2)

#### **e. Effect on ‘Return to Play’ time**

The rehabilitation team were reluctant to declare any improvement in ‘return to play’ time, as they had only had the bath for just over a year, and had no case-controlled quantitative data. However, based upon their own experiences of the bath in practice, they felt that the bath was probably having

some effect on 'return to play', and they were keen to see data proving this to be the case or otherwise:

*"It's probably too early to say yet, because we haven't, we've only had it just under a year so it's quite difficult to say, we probably haven't got enough case studies. But as a package we do... because here at times, when they're injured, we throw the kitchen sink at them, so we give them massage, we give them acupuncture, we give them Compex, we give them exercise rehabilitation therapy. So there's lots of things we do. So I suppose we never really know which one of those modalities has worked... But ultimately yes, I think it can reduce... I think it can speed up rehab time. By how much and the percentage, I don't know, I couldn't tell you. But definitely, there's definitely something in it and I think it can help players return quicker ... We're quite hot on [measuring return to play time], so when a player's injured, from day one we'll have a projection and a plan of where they should be at each stage of their rehab process and then we can go to the coaching staff, 'Well we think that they should be back in 12 weeks'. It's very clearly marked out with what they should be doing each week." (Rehab1)*

*"It's a difficult one. There's so many factors involved, it's difficult to say, but potentially yes, I think it probably could. If you can get rid of that inhibition and you can get the muscle firing a lot earlier than you would do normally, then yeah, you can say that does take a few days off the return to play time." (Rehab2)*

*"Yes, I think it assists it, yes. I couldn't give a figure as to how much the bath affects RTP time, no, because everybody's such an individual... Long-term injured, no, because like I say, it's a very subjective, projected time. I think when we've had somebody with an injury, or just a depower, like the kicker, I think without the bath we wouldn't have got the player to the starting line, but that's only me thinking about it retrospectively, because we'd done all the physical therapy, we'd done all the stretching, we'd done everything that we would normally do and it hadn't really affected it. The only thing significantly affected it that we'd done to anybody differently in that position was the bath." (Rehab3)*

Similar to the rehabilitation team, the players were unable to definitively say that the bath improved 'return to play' time. However, based upon their personal experiences; they were inclined to believe that the bath indeed does have an effect:

*I would say, almost certainly, just going by friends and stuff... A few times just with using the lower back quite a lot, I have had a tight back after a game and I have jumped in the bath two or three days consecutively and been outside on the fourth day." (Player1)*

*"Yes it speeds it up definitely, without a doubt." (Player2)*

*"I can't say because I haven't ...had a serious injury, I've just had niggles what we're keeping on top of, well preventing injuries, so I can't really say ...but so far yeah, I've found it does help, yeah." (Player3)*

*"Yes hopefully, no they are really happy with the way I have been going and the bath seems to help the feeling come back into under my kneecap as well... it seems to have helped a lot." (Player4)*

*"I'm not too sure, it's hard to say." (Player5)*

*"Yes ...I think my leg would have wasted away a lot more if I hadn't been using it." (Player 5)*

## **6. Disadvantages and improvements**

Overall, players found it difficult to identify disadvantages with the bath and had a very positive view of it (even the player who found the bath very uncomfortable):

*"I couldn't give you one. I don't think it could give you one, no." (Player1)*

*"No there's nothing wrong with it." Player3)*

*"No, I can't really see any disadvantages." (Rehab1)*

*"Not really, I think the effect that we get from it is what we want from it, other than the practical stuff, of it being a little bit bigger, I think actually what we get out of it is good." (Rehab2)*

There were some areas where it was felt that the bath could be improved further. Players identified that the bath could be difficult to step in and out of if a player was



acutely injured. They also felt that improvements to help injured players would not be easy, and it may be simpler just to ensure that an injured player had a member of the rehabilitation team present to help them into the bath:

*“Obviously where the bath is we have showers so it is sometimes slippery ...But sometimes when I have had ankle injuries and stuff and I am in the [cast] it is sometimes difficult to climb over and just be careful but I wouldn’t say it was a problem ...When you are kind of post knee op and your knee is in a straight position, you can imagine it is hard to kind of elevate yourself with a straight knee, obviously with the side [of the bath] being reasonably high. But no personal preference, it is absolutely fine with me.” (Player1)*

*“It is [easy to use now]. It wasn’t when I was a bit less able, because I used it from about four weeks post op and I’m nine weeks post op now, so it is easy for me to get in and out, but before I had the rehab there, [the rehab team] helped me in because I was on crutches and I couldn’t put my foot down so he just like held my leg up while I slid across on it, just for protection of my leg... I could have done it [alone] but he just didn’t want me to knock it or anything like that... I don’t think there is [a way to make the bath easier for injured players], you just need someone else there.” (Player4)*

Some also felt that the size of the bath could be improved for larger players:

*“The only thing for someone like me because I am quite tall ...because you are quite cramped in it a bit. So if somebody was 6’7”, 6’8”, they might struggle to get in ...Just that it could be a bit longer...I don’t think I [would make any other improvements] to it, no.” (Player2)*

*“Well if you can make it a bit longer.” (Player5)*

*“Aside from it being a bit small, not really, no [other disadvantages]” (Player6)*

*“I think probably the only thing is the size of it because we’re dealing with the bigger than average bloke. Some of them, so you know if we’ve got a 6’7” lad, you know sometimes he might be kind of cramped up in it a little bit, but that’s just the nature of the boys we’re dealing with. For the average patient it’s absolutely fine” (Rehab1)*

*“I think some of our players find it a little bit small because they’re so tall; some of them are 6’5” plus, like 6’7”, 6’8”. So they are a little bit sort of cramped in there and they can’t get all their legs in there. If you try and spin them round or get them on their side, it’s not ideal for that sort of player really.” (Rehab2)*

Some participants felt that the bath could be improved by allowing people to use it for treatment of upper limb injuries. It was felt that the current depth and length of the bath was more suited to treating lower limb or lower back injuries:

*“It’s very easy to also sell it to the players and they can see the relevance of it for lower limb and lower back, but they can’t ...and I don’t tend to see as much of a benefit for upper limb and upper extremities. So how you would make that better, because I’d really like it to work for upper limb and upper extremities better... [but you can’t] fit upper extremities into the bath. Yeah, because it doesn’t seem to be as effective, we’ve always had better results when we’ve had lumbar spine, glute, lower limb. (Rehab3)*

*“I just use it for lower body purposes so the water is fine; I would say it just gets into my glutes and stuff. So whether obviously upper body it would be different for someone else I don’t know.” (Player1)*

It was felt that a deeper bath may also help larger players completely submerge their lower limbs:

*“I think the seat could be deeper to get your whole, all my quads and stuff under, because I struggle with that ...At the moments it’s just covering I’d say, I’ve still got leg exposed, so basically lower the seat” (Player3)*

*“I think it should be a little bit deeper, some of the boys fit in it fine, like I fit in, but then like I feel like it is quite shallow.” (Player4)*

*“It’s been good for me because obviously my lower limbs, it works well for the lower limbs, I wouldn’t know how it feels really to be completely submerged...yes, I wouldn’t mind trying it.” (Player5)*

There was also concern from some players that the bath was uncomfortable on their core muscles, although they were not sure as to suggestions on how to improve this. Rehab2 suggested this may be because they were using the bath on too high a

setting, because they were not used to it, or because they had been sitting in the bath for too long:

*“It’s not too bad, just when you are sitting back, leaning back on that pad, and as it gets harder, you get used to it after a bit, but when you first start off it sort of hurts your core, well not hurts but is like more intensive.” (Player4)*

*“Like I said, some find they’re a little bit sore afterwards, whether that’s because they’ve just cranked it up too much, they’re not used to it, they’ve actually done more than what is necessary. So yeah, that sort of contracting of the muscles can almost give them a little bit of a [delayed onset muscle soreness] effect, which would be a disadvantage.” (Rehab2)*

One participant felt that the aesthetic look of the controls could be improved, as they looked like ‘a prototype kind of control’:

*“I think that the actual controls are sometimes... they seem to me a little bit like a toy. I think that they seem a bit like a prototype kind of control.” (Rehab3)*

One of the players felt that he would like a higher setting:

*“Put the volume a bit higher, yes the maximum of 500 and obviously I would like it a bit higher than 500.” (Player5)*

Finally, Rehab2 felt that it would be useful to have guidance on potential treatment programmes included with the bath:

*“It would be quite nice to have almost like a programme in there, so if you’re looking at neural hamstrings, this is what we suggest you do, you’re in there for however many minutes, so many times, almost like a prescription of treatment, although then you will still have to alter that per individual. It would be quite nice to, instead of saying ‘Right, let’s stick you in and let’s guess, to have a little bit of a guideline.’” (Rehab2)*

## **7. Further applications and research**

### **a. Further applications within sport**

The rehabilitation staff felt that the bath had further applications outside of their training facility across a range of sports. Rehab3 was concerned that

currently the bath marketing was not aimed at the sports market, which may put some people off purchasing the bath, particularly if their neuromuscular knowledge was not strong:

*“Outside of facilitating rehab and facilitated performance that’s existing, and recovery, I think it’s all covered. I think that every sport would benefit from using it. It’s just a concept that a lot of people don’t naturally get their head around, I think that most people look at it almost like a spa product and it’s something that I’ve mentioned to the guys who have designed the bath, that a lot of their literature is based around the fact that they have a girl in a bikini... in a nice sort of treatment room... in like a beauty salon. You know [Rehab 1] and I spent a lot of time on neuromuscular training, we fully understand it and I think that it was our knowledge that probably facilitated the product coming in [because we understood it]. So I think they have to, I think it would work really well in sport, wider [than our club alone], I think they have to appeal to the individuals within sport for it to be taken seriously.”*  
(Rehab3)

*“I think as far as I know we’re the only rugby club in England that are using [the bath], certainly in the Premiership.”* (Rehab1)

*“From a diagnosis point of view, I don’t really use it to diagnose. So I could maybe take that into my practice if I understood it a little better and had a little bit more training from a diagnostic point of view. But recovery and treatment... and that really covers all our bases, the only other area you could possibly tap into would be pre and post match, but that’s a little bit more difficult.”* (Rehab2)

#### **b. Further applications outside of sport**

One participant who found the bath uncomfortable to use (although still maintained use of the bath because of treatment effects) was not sure whether the bath would have applications outside of sport because of this:

*“I don’t know, whether I am a big wimp, ...I do it because I feel that as a job I need to be fit as long as I can, and it is not an enjoyable experience being electrocuted or whatever it is going on in there. So whereas if I said ...I am just thinking of my brother and sister, I would say ‘get in there, you will feel better’, they would be in there for five*

*minutes and say 'I don't enjoy this'. Whereas I will sit in there for 20 minutes not enjoying it because I know I will reap the rewards in a sporting environment." (Player1)*

The rest of the participants however, felt that there were applications outside of the sporting environment, such as relaxation applications, chronic back pain, reducing muscle atrophy in older people, use in amateur sport rehabilitation, and use within the medical field e.g. Guillain-Barré syndrome.

*"I can see it being used to relax people and stuff like that. Because you are comfortable when you are in it, so yes, I definitely think so." (Player2)*

*"Yeah, obviously I guess if you're just the average person and you've probably got a sore back or something, or just through general everyday things in life, then yeah I can't see why not." (Player3)*

*"Yes I think it would be just as another sort of treatment, because people, like after gym sessions, people like to go in a sauna or anything like that and I think it could be used as a non treatment for everyday people really." (Player4)*

*"Yes, I guess so, yes, I think it would help a lot of people that have tight bodies. I think if they are struggling, but for me, when I sit in it after the training, it actually helps my body feel relaxed. It feels like I have just finished having a massage." (Player5)*

*"Maybe like the elderly because it is easy for them to get in and it just keeps their muscles working and stuff like that." (Player6)*

*"I personally have only ever worked in sport, I've never worked in an NHS setting or say an elderly care setting, but I think, I don't know much about those areas but I can definitely see it having an impact with people with all sorts of different medical conditions. Whether there's any contraindications for those people I don't know ...But yeah, I'm sure it can help other populations, definitely." (Rehab1)*

*"Yeah, I think you'd get good benefits and good results from a more sedentary or a more sort of amateur sports level population. People like things that work and people like things they can feel working. So if you ultrasound someone you don't feel anything. If you stick someone in*

*a bath and they can feel that, they can see their muscles contracting, I think that will help a lot of people from a mechanical pain point of view, but sometimes from a cognitive pain point of view as well, people with lower back problems that have hurt for years and years and years. That could be the one revolutionary treatment they have to make them feel a lot better about it.” (Rehab2)*

*“Well generally within the healthcare environment definitely. I know that they use it a lot with Guillain-Barré Syndrome, which is quite funny because my mother-in-law had Guillain-Barré and she’d never heard of it and I’m sure if she had have had that open to her she would have utilised it. So think it’s just a marketing sort of placement, isn’t it? (Rehab3)*

### **c. Further research**

The rehabilitation team were keen to see a body of quantitative data to support their beliefs and experiences of the physical and psychological effects of using the bath. Areas of further research suggested included: physical mechanisms of action on injury and performance, affect on player ability to lift weights, affect on player speed, reaction times, balance, perception, force production, joint stability, and pain levels. They felt that collecting such data would help to promote the bath to healthcare professionals, particularly those practicing from an evidence-based approach:

*I think I’d say yeah, massively interested to see how it can affect performance because I know it can help us in the rehab process. But can it help increase a one RM say, one repetition maximum, can it help us get the players to lift more weight, can it make the players quicker? Things like that, that’s what I would like to see and its application to performance, not just injury.” (Rehab1)*

*“I would like to see some quantitative analysis on it to see if it can actually, see how much it can help improved say reaction time or balance or perception or force production or joint stability. I think it has... I think it can have a very significant effect on these equalities but I would like to see some hard evidence and facts and figures to say well yes, actually pre and post treatment this has changed. I think along with these interviews, I think it will tie in really nicely because then you’ll have a complete package then, you’ll have the quantitative side and the feelings and opinions of*

*the lads. Then hopefully that will be backed up by the quantitative data that's collected.” (Rehab1)*

*“Also, it would be quite nice to see how, to try and find out how much of an effect it has versus just massage or versus just manual treatment. I think that would be quite interesting to find out... I think it would be difficult to have objective sort of data in there, but from a subjective point of view, just how much improvement it makes them feel, so a pain score before and after, a pain score before and the next day, especially things with chronic... we get chronic Achilles tendonopathies and they have to report every day on how they feel ...How do you feel, yeah you've used the bath, it feels a lot better. Or no, it's made it feel worse. Well, has it made it feel worse because you trained and then got in the bath. Trying to just understand it more and when it's best to use it because we're still guessing that at the minute as well. So it would be quite nice to have...an evidence based practice instead of anecdotal... I think if some data can be gathered on it, I think it would be more interesting and more people would probably take its uses on board and involve it in their clubs and practices a lot more.” (Rehab2)*

*“I would like to see, anecdotally I know, that they improve after it and I know that it, and the science behind that is because it affects the neuromuscular driver, the muscle, so therefore it's pre-fired before they start. I'd like to see that proven because it's very difficult to express that to other individuals, although anecdotally we know it works ...[What could you measure?] ...balance tests are already out there, that are used as standard, it would be interesting to see how balance is affected and is their ability to balance improved after using the bath as opposed to not using it?” (Rehab3)*

*“I mean we know the benefits of the bath...we speak to other people in sport and other people in sport think that it's a gimmick and that they don't really get it. It would be good to have that kind of structured support for sports environments and for other professionals. I think that's for them [the inventors] to work out how to articulate the information better.” (Rehab3)*

## CONCLUSIONS

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The rehabilitation staff and players all had prior experience with a range of electrical physical therapy devices, including: Compex, ultrasound, low intensity pulsed ultrasound, shortwave diathermy, and TENS. The Compex device was mentioned in particular, as this was often used as part of the rehabilitation package offered by the rugby club. Participants compared the bath favourably against other electrical physical therapy devices and felt that the bath had an advantage over other devices in that players were able to use the bath alone, rather than having to have a member of the rehab team present each time. It was also felt that the bath was more of an 'overall' treatment for the neuromuscular system, in comparison to other devices, which were viewed as localised treatments.

The player's views on the comfort of the bath were mixed. Some players found the bath experience very comfortable and enjoyable, and preferable to other electrical physical therapy treatments. However, others found the experience uncomfortable – although this tended not to deter from their use of the bath, as they were able to appreciate its physical benefits. Indeed, players who found the bath uncomfortable tended to still use it, as they were able to see the benefits 'the next day' or '10 minutes later'. There was concern from some players that the bath was uncomfortable on their core muscles. There was only one player who refused to use the bath due to feeling discomfort. The bath was less comfortable for taller players, as it was difficult for them to fully submerge their legs.

In terms of how the bath is used, it is initially used with both player and rehabilitation staff together. The member of the rehabilitation staff guides the player through the settings and their treatment. Once the player is comfortable, and knows what they need to do to conduct their treatment, they are then able to use the bath alone, without a member of the rehabilitation team present. The players themselves used the bath frequently once they had been shown how to use it. The rehabilitation staff tended to use the bath only with new players, or players with new injuries. The amount of times per week the bath was used varied from player to player, and injury to injury, varying from twice a week to every other day. Further, the players were happy with their level of use of the bath, and did not want to reduce or increase their use, although one player stated that he would maybe use it more as he preferred to use the bath at the end of the day prior to having a shower.

The ideal time of day to use the bath varied depending on the players' individual rehabilitation plans or injuries, and personal preferences. Some players used the bath before training or playing to 'fire up' their neuromuscular system, whereas others used it post-match or training as a recovery tool. The bath could also be used alone as a rehabilitation device in its own right, or as part of an overall session. The rehabilitation team saw the jets as a personal preference. Rehab2 preferred to use



the bath without the jets, as she was able to see the contraction of muscles when she was overseeing a treatment, but also conceded that, when alone, the players would use the jets so they could enjoy their bath.

The bath is used at the training ground for a wide variety of injuries, including muscular, ligament, and capsular injuries. In particular, the bath was used for lower body injuries, rather than upper body injuries. Players and the rehabilitation staff felt that it was difficult to use the bath for treatment of upper body injuries due to the depth of the water. Participants felt that the device prevented wastage of muscle following an injury. One player also described how the bath had alerted him to injuries he thought had healed, yet still were physically present.

As well as injury, the bath was also used to help players recover from fatigue, and some players preferred to use the bath for this purpose rather than having a massage or personal training rub. The bath was also used to 'fire up' the muscles for players currently following a rehabilitation programme, or for post-operative players. One player was also using the bath to 'keep on top of' minor injuries, and to help to prevent further injuries.

The three members of the rehabilitation team discussed examples where the bath had worked well as part of the rehabilitation programmes in practice. All three spoke of examples where previous attempts with other electrical physical therapy devices had failed, however including the bath into the rehabilitation programme had produced positive results. When the bath had not worked well, it was because the players did not like the feeling of the bath, and found it too uncomfortable, rather than the bath not having any physical effect on the player's muscle or injury.

There were very few identified contraindications for the bath. The rehabilitation staff identified that as long as they had a clear diagnosis of injury, and the player did not have a condition which may increase risk of infection (e.g. open wounds from surgery, skin conditions such as eczema), then they would be able to use the bath. If players had a particularly sore injury, the bath could be used at a lower level. The only precautions with the bath advised by the rehabilitation staff were health and safety concerns, such as transferring into the bath in a wet area, particularly for players with a severe injury and may be using crutches. Rehab2 identified that some players feel sleepy after using the bath but these players were 'very good at knowing when to use the bath' and would not use it prior to a training session.

The players described that the physical effects they felt may be attributable to the bath. These included: 'firing up' the nervous system, decreased muscle atrophy, highlighting old injuries which may still be 'lurking', loosening up muscles prior to rehabilitation and training programmes, improved confidence regarding injuries, nerve regeneration, and improved range of movement. The players also spoke of how the bath made them feel like they had 'had a workout' and 'you can tell you have done something'. Players spoke of how they felt 'looser' after a treatment in the

bath, and felt it was an added extra on top of their usual rehabilitation and physiotherapy treatments.

The rehabilitation staff felt that the bath's physical effects lay in muscle activation, overcoming muscle inhibition, restoring neural pathways, and reducing muscle atrophy. With regards to whether or not the bath was having an effect above and beyond other devices or elements of their rehabilitation programme, players were aware that it was difficult to remove the potential effects of the bath from the potential effects that other components of their treatment were having. Because of this, players were keen to see more research. The rehabilitation team broadly agreed with the players, that it was difficult to remove the potential effects of the bath from other components of rehabilitation and treatment but still felt that it was a very useful tool to complement a treatment plan.

With regards to psychological effects, it was felt that the bath could produce improvements in confidence regarding injuries and have a relaxation effect, as a result of the players being able to see the physical movement of their muscles when in the bath. The rehabilitation team felt that the physical improvements potentially seen as a result of using the bath provided important psychological effects for the players, and may even produce a useful placebo effect, increasing the physical effect of the bath.

Players were dubious about the bath at first – the rehabilitation staff spoke of how this was often because they were cautious about the use of electricity and water. However, they also stated that they would tend to trust their rehabilitation staff if they were told that it would have an effect. Other than this, there were no expectations of effect.

The rehabilitation team were reluctant to declare any improvement in 'return to play' time, as they had only had the bath for just over a year, and had no case-controlled quantitative data. However, based upon their own experiences of the bath in practice, they felt that the bath was probably having some effect on 'return to play', and they were keen to see data proving this to be the case or otherwise. Similar to the rehabilitation team, the players were unable to definitively say that the bath improved 'return to play' time but, based upon their personal experiences, they were inclined to believe that the bath indeed did have an effect.

Overall, players found it difficult to identify disadvantages with the bath, and had a very positive view of it (even the player who found the bath very uncomfortable). There were some areas where it was felt that the bath could be improved further. Players identified that the bath could be difficult to step in and out of if a player was profoundly injured. They felt that improvements to help injured players would not be easy, and it may be easier just to ensure that an injured player had a member of the rehabilitation team present to help them into the bath. It was also thought that the size of the bath could be improved for larger players. Some participants felt that the

bath could be improved by allowing people to use the bath for treatment of upper limb injuries. Participants believed that the current depth and length of the bath was more suited to treating lower limb or lower back injuries and that a deeper bath may help larger players completely submerge their lower limbs. There was also concern from some players that the bath was uncomfortable on their core muscles, although they were not sure as to how this might be improved. Ultimately, players seemed to be happy to experience this discomfort, as they were pleased with the physical results they experienced from using the bath. One of the rehabilitation team suggested they may be feeling discomfort because they were using the bath on too high a setting, because they were not used to it, or because they had been sitting in the bath for too long.

The rehabilitation staff felt that the bath had further applications outside of their training facility, across a range of sports. One participant was concerned that currently the bath marketing was not aimed at the sports market, which may put some people off purchasing the bath, particularly if their neuromuscular knowledge was not strong. The majority of players and rehabilitation staff felt that there were applications outside of the sporting environment, such as relaxation applications, chronic back pain, reducing muscle atrophy in older people, use in amateur sport rehabilitation, and use within the medical field, e.g. treating people with Guillain-Barré syndrome.

The rehabilitation team were keen to see a body of quantitative data to support their beliefs and experiences of the physical and psychological effects of the bath. Areas of further research suggested included: physical mechanisms of action on injury and performance, effect on player ability to lift weights, effect on player speed, reaction times, balance, perception, force production, joint stability, and pain levels. They felt that collecting such data would help to promote the bath to healthcare professionals, particularly those practicing from an evidence-based approach.

## RECOMMENDATIONS

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The following recommendations reflect the feedback from both the players and the rehabilitation team. In defining the further development and marketing of the Biosysco Aquaneuro bath, it is recommended that the client consider that:

- **The mechanism of action of the bath remains the same.**  
All participants were experienced with a variety of electrical therapy devices already on the market, and viewed the bath favourably in comparison.
- **The mode of operation of the bath remains the same.**  
Players and rehabilitation staff valued the simple mode of operation, which allowed players to use the bath as and when they liked without supervision from the rehabilitation team, following initial instruction.
- **A larger version of the bath is developed.**  
The bath was less comfortable for the taller players, as it was difficult for them to fully submerge their legs into it.
- **A deeper version of the bath is developed.**  
Participants felt that they currently could only comfortably use the bath for the treatment of lower limb injuries, as it was difficult to submerge a player's upper limbs fully into it.
- **Further research regarding the physical effect of the bath upon the body is conducted to evidence the perceived benefits felt.**  
The rehabilitation team and the players were pleased with the physical effects they attributed to the bath and were keen to see data from clinical trials to support their anecdotal evidence, specifically regarding the following:
  - Muscle activation
  - Overcoming muscle inhibition
  - Restoring neural pathways
  - Reducing muscle atrophy
  - Effect on player ability to lift weights
  - Effect on player speed
  - Effect on reaction times
  - Effect on balance
  - Effect on perception
  - Effect on force production
  - Effect on joint stability
  - Effect on pain levels

- **Further research regarding the bath’s contribution to ‘Return to Play’ time is conducted.**

Although the players and the rehabilitation staff, based upon their own experience of using the bath, believed that using the bath was probably having a positive effect on ‘return to play’ time, they would want to see case-controlled quantitative data to support this perception.

- **Guidance on how to reduce discomfort in the core muscles is provided.**

There was concern from some players that the bath was uncomfortable on their core muscles.

- **Guidance on potential treatment plans for common injuries is provided.**

As the rehabilitation staff at the training ground were new to the bath, they felt they were using it on a ‘trial and error’ basis, albeit informed by their practice and knowledge. For new users of the bath it would be useful to have guidance regarding how the bath can be integrated into injury treatment plans.

- **The bath is marketed for use both for localised treatment and for all over therapy.**

The rehabilitation team and the players felt that they were successfully using the bath for a variety of purposes, including treatment and rehabilitation of localised injuries, and as an ‘overall’ treatment for the neuromuscular system, e.g. recovery from fatigue.

- **The marketing message addresses the issue of barriers to use.**

Some players found the bath uncomfortable to use. However, even those that did so, were pleased that they had persevered in using it, due to the physical effects following their rehabilitation plan.

The issue of sitting in a bath of water with electricity running through it was also identified as an initial barrier to player use.

- **Marketing materials targeting the sports environment should be developed.**

All participants felt that the bath could be successfully used elsewhere in other sporting environments. One participant was concerned that current product marketing was not aimed at the sports market, which may deter people in this sector from purchasing the bath, particularly if their neuromuscular knowledge was not strong. It may be useful to gather clinical data, and develop sports case studies (some described herein) to promote the bath to other rehabilitation professionals.

- **The application of the bath outside of sports is considered.**  
The majority of players and rehabilitation staff felt that there were appropriate applications for the bath outside of the sporting environment, such as relaxation applications, chronic back pain, reducing muscle atrophy in older people, use in amateur sport rehabilitation, and use within the medical field.