The Vienna FES Interview Protocol

The Vienna FES Interview Protocol – A mixed-methods protocol to elucidate the opinions of various individuals responsible for the provision of FES exercise

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Abstract

Functional Electrical Stimulation (FES) is the production of electrically elicited muscle contractions to perform a function or task. It has been used as a method to regain lost body functions or support weak body functions, and as such, has been clinically available since the early seventies. Some methods are applied routinely while others have not been translated to the bedside, or are still largely restricted to laboratory use. Progress in this field might be achieved by a strong cooperation of patients, clinicians, therapists and engineers. A better insight into multiple perspectives may help in understanding the shortcomings of current FES technology. This will help direct future research efforts into design of systems and potential application in relevant populations. In addition, these findings can assist with the translation of FES technology into a community context. We outline an interview protocol designed for use at the 12th Vienna International Workshop on Functional Electrical Stimulation where the mentioned experts from the field of FES met.

Key Words: qualitative, FES, interview
individuals involved with FES. These perspectives will add to the small body of literature in the area and influence further innovation in this field.

Examples of different types of FES research

Research can be characterized in three domains; quantitative, qualitative and mixed-methods. Within the context of FES research, there are several examples of all forms of these studies. For example, use of near-infrared spectroscopy (NIRS) has been used to examine oxygen consumption levels of muscle before and after a training period of FES cycling in individuals with multiple sclerosis. Qualitative methods have also been employed to explore people’s opinions about FES, from the perspective of both individuals with SCI and medical professionals in the work of Donovan-Hall et al. Mixed-methods studies offer an advantage of combining both methodologies together, providing a greater scope for “understanding” of a given issue. In the context of FES research, mixed-methods designs may be used to gain a thorough understanding of the effects of FES on the individual. For example, the Edinburgh group conducted both analysis of gait (quantitative) and semi-structured interviews (qualitative), in their study of FES for foot drop in stroke. For the protocol discussed herein, we devised an interview study focused solely on the experiences of various groups involved with FES, whom were not patients themselves. It was a mixed-methods design in the sense that while it was focused on a qualitative methodology of interview questions, there was also a small quantitative component. Multiple instruments were also used, including; a demographic questionnaire, semi-structured interview schedule and short response questions.

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A protocol was developed to investigate the opinions of individuals responsible for the provision or research of FES for exercise in paralyzed populations, in attendance at the 12th Vienna International Workshop on FES, Austria, Sep 7-9, 2016. It was the first time such an activity was carried out at the workshop. While usually the workshop is focused on the presentation of original data, this was the first time the conference itself was used for the collection of research data of a qualitative nature. The purpose of the study was to add to the relatively small body of qualitative information in the current literature, which will be a focus of upcoming work that aims to present the results of this study. The protocol discussed in this communication is of a 3-part structure.

The research questions which this study aimed to address were as follows:

- What do FES providers and engineers conceive to be the preferred type(s) of FES technology that clients use, or would use, on a regular basis for exercise?
- How do the perceptions of biomedical engineers differ from that of FES providers who are involved with FES therapy (selling, prescribing, or recommending) for typical populations who would use it.
- What is the opinion of FES providers and engineers regarding self-use of FES for exercise?

Fig 1. The demographic questionnaire. It was designed to encapsulate the basic characteristics of participants in a timely manner. Participants’ perspectives may be compared later on a basis of these characteristics.
The Vienna FES Interview Protocol
Eur J Transl Myol 27 (3): 160-165

1. What are the issues surrounding daily use of FES for exercise in paralyzed populations?
2. Can you briefly outline your experience of FES with clients?
3. Who sells FES equipment in your country? Who tells people how to use it?
4. Do you think exercise adherence differs in a lab or clinic as opposed to a home environment? Why?
5. What do you think are some of the benefits of FES?
6. In your experience with FES therapy, what are the initial expectations of clients before starting FES exercise?
   Are their initial expectations met? Do they differ depending on when they start FES post-injury
7. What are some of the big unanswered questions in the field of FES?

Fig 2. Interview schedule. The interview was designed to be a smaller version of a larger Australian protocol, focusing on the most relevant questions to ask participants in a short period of time at the conference.

- How do people define functional electrical stimulation, and are there any common misconceptions?
- What do people think FES is used for, and how many people do they think use it for exercise?
- What is the perception of FES providers regarding who they think is responsible for instructing in the correct usage of FES?
- What are the perceived health benefits of FES, and how do the perspectives of FES providers match against literature?
- What are the opinions of FES providers regarding factors that contribute to exercise adherence in lab, clinic and home settings?
- What do FES providers see as being important unanswered questions in the field of FES?
- How do the perspectives of international FES experts regarding expectations from FES treatment compare against the currently available qualitative literature on FES? (e.g., Barrett & Taylor).

Herein we describe its format, while alluding to potential relevance of the findings of this study for the FES community.

Section 1 – Demographic questionnaire
The first section was a demographic questionnaire, used to capture characteristics such as age, gender and country of origin of participants (Figure 1). It was the only part-quantitative component. The questionnaire also asked participants to stipulate their occupation, which may be colloquially defined as “sellers” (FES seller/retailer), “providers” (FES prescriber/researcher) or “builders” (neuromodulation engineer). A category was also left for those participants who did not fit one or more of those categories. This grouping of participants is such that post-hoc comparisons of perspectives derived from section 2 may be drawn, across different occupational groups. These perspectives may be able to guide further innovation in this field, taking into account considerations from different angles.

Section 2 – Semi-structured interview
The second section was a semi-structured interview, designed to encapsulate the opinions of participants regarding FES for exercise in paralyzed populations. Such interviews are typically carried out by using a list of questions which give some direction to the interview, but at the same time individuals are given due time to expand further on any issues in which they may wish to digress from the questions. The questions were designed following a review of the literature. A similar semi-structured approach was adopted by the work of Shiels & colleagues in their foot-drop study. The interview protocol was a truncated version of a larger instrument to be used for interviewing participants of the second part of this study in Australia. The purpose of this reduction in size was to facilitate a design that could be conducted in a time period of 10-15 minute timeslots at the conference. It was made to be concise, whilst focussing on the most relevant issues.

There were seven interview questions (Figure 2). Question 1 was a general enquiry regarding what issues conference participants could envisage may be faced in the daily use of FES by clients. This question is important in the context of device development. For example, Bates et al. assert that individuals will “accept” technologies if they can be used in a way they themselves desire. Elucidating, and addressing issues with current FES systems may help improve their uptake in the future. Questions 2 and 3 were more personal, focussing on the users’ themselves and experience of FES within their country. Question 4 was aimed at investigating the differences between exercise frequency in the home as opposed to an environment where there is an external form of assistance readily available (laboratory or clinic setting). Question 5 was focussed on the perceived benefits of FES, from the perspective of participants. Question 6 was perhaps the
most involved question, delving into expectations of FES from a client/patient perspective. Expectations are essential to understand in this field, and it was suggested by Bradley that work in this field is requisite as one’s expectations may relate to how suitable one is to partake in FES exercise. Moreover, the findings of our study will build on literature examining expectations of FES technologies to date, such as Guest et al. The final question 7 was aimed at investigating what questions are unanswered in the field, effectually probing the idea of where research could be aimed in the upcoming years.

Section 3 – FES Table

The final component of the study protocol was an open-ended table, listing several different modalities of FES exercise (Figure 3), with columns for participants to list advantages and disadvantages that they perceive with such technologies. The table included common forms of FES exercise, such as FES cycling, isometric electrical stimulation, and FES supported standing up, standing and stepping. Also included were newer forms of FES exercise: rowing, implantables and exoskeletons combined with FES technologies. The table listed these forms with general wording and as such, was open to various interpretations (Figure 3) as was seen at the conference.

Intended outcomes, future directions, preliminary observations

The data obtained from the application of this protocol may have several implications for the field of FES technology development and application. These include:

1. Following the EU RISE projects, the data obtained from participants may be used to further understand issues surrounding translation of FES for usage in the home, in concordance with question 4;
2. The perceived benefits of FES may differ from actual benefits;

![Fig 3. The table was designed to be very open-ended, with columns listing advantages and disadvantages.](image-url)
3. The final question 7 may be used to help direct future clinical studies of FES, that are aimed at elucidating answers to research questions that are still not understood well in this area;
4. Opinions of different types of FES exercise may be compared;
5. Perspectives of providers and researchers may be compared with those of patients themselves, which is the focus of other forthcoming work.

We hope that this protocol may be used to highlight some current issues with FES technology, and lead to a greater understanding of where future research efforts could be well-guided to pursue.

**List of acronyms**

- CP - cerebral palsy
- FES - functional electrical stimulation
- MS - multiple sclerosis
- SCI - spinal cord injury

**Author’s contributions**

MJT drafted the manuscript and was responsible for literature review and study design, AEB and CF contributed to the study design, AEB, CF, MB, AJR, gave feedback on the manuscript, MB assisted with the organization of the study in Vienna and drafting of the manuscript.

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**Conflict of Interest**

The authors state no conflict of interests.

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