Development of a computer application to help in the decision-making process in teaching dentistry

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Abstract

Objectives: This article describes the development of a computer application, Asiodint 1.0, whose objective is principally to help students and also newly qualified graduates in the decision-making process in a variety of clinical situations. The tree starts with an initial identification, naming the problem to be solved. It then follows a path via various stages (nodes), according to the responses to the variables which are important in this decision-making process, configuring a final outcome.

Study design: A population of 90 individuals was chosen, divided without any specific criteria into three groups: A) students, B) qualified dentists with at least 2 years' and at most 5 years' professional experience, C) qualified dentists with more than 10 years' professional experience. Two clinical cases were designed for the themes used in the program (evaluation of an abutment tooth and treatment of an extracted tooth). The participants answered questions on the two cases first based on their knowledge and then with the help of the program, and were able to check the degree of agreement between their opinion and that offered by the program. Finally each individual had to fill in a questionnaire on their opinion of the program, additionally describing the advantages and drawbacks they found in the application and whether discrepancies were due to a fault in the program's data base, an error by the individual or other reasons.

Results: 100% of the participants stated that they would like to have this tool as an aid and 96.7% thought that it could be used to improve teaching.

Conclusions: This program may be used repeatedly and at any time by students and teachers who so wish. This offers the advantage that it can be reviewed to reinforce information learnt by the students. The teaching staff can, however, if they so desire, design any theme they wish, increasing the efficiency and support capabilities of the program. Development of a computer application to help in the decision-making process in teaching dentistry. Program innovation.

Key words: Computer-aided instruction, education, making decisions.

Introduccion

An extensive analysis of professional activities in dentistry has revealed a number of situations in which dentists have failed to choose the best option (1) owing to an inadequate basis for the decision-making process. Current advances in computing are promoting the application of computing techniques to solve problems relating to decision-making, particularly for students (2).

This article describes the development of a computer application, Asiodint 1.0, whose objective is principally to help students and also newly qualified graduates in the decision-making process in a variety of clinical situations.

The system is based on the development of a data base administered by the teaching staff of Integrated Adult Dentistry (Seville University), consisting of progressive interconnecting stages called nodes. The complete system is what is known as a tree of theme. Figure 1 shows all the themes that make up this program initially.

The tree starts with an initial identification, naming the problem to be solved. It then follows a path via various stages (nodes), according to the responses to the variables which are important in this decision-making process, configuring a final outcome.

Figure 2 shows an example of a tree, which is included in the application, corresponding to the evaluation of an abutment tooth according to its root shape, where the initial and final nodes and intermediate nodes can be seen.

The variables of each node may be numerical (for example depth of drilling), yes/no (for example bleeding on drilling), or multi-choice (from a group of options determined by the expert). The screen for each node also incorporates images, help texts and frames for grouping and highlighting information.

A free evaluation version in Spanish has been put on the Internet at ftp://ftp.cica.es/pub/salud/asiodint1.0 where you can find "castelló.zip", a compressed version in win-zip of the Asiodint 1.0 program in Spanish with the full data base; "instalación.zip", a compressed version of the empty Asiodint 1.0 program, ready to load your data base; "leame.html", installation help in Spanish. An English version is currently being prepared.

Material and Methods

A population of 90 individuals was chosen, divided without any specific criteria into three groups:

1º.- 30 5th year students from the School of Dentistry of Seville.

2º.- 30 qualified dentists with at least 2 years' and at most 5 years' professional experience.

3º.- 30 qualified dentists with more than 10 years' professional experience.

Two clinical cases were designed for the themes used in the program (evaluation of an abutment tooth and treatment of an extracted tooth). The participants answered questions on the two cases first based on their knowledge and then with the help of the program, and were able to check the degree of agreement between their opinion and that offered by the program. Finally each individual had to fill in a questionnaire on their opinion of the program, additionally describing the advantages and drawbacks they found in the application and whether discrepancies were due to a fault in the program's data base, an error by the individual or other reasons.

1º.- Evaluation of an abutment tooth:

- **Evaluate possible periodontal disease.**

- **Root shape.**

- **Occlusion.**

- **Loss of insertion.**

- **State of pulp.**

- **State of crown.**

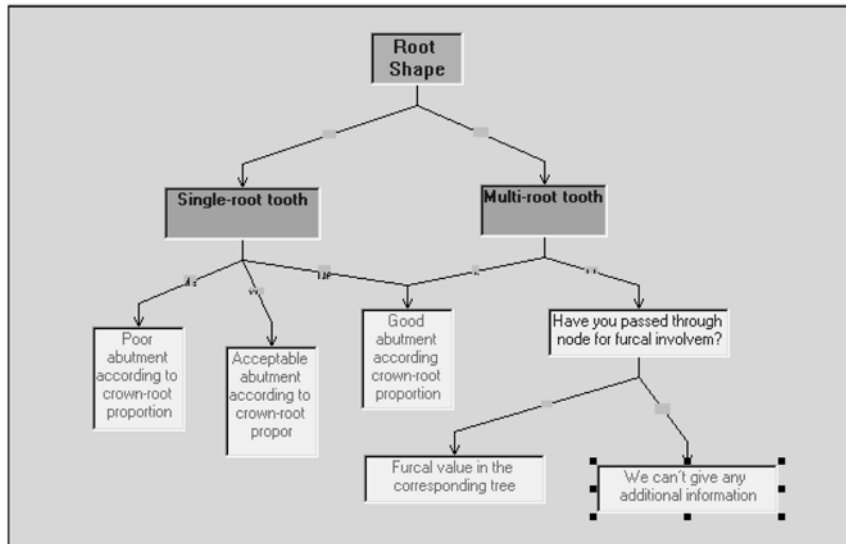**2º.- Treatment of extracted tooth.**

Fig. 1. List of themes.

Fig. 2. Example of a tree.

1º.- Did you find it difficult to use the program?

2º.- Do you think that the presentation of the program is easy to understand?

3º.- Did you find it enjoyable and pleasant?

4º.- Do you think that this program can be used to improve teaching in Dentistry?

5º.- If you were a student, would you like to have subjects in which you could use these programs for support?

6º.- If your answer to the previous question was no, please state why.

7º.- Do you think that it has any professional value?

8º.- The existence of discrepancies between your responses to the clinical cases and those given by the program is due to:

9º.- Mention three advantages of the program.

10º.- Mention three of its defects.

11º.- What would you change or add?

Fig. 3. Questionnaire on the evaluation of the program.

Table 1. Results of the questionnaire on evaluation of the application. Simple descriptive study.

Question nº 1	GROUP 3	GROUP 2	GROUP 1	OVERALL
NOT AT ALL	60	66.7	43.3	56.7
SLIGHTLY	33.3	20	43.3	32.2
AVERAGE	6.7	10	6.7	3.3
CONSIDERABLY	0	3.3	6.7	3.3
VERY MUCH	0	0	0	0
Question nº 2				
YES	96.7	96.7	96.7	96.7
NO	3.3	3.3	3.3	2.2
NS/NC[1]	0	0	0	1.1
Question nº 3				
NOT AT ALL	0	6.7	3.3	3.3
SLIGHTLY	10	0	13.3	7.8
AVERAGE	13.3	13.3	13.3	13.3
CONSIDERABLY	33.3	43.3	26.7	34.4
VERY MUCH	43.3	36.7	43.3	41.1
Question nº 4				
YES	96.7	96.7	96.7	96.7
NO	3.3	3.3	3.3	1.1
NS/NC	0	0	0	2.2
Question nº5				
YES	100	100	100	100
NO	0	0	0	0
NS/NC	0	0	0	0
Question nº6				
	0	0	0	0
Question nº7				
YES	76.7	83.3	63.3	74.4
NO	13.3	6.7	6.7	8.9
NS/NC	10	10	30	16.6
Question nº8				
Error data base	3.3	3.3	0	2.20
Error in your response	80	76.7	66.7	75.47
NS/NC	3.3	6.7	23.3	11.11
OTHER	13.3	13.3	10	12.21

[1]Don't know/No comment

Results

The questionnaire on the participants opinion of the program is shown in Figure 3. The results obtained in the three groups are described in Table 1, both overall and by group. The analysis of the questions 9-11 are described in Tables 2-4.

The results of this paper have been to implement an educational toll for treatments decisions in dentistry.

The opinion shows an good acceptance of the software. Almost all the answers said that it is easy to use, with a good interface, and could improve the teaching process. Only the student express more initial difficult because they have used less software dental aplication.

Table 2. Analysis of the response to question 9.

ADVANTAGES	FREQUENCY
Easy	38
Instructive	27
Clear	26
Useful	26
Enjoyable	18
Innovative	18
Rapid	20

Table 3. Analysis of question 10.

DEFECTS	FREQUENCY
Does not pick up all the treatment options	12
Need to have a computer	7
Slow	6
Pushing the "agree" button	3

Table 4. Analysis of question 11.

CHANGES	FREQUENCY
None	54
Expand themes	13
More images	4

Discussion

The majority of the decisions taken by dentists are fairly routine and often repetitive (3). One tool which can be used to help in this decision-making process is a computer program developed for this purpose, such as the one devised and studied here. Computer-assisted diagnosis consists of the application of computer technology to support the diagnosis of diseases. Computers can store and recover huge quantities of data and perform complex mathematical and logistic operations rapidly and accurately. In computer-assisted dental diagnosis, this ability to manage data is combined with algorithms ideally to produce diagnostic results of equivalent or superior accuracy to those produced by experts (4).

Computer-assisted diagnostic systems enable diagnostic data to be obtained more efficiently (5). Computers are an ideal means of supplementing the potential defects of the human memory in retaining and manipulating all the information necessary to produce a diagnosis.

An interactive tutorial, a computer-assisted diagnostic system, has been developed which could help in the teaching and education of dentistry students, as well as in continuous training for dentists (6). This is the basic objective of developing this computer program. As confirmed from the results, 100% of the participants stated that they would like to have this tool as an aid and 96.7% thought that it could be used to improve teaching.

According to Gordon (7), formulating diagnoses and treatment plans is a very variable and uncertain process, and is difficult to teach using traditional teaching methods; it is therefore necessary to create strategies to reduce complexity in decision-making (8). Computer-assisted teaching, regarded as a method of self-instruction, could be a useful alternative in decision-making, which would engage students in an interactive learning process (9).

Self-instruction allows students to learn at their own pace, creating a feedback mechanism for each individual according to the areas where the individual has the most problems, allowing him/her to go more slowly in those subjects and thus to be able to assimilate them better. Numerous studies have demonstrated that self-instruction is more efficient than lecturing in dental education, with the same or better academic development (10-12).

Apart from offering this mechanism for self-learning, these computer applications can meet other educational needs such as supporting theory classes and practical classes by the simulation of clinical cases, complementing the types of learning for each student, providing as examples rare and atypical cases which may arise in general practice, and all of this implies an increase in computing level (13). Students will also have the opportunity to give critical opinions and to solve clinical problems (14,15).

The efficiency of these learning programs can be questioned in view of the time necessary to develop them. Many hours of work and much effort have been invested

in configuring this program, mainly in the first two years after the start of the study. Once developed, it is easier to add more cases or to improve the quality of the various screens.

This program may be used repeatedly and at any time by students and teachers who so wish. This offers the advantage that it can be reviewed to reinforce information learnt by the students. The teaching staff can, however, if they so desire, design any theme they wish, increasing the efficiency and support capabilities of the program.

The procedure used to validate the program was based on other studies conducted to verify the validity of these computer programs, bearing in mind that these questionnaires are a reasonably good technique for ascertaining the opinions of each individual (16).

The intention was to perform McNemar's test to evaluate the significance of the differences between the response to the clinical cases before and after using the Asiodint 1.0 program and it was observed that SPSS Pc (+) software did not allow this because the second variable is a constant with the computer generating the same outcome for all 90 cases, showing that no statistical test can be performed.

It was found from the descriptive point of view that 100% of the participants thought that they would like to have this computer application as a support and 96.7% thought that it could be used to improve teaching. Similar results were obtained in a study conducted with medical students by Knapp (17).

Our program was designed according to these criteria with the aim of supporting decision-making in Integrated Dentistry, consequently it does not focus on a single theme or aspect of Dentistry. The program can store information on all areas and also has the advantage that themes from all areas of Dentistry will gradually be introduced. The user's attitude should be active in that he/she should gradually be choosing the different options according to the clinical case in question, and not acting as a mere spectator.

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