



## Original article

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## THE ADVANTAGES OF SPEED OF COMPUTERIZED MANAGEMENT OF A DENTAL CLINIC

### SUMMARY

Dental clinics are increasing the use of electronic computerized systems which contain digital card indexes of patients and enable computerized management, thereby replacing the traditional manual management. The systems have significant advantages, the most important of which is saving the time needed for performing administration and management jobs. The aim of the research was to determine the precise amount of time saved by using computerized management, compared to manual management of a dental clinic. Experimental study was used to measure the time spent in performing manual and computerized jobs of a dental clinic. The existing files of 500 patients were simulated including medical records, protocols, finances, reports and tabular appointments. All measurements were performed by two examiners independently, repeating the process twice. Statistical significance for significance threshold  $P < 0.05$  was tested using Student's t-test for independent samples. The greatest saving of time in separate jobs was obtained in creating a three-month ZLUZ service (service for oral protection and treatment) report and it amounted to 42 minutes and 31 seconds, whereas the least time saved, 6 seconds, was in filing an appointment. The only negative saving of 2 seconds was obtained in filing a radiographic image. The other jobs include saving of 12 minutes and 28 seconds for doctor's performance of monthly report and up to 11 seconds for creating a new medical record. Statistical analysis has confirmed that for  $P < 0.05$  there is a statistically significant difference between computerized and manual management. There is a great time gain in computerized management of dental clinic and it amounts to over 16 working hours a month. This type of management has other advantages which primarily refer to the quality of service, charging efficacy, reduced complexity in performing jobs, improved competence and self-confidence of the employees.

*Key words:* computerized dentistry, computerized management, electronic medical record, software, documentation

### INTRODUCTION

Dental informatics represents the application of computers and informatics in improving dental practice, research, education and management. Lately, dental clinics have increased the use of electronic computerized medical records of patients

which have replaced previous manual management (1). Computerized management of a clinic is composed of two elements: research and practical application at the clinic. The research element is a consequence of examining and assessing data from the created base during quality application of the system in practice (2). Compared to computerized

system, manual management of the clinic possesses numerous shortcomings, though there are also certain advantages. The benefits of computerized management include speed, low price, efficacy, documented advice, minimized occupancy, simultaneous access to several doctors or users, asynchrony (3). Major potential disadvantages are: the necessity of training and technical requirements. Although the superior speed of digital systems is obvious, there are no clinical studies in our country that show the exact time saved by applying these systems compared to traditional manual methods (4-6). Saving time represents a direct financial gain of a dental clinic. As the use of computers in dental practice has become more common but still far from complete (in 2007, Schleyer showed that only 25% of dentists in the United States used computers for managing their clinics) (7), it is necessary to know the exact advantages of using the computerized management in terms of saving time which can easily be calculated as working hours and money saved, which would provide an additional motive for dentists to apply this technology in their work. Also, the dental community will benefit greatly because it will be able to analyze the obtained data for the purposes of scientific researches. The aim of this paper was to determine the advantages in speed and saving of working hours by computerized management of a clinic.

#### MATERIAL AND METHODS

An experimental study lasted from May to September 2009 at two dental clinics in Niš and Belgrade. A comparative measurement of manual and computerized management of a clinic was performed. In computerized management, PC computers were used with the following features: Pentium DuoCore, 3GB RAM, 250GB HDDF, ATI Radeon, HD 4350 512MB, Microsoft Windows XP operative system SP3 (USA) and software for digital filing in dentistry: XPA3 Prolom (Serbia), version 5.0.2.0. Two examiners with more than two years of experience with Prolom software performed computerized management, whereas manual jobs were performed by two examiners with more than 5 years of experience. Time was measured by Timex Marathon Stopwatch T5G811. Documents were printed on a laser printer HP LaserJet 1020. The study was performed by simulating the already existing files of clinics with 500 patients, including the medical records, protocols, finances, reports and tabular appointments. Randomized input of 20 cases was used for the examination of infectious diseases notification because there were no such cases among the clinic files. All measurements were independently performed and repeated twice by two

examiners. Mean values were obtained from the results and then set as the basis of the results. Monthly saving per separate job repeated several times during the day (daily frequency) was obtained according to the formula:

$$\text{Monthly saving} = \text{Daily frequency} * \text{Saving per job} * \text{Number of work days}$$

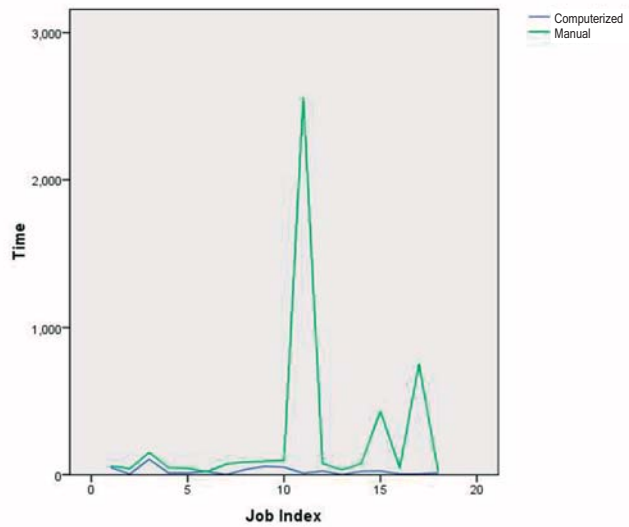
The number of work days was 24. The results were entered in Microsoft Excel 2003 software and processed by MedCalc software version 9.2.0.1. Statistical significance for  $P < 0.05$  was tested by Student's t-test for independent samples.

#### RESULTS

The computerized procedure of creating a medical record lasts for 49 seconds, whereas the same procedure performed manually lasts for 60 seconds. Finding the record in the documentation with computer takes 4 seconds whereas manual search is ten times longer and takes 41 seconds. Computerized documentation of dental status lasts for 1 minute and 45 seconds while manual documentation takes 2 minutes and 30 seconds. Filing the diagnosis in the medical chart, including the text of the diagnosis, graphic marking and coding according to the international classification of diseases 10th revision, takes 12 seconds if performed by a computer and 49 seconds if done manually. Introducing the therapy into the chart along with the text, graphics and service code lasts for 12 seconds on a computer and 44 seconds manually. Computer needs 22 seconds to load radiographic documentation from a CD, while adjoining the radiographic documentation on a film to the patient's chart takes 20 seconds. According to the documentation of diagnosis, therapy or medical notice, the software creates a note of patient's protocol so that the time needed for this operation is 0 seconds, whereas manual input takes 1 minute and 12 seconds. Filling in a referral to specialist by the software with laser printer takes 35 seconds while manual process takes 1 minute and 27 seconds. Filling in a specialist report by a computer with laser printer takes 58 seconds whereas it takes 1 minute and 31 seconds to fill in the report manually. Filing an infectious disease by a computer with printing takes 51 seconds, while manually it takes 1 minute and 37 seconds. Computer needs 10 seconds to create a three month ZLUZ service report (service for oral protection and treatment) while manual process lasts for 42 minutes and 41 seconds which is 256 times longer. Financial statement and billing take 25 seconds if done on a computer, but if performed manually the process takes 1 minute and 16 seconds. The computer automatically files the bill into the

taxpayers' book so this operation takes 0 seconds while manual filing takes 33 seconds, and it is also necessary to add up the amount after 13 inputs which takes 1 minute and 29 seconds with triple check. Computerized filling in and printing of billing form takes 23 seconds while manual operation takes 1 minute and 15 seconds. Computer needs 25 seconds to create and print a monthly financial report; manually, the process takes 7 minutes and 9 seconds. Computer provides a debtors report in 5 seconds, manual process takes 45 seconds. Computer can calculate dentist's output in 5 seconds while an operator needs 12 minutes and 33 seconds to do this manually. Making appointments by computer takes 11 seconds, manually, it takes 17 seconds. *Table 1* shows the results of comparative measurements.

*Figure 1* visualizes the speed ratio between computerized and manual management according to *Table 1*.



*Figure 1. Graphic representation of the relationship between computerized and manual management according to results in Table 1.*

*Table 1. Measured median time needed for performing computerized and manual procedures expressed in seconds*

Type of work	Computerized	Manual	Saving
Creating a new medical chart	49	60	11
Finding a chart in the documentation	4	41	37
Documenting a status	105	150	45
Entering a diagnosis in a chart (text, graphics, icd)	12	49	37
Entering a therapy in a chart (text, graphics, code)	12	44	32
Entering a radiographic image in documentation*	22	20	-2
Filing a patient's protocol	0	72	72
Referral to a specialist**	35	87	52
Specialist report**	58	91	33
Infectious disease notification**	51	97	46
Three month ZLUZ report	10	2561	2551
Cost and billing**	25	76	51
Filing a bill in taxpayers' book	0	33	33
Filling in a payment request**	23	75	52
Monthly financial report**	25	429	404
Debtors report	5	45	40
Doctor's performance monthly report	5	753	748
Filing an appointment	11	17	6
<b>TOTAL:</b>	<b>452</b>	<b>4700</b>	<b>4248</b>

\* Computerized process includes an input from a CD while manual process includes an input from rtg foil.

\*\* Computerized process includes laser printing.

*Table 2* shows jobs, calculated saving in seconds per job, daily job repetition frequency (obtained as median values from clinic's protocols) and time saved per job monthly, with 24 working days a month as basis, according to the formula for calculating monthly saving.

Statistic analysis of results obtained by Student's t-test for independent samples determined that there is a statistically significant difference for  $P < 0.05$  between computerized and manual management of jobs at a dental clinic.

Table 2. Monthly saving per job in seconds and total monthly benefit in minutes

Job	Time saved in seconds	Daily frequency	Time saved in minutes	Time saved in %
Filing a patient's protocol	72	9	259.2	26.33
Finding a chart in the documentation	37	9	133.2	13.53
Entering a therapy in a chart	32	9	115.2	11.70
Entering a diagnosis in a chart	37	7	103.6	10.52
Documenting a status	45	5	90	9.14
Cost and billing	51	4	81.6	8.29
Filing a bill in taxpayers' book	33	4	52.8	5.36
Filling in a payment request	52	2	41.6	4.23
Specialist report	33	2	26.4	2.68
Creating a new medical chart	11	5	22	2.23
Filing an appointment	6	8	19.2	1.95
Three month ZLUZ report*	2551		14.17	1.44
Doctor's performance monthly report**	748		12.46	1.27
Monthly financial report**	404		6.73	0.68
Referral to a specialist	52	0.3	6.24	0.63
Debtors report	40	0.16	2.56	0.26
Infectious disease notification	46	0	0	0.00
Entering a rtg image in documentation	-2	3	-2.4	-0.24
		<b>TOTAL</b>	<b>984.56</b>	<b>100.00</b>

\*Time saved in three months so the monthly benefit is obtained by dividing the saving into three parts.

\*\*Time saved in one month so the monthly benefit is expressed in minutes.

## DISCUSSION

The use of computers with powerful specialized dentistry software (Figure 2) provides more speed in managing a dental clinic as opposed to manual management.

Although the sum of separate job measurements shows the ratio of 452:47.000 (Table 1) in favor of computerized system which is 10 times faster, it should be kept in mind that the frequency of repetition of these jobs at the clinic is not equal, i.e. the ratio is not 1:1. For example, creating a new medical chart or similar jobs, which are repeated several times a day have a greater frequency than some other jobs such as creating a three month report. Thus, monthly saving for a separate job which is repeated several times a day is obtained from daily job frequency, time saved per job and a number of work days, and it is calculated according to the monthly saving formula.

When a new medical chart is created, the ratio between computerized and manual job is 49s : 60s, i.e. 11 seconds are saved. If we consider the daily frequency of this job with a median value of 5 and 24 working days a month, we will have the following monthly gain:

$$\text{Monthly saving} = 5 * 11 \text{ s} * 24 \text{ days} = 1320 \text{ seconds} = 22 \text{ minutes}$$

Total saving per month is 984.56 minutes, i.e. 16 hours and 25 minutes. The greatest part of this time saving, 259 minutes and 12 seconds (26.33%) is obtained from filing the patients' protocol. This job is performed by the computer at runtime, in other words, the protocol is created dynamically, based on patients' charts so in this case the saving is 100% compared to manual process. Negative saving, i.e. increase in time needed for a job occurs when documenting a radiographic image with additional time consumed, which amounts to 2 minutes and 24 seconds a month. Figure 3 shows the involvement of separate jobs in monthly benefit.

From the facts presented here, it can be seen that two work days (8 hours each) more are spent in managing a clinic manually compared to computerized management.



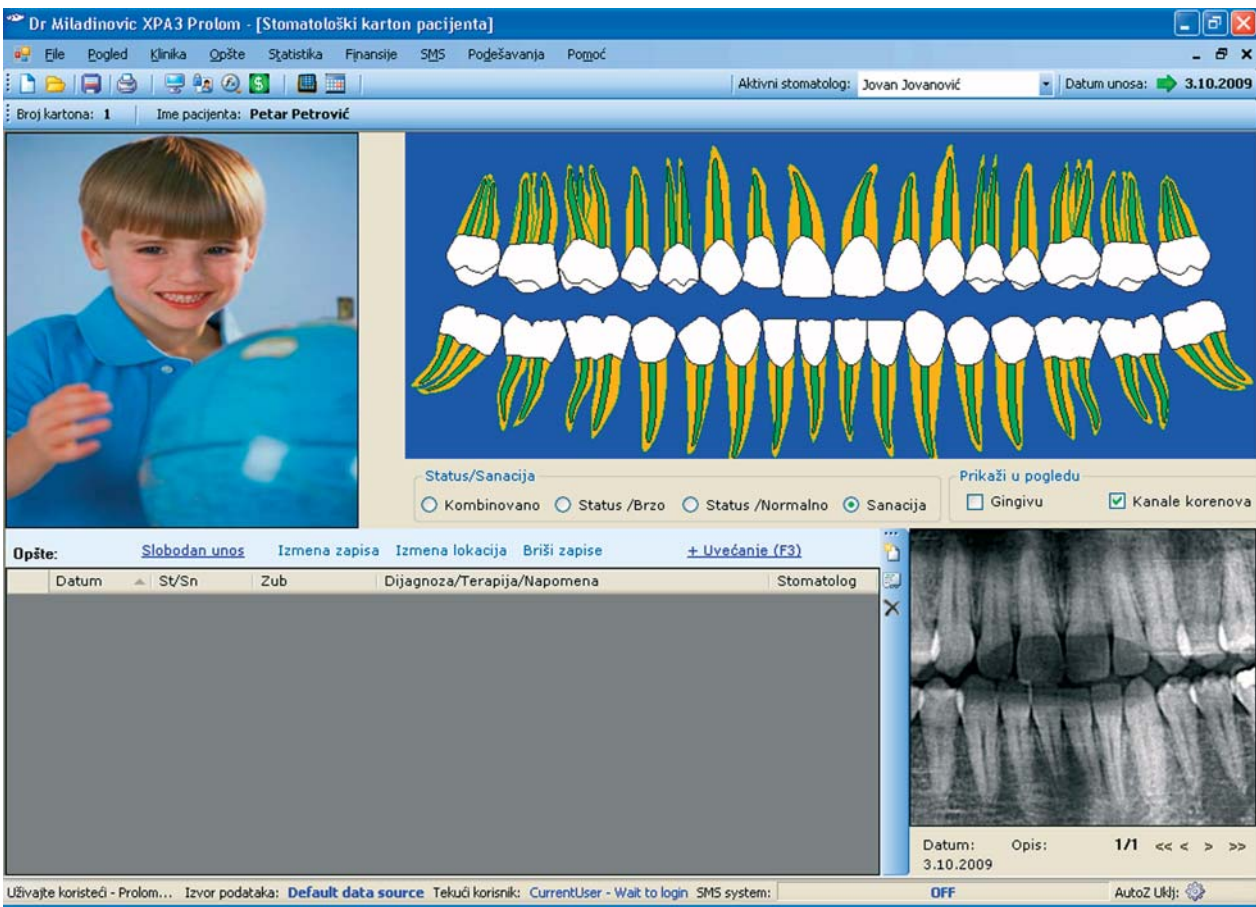


Figure 2. Electronic medical record in digital documentation of patients created by XPA3 Prolom software for dental clinic management

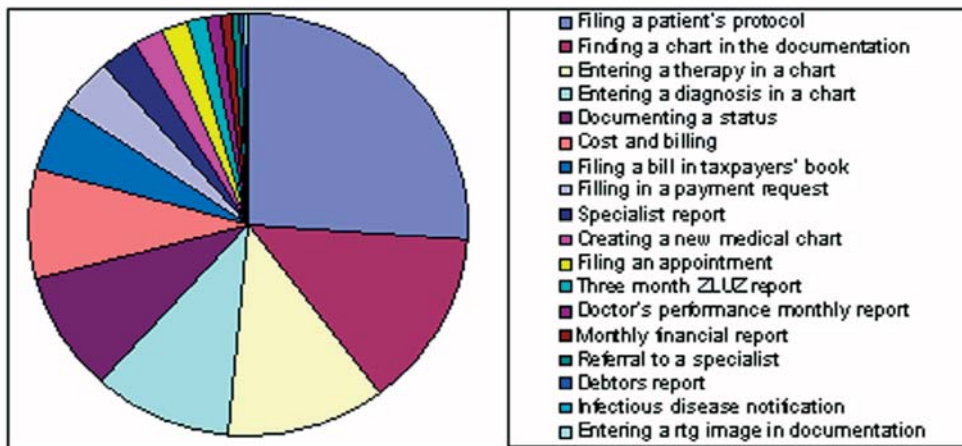


Figure 3. Jobs participation in total time saved per month

Other authors provided important advantages of computerized clinics. Gillette et al. (5) state that the benefits of insurance charging speed and high quality documentation contribute to optimal health care. The advantage of computerized documentation and clinic management has brought great interest in forming separate branches, teams and magazines which explore this area, such as: EDB section of American Dental Association, or magazines: The Journal of Evidence-Based Dental

Practice, or data base: Trip Database (8). Frideres et al. (9) state the results of their research where dentists and other employees through questionnaires or practical work report great advantage of computerized management including the calculated financial gain but also the improved competence and self-confidence of the whole team, which is in accordance with our results. Without stating the exact time saved, Freydborg (10) reported that computerized method can speed up the input and

reproduction of images, help follow the patients' conditions and improve the speed and quality of diagnosing, as well as make therapy planning more efficient, which is also in accordance with our results. Benn (11) stated that computers are ideal for gathering diagnostic data from patients and automating the process of planning the necessary therapies, whereby they reduce the complexity and time needed for the management of a clinic. In his research, Anderson (12) stated that every doctor's office should possess good software for computerized management and that no practice should be based on manual performance. Thus, the software represents the heart and arteries, and it is impossible for a dental clinic to take good care of its patients without them.

Automated process of computerized management and replacement of paperwork in healthcare has great significance for dentists and patients, but also for administrators and managers (13). However, the present state which considers the level of distribution of computerized management in Serbia is not representative (14). Although there are no exact data concerning the percentage of computerized clinics in our country, it is certain that the number is small. In accordance with the needs of dental care of patients and great benefits obtained

from computerized management of clinics, both dentists and the state should give more support to this sector with the major aim of uniting the computerized dental management at on the level of state through an online system such as XPA3 Online or similar.

## CONCLUSION

There is a large amount of time gained when computers are used in the management of a dental clinic. The gain amounts to over 16 working hours, i.e. 2 work days on a monthly level. Besides saving time, the new way of managing a clinic offers other advantages which primarily concern the quality of services, effective charging, and reduced complexity of jobs, but also improved competence and self-reliance of employees.

The aim should be to increase the number of clinics with computerized management and to unite the computerized process at state level through an online system.

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## REFERENCES

1. Mihailović B, Miladinović M, Mladenović D, Lazić Z, Janković A, Živković D, Vujičić B. *Kompjuterizovana stomatologija. Obeležja*, Beograd 2009.
2. Bader J, Ismaili A, Clarkson J. Evidence-based dentistry and the dental research community. *J Dent Res* 1999;78(9):1480-3.
3. Mihailović B, Duka M, Miladinović M, Mladenović D, Janković A, Živković D, Vujičić B. *Primena Interneta u stomatologiji*. PONS 2009. In Press.
4. Gillette J. Striving for excellence with evidence-based dentistry. *J Evid Based Dent Pract*. 2009 Sep;9(3):125-8.
5. Gillette J, Matthews JD, Frantsve-Hawley J, Weyant RJ. The benefits of evidence-based dentistry for the private dental office. *Dent Clin North Am* 2009;53(1):33-45, viii.
6. Aravamudhan K, Frantsve-Hawley J. American Dental Association's Resources to Support Evidence-Based Dentistry. *J Evid Based Dent Pract* 2009;9(3):139-44.
7. Schleyer T, Spallek H, Hernández P. A qualitative investigation of the content of dental paper-based and computer-based patient record formats. *J Am Med Inform Assoc* 2007;14(4):515-26.
8. Gillette J. Evidence-based dentistry for everyday practice. *J Evid Based Dent Pract* 2008;8(3):144-8.
9. Frideres T, Gillette J. Evidence-based dentistry professional development and training for the dental office team. *J Evid Based Dent Pract* 2009;9(3):129-34.
10. Freyberg B. Digital esthetic connection. *Alpha Omegan* 2006;99(3):113-4.
11. Benn DK. Applying evidence-based dentistry to caries management in dental practice: a computerized approach. *J Am Dent Assoc* 2002;133(11):1543-8.
12. Anderson LH. Integrated office technology: how technology can help improve office efficiency. *J Am Dent Assoc* 2004;135 Suppl:18S-22S.
13. Williams F, Boren SA. The role of the electronic medical record (EMR) in care delivery development in developing countries. *Inform Prim Care* 2008;16(2):139-45.
14. Mihailovic B, Duka M, Miladinovic M, Golubovic I, Vujicic B. Computerized oral surgery. *Acta Fac Med Naiss* 2009;26(2):93-9.

## PREDNOSTI BRZINE KOMPJUTERIZOVANOG UPRAVLJANJA STOMATOLOŠKOM AMBULANTOM

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### SAŽETAK

Stomatološke ambulante sve više koriste elektronske kompjuterizovane sisteme koji sadrže digitalne kartoteke bolesnika i omogućuju kompjuterizovano upravljanje poslovima, čime zamenjuju tradicionalno ručno vođenje. Ovi sistemi poseduju bitne prednosti, a jedna od glavnih je ušteda utrošenog radnog vremena za obavljanje upravljačkih i administrativnih obaveza. Cilj ovog istraživanja bilo je o dređivanje tačnog vremenskog skraćenja koje donosi kompjuterizovano upravljanje nad ručnim upravljanjem stomatološkom ambulantom. Urađena je eksperimentalna studija, izvršeno je merenje ručnog i kompjuterizovanog obavljanja poslova ambulante. Simulirane su postojeće evidencije ambulanti za 500 bolesnika, sa uključenim kartonima, protokolima, finansijama, izveštajima i tabelarnim zakazivanjima. Sva merenja su nezavisno uradila po dva ispitivača, ponavljajući ih pritom po dva puta. Statistička značajnost za prag značajnosti  $P < 0.05$  ispitana je Studentovim T testom nezavisnih uzoraka. Najveću uštedu po pojedinačnom poslu donosi kreiranje tromesečnog izveštaja službe za ZLUZ i iznosi 42 minuta i 31 sekundu, dok najmanju daje evidentiranje zakazanog termina, 6 sekundi. Jedinu negativnu uštedu daje unos radiografskog snimka i ona iznosi 2 sekunde. Ostali poslovi ulaze u rang uštede od 12 minuta i 28 sekundi za mesečni izveštaj učinka po lekaru, do 11 sekundi za otvaranje novog kartona bolesniku. Statističkom analizom utvrđeno je da za  $P < 0.05$  postoji statistički značajna razlika između kompjuterizovanog i ručnog upravljanja. Postoji velika vremenska dobit kompjuterizovanog upravljanja stomatološkom ambulantom i iznosi preko 16 radnih sati u mesecu. Postoje i druge prednosti ovakvog načina vođenja ambulante, a koje se pre svega tiču kvaliteta pruženih usluga, efikasnosti naplate, smanjenja kompleksnosti izvršenih poslova, poboljšanja kompetencije i samopozdanja osoblja ambulante.

*Ključne reči:* kompjuterizovana stomatologija, kompjuterizovano upravljanje, elektronski stomatološki karton, Softver, evidencija