DEVELOPMENT OF FLEXIBLE SOFTWARE FOR STUDYING PERIPHERAL NERVE REGENERATION

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SUMMARY

The study of the peripheral nerve regeneration after sciatic, fibular and tibial injuries, obtained through motion analysis, is regarded as a good evaluation criterion for quantifying the degree of nervous evaluation. The Functional Analysis of the Peripheral Nerves (AFNP) system that can transform this process into a computed one, not only provides the user with a higher evaluation agility, but also allows researchers to use a larger number of animals on experimental groups, facilitating the capture and data storage and processing, as well. Flexibility was a very important result to be highlighted, because more than one user is able to interact with the system.

Keywords: *Peripheral Nerves; Fibular nerve; Tibial nerve.*

INTRODUCTION

A medical diagnosis process pretty much depends on the quality of data collected from a patient and of the area under appreciation. Concerning data collection, this is required in a sufficient number containing the most relevant topics for the identification of the diagnosis and the subsequent therapeutic planning.

From the 1980's on, ischiatic nerves of different animal species have been used in studies and researches on peripheral nerve regeneration. Nervous root injuries, followed by several treatment approaches and submitted to different technique of function evaluation of the limb, have been the focus of researches particularly addressing ischiatic nerve regeneration, and peripheral nerves in general.

Gait analysis conducted on the course of evaluation studies provides the researcher with a unique opportunity to assess specific aspects of nervous recovery in a non-hostile model. The accuracy of the functional index performed in nervous injuries or regenerative studies can be confirmed with the use of groups constituted of subjects (rats). Rats' peripheral nerves are similar to human tissues. The first analysis is made with the animal in its usual state, or, as commonly named, control state. Then, the group of rats is submitted to injuries and assessed, according to the method, for the time factor. This allows the investigator to follow-up an injured nerve regeneration progress, and also helping him/ her to determine an optimal evaluation of the electrical and histological regeneration. This is called experimental state.

The scope of this study was data handling by functional quantification through morphological and electrophysiological evaluations using software programs, by assessing gait, with ischiatic, tibial and fibular nerves.

MATERIALS AND METHODS

In this system, the materials employed are gait prints, footprints that are digitalized by users and transformed into inputs to the system. The employed printing method was the one described by Lowdon et al. which uses 43 x 28 cm Xerox® paper stained with a 0.5% Bromophenol blue sulfonic anhydride solution (Sigma) in absolute acetone (Figure 1).
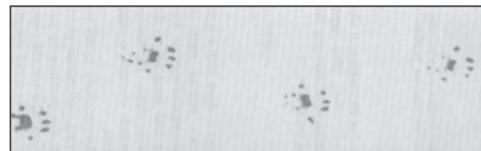
Figure 1 – Gait recording using the method by Lowdon, Seader & Urbaniak (1988)

In terms of hardware, we used a scanner for digitalizing gait. A printer machine was employed for report printouts, and a PC-AT computer was used for building up the system.

Additionally to these materials, ancillary applications and integrated development environments (IDE) were included, which operated in every phase of software development, from the requirements analysis to documentation and knowledge transfer. The method employed in this study aims to explain the procedures for the development of the AFNP software, once the

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application of the automated method of functional evaluation if the purpose hereof. Thus, Figure 2 provides a view to the whole automated method by AFPN, with the description of each phase (Figure 2).

RESULTS

The study resulted on a user-friendly software program, where the researcher can simply copy the"usp.mdb" file containing all data and images in its "Image" directory. Thus, should the researcher needs to use the information somewhere else, the system user can simply set the software up again and replace the "usp.mdb" setup file and copy the images to "Image" directory (Figure 3).
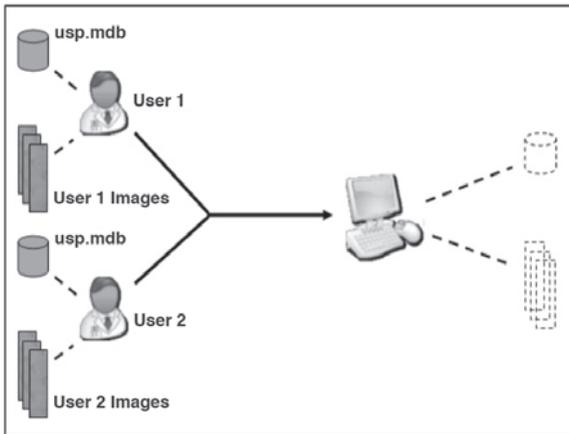

Figure 3 – AFPN flexibility

Throughout the system, a help function is available to users addressing the topics to be developed in each phase, as well as a context help. This is important, because it helps the researchers during investigations, thus providing an interactive interface with the user (Figures 4 and 5).

The user can select the language in which the software will be displayed between English and Portuguese, including the whole help system previously described. In Regional Configurations of the Windows operating system, the software automatically recognized the Portuguese language, or, if any other language is pre-selected, the software will be displayed in English.

It also features a very user-friendly display interface, from the set up phase, that do not require any previous knowledge from researchers, and following this profile, it is quite intuitive and easy to use because it follows the windows pattern, which most of the users are comfortable with. The results of the evaluations can be displayed as graphs or reports (Figure 6).

DISCUSSION

The main purpose of using information systems in healthcare is the progressive increase of the number of data, information and knowledge a healthcare professional must use to appropriately execute his/ her job (CIS-EPM). However, even with appropriate data and relevant knowledge, the use of an intelligent approach is required for solving problems. Shortliffe, 1990, in his book Medical Informatics, defines Medical decision-support systems (DSS) as any software program able to assist doctors on solving problems. Therefore, the AFPN represents another
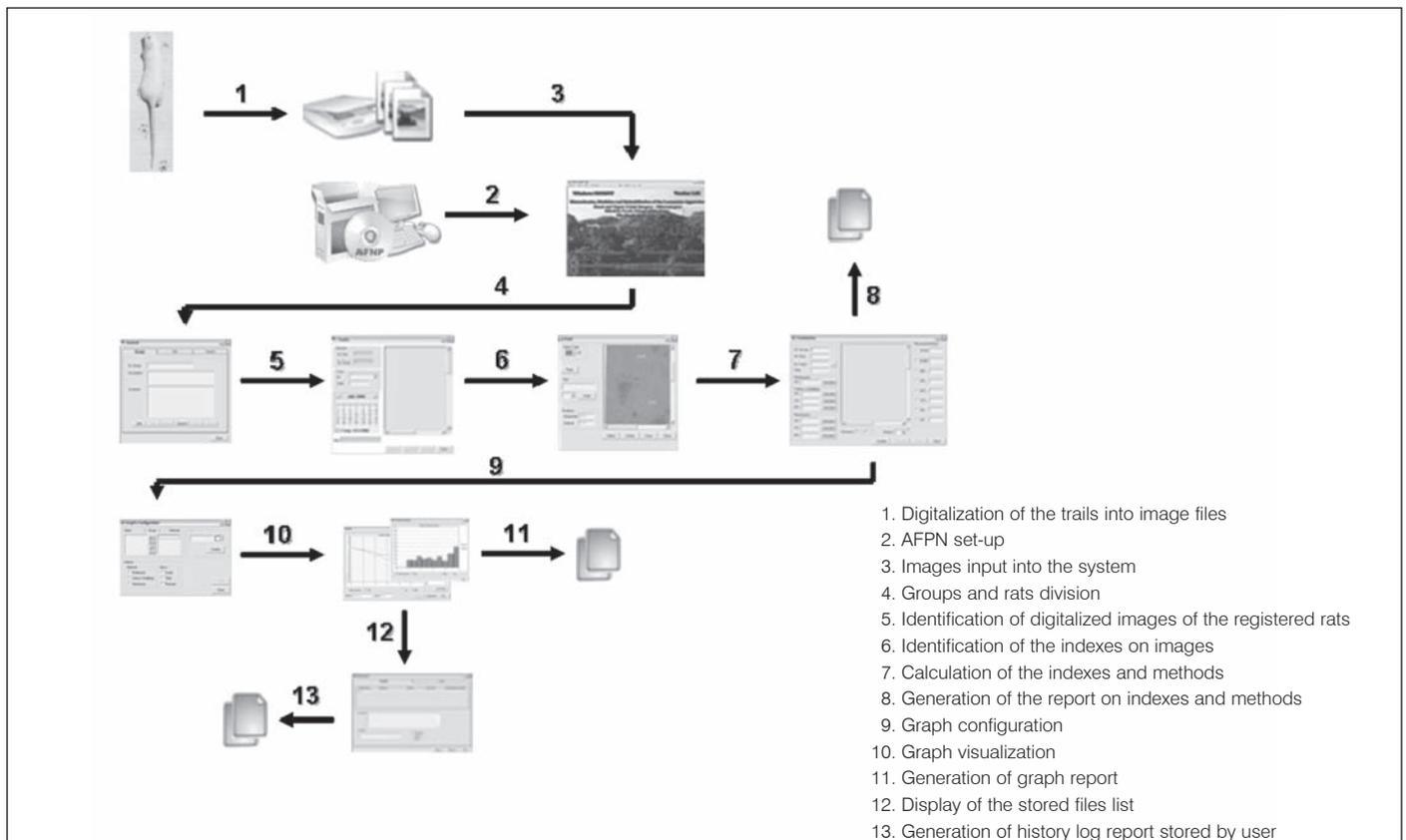

1. Digitalization of the trails into image files
2. AFPN set-up
3. Images input into the system
4. Groups and rats division
5. Identification of digitalized images of the registered rats
6. Identification of the indexes on images
7. Calculation of the indexes and methods
8. Generation of the report on indexes and methods
9. Graph configuration
10. Graph visualization
11. Generation of graph report
12. Display of the stored files list
13. Generation of history log report stored by user

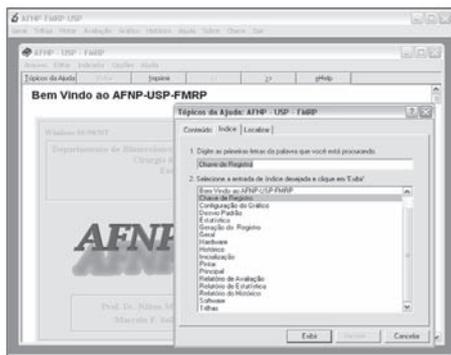*Figure 2 – Automation phases for functional evaluations with the AFNP*
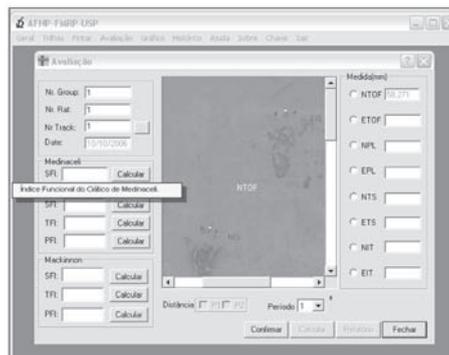
Figure 4 – Help topics
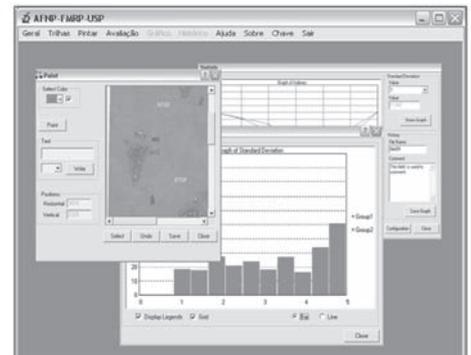

Figure 5 – Context help

Figure 6 – User-friendly interface

opportunity to realize that information systems have a positive impact on productivity increase and on supporting doctors in their daily decision-making process, based on specialized knowledge.

Flexibility was one of the goals in this project. This software program enables researchers to assess and compare a number of groups according to the peripheral nerves methods studied. Another noticeable flexible characteristic is concerned to the fact that more than one user can work with the same system setup and ion a same computer; they must simply have data stored on a Microsoft Access file and the digitalized footprints data saved as image files.

The Microsoft Access database was selected because this would exclude the need of having an additional database installed or any other database mechanism setup for storing data. In addition, for using the system, the installation of a Microsoft Access application in a researcher's computer is not necessarily required. The ease of transferring data of the analyses stored on a database from one computer to another must also be emphasized, with the user being required only to copy the "usp.mdb" file saved on the system to another

system installed in another computer, together with the corresponding images of each analysis.

CONCLUSION

The AFNP is a flexible software program, because its installation is not limited to only one computer. Or, oppositely, the installation of the software is not designed for only one researcher. This software ease of use for its intuitive and self-explanatory profile was really found since set up, where no other pre-set up is required from the researcher, through the language selection and in any phases of the research analysis, the assistance of the help mode in terms of context or to the automated process.

The use of this software program provides the ability to realize a uniformity of the methods employed in research.

It allows access to data stored from the different research methods from the tool history log, thus enabling its use in future studies.

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