Examination, diagnostic chart, and computer – aided diagnosis of partially edentulous patient

Nadira A HATIM*
Reem A AL-JARAH**
Anhar Kh AL-QADDO***

ABSTRACT

Examination and diagnostic charts of previous studies had concentrated on certain factors and ignored others, which affect on the suggestion and sequence of sound treatment plans besides that several different computer programs have been developed to aid in dental decision making.

The goals of this paper were to prepare a diagnostic chart especially for partially edentulous patients, that help dentists make decisions in terms of diagnosis and treatment planning by using visual basic version 5.0 to design a special program for this study to improve patient care by helping the dentist make better decisions in vastly increasing field of knowledge in dentistry to help dentist for future research about the most popular and complex diseases and how to treat it, to help other Ministries, Ministry of higher education, and Ministry of health and special clinician in the application of Removable Prosthetic Diagnostic computer Program (RPDcP).

A program was designed specially for this study by using visual basic version 5.0. This program contains (41) program forms, (255 fields) of examination and diagnosis of partially edentulous patients. The program was applied clinically. The results were statistically analyzed by using principal component analysis and linear combination to explain the whole variation to the original data.

The program had capabilities of production, storage, retrieval, scanning, browsing to permit integration of other documents or pictorial representations.

Key Words: Computer-aided diagnosis, partially edentulous patients, fixed and removable prosthesis.

الخلاصة

يهدف هذا البحث إلى تحضير جدول بياني يحتوي على معلومات خاصة بفحص وتشخيص الحالات السريرية لمرضى يعانون من فقدان جزئي للأسنان يساعد طبيب الأسنان في تشخيص الحالة واستنتاج خطوات العلاج المقترحة لغرض تنفيذها. تم تصميم برنامج حاسبي (RPDcP) باستعمال نظام (Visual Basic version 5.0) أعد خصيصا لهذه الدراسة لاتخاذ القرارات الواسعة في حقل المعرفة

*Nadira Abdul-Ridha HATIM; BDS, MSc: Assistant Prof. Department of Prosthetic Dentistry, College of Dentistry, University of Mosul, Mosul, IRAQ.

**Reem Ali AL-JARAH; BSc, MSc: Assistant Lecturer. Department of Basic Sciences, College of Dentistry, University of Mosul, Mosul, IRAQ.

***Anhar Khairuldin AL-QADDO; BSc: Assistant Researcher. College of Administration and Economy, University of Mosul, Mosul, IRAQ.

في علم طب الأسنان، واعتماده في الدراسات البحثية المستقبلية من خلال تصميم برنامج إحصـــائي خـــاص بهذه الدراسة، ومساعدة المؤسسات البحثية والصحية والتعليمية الأخرى في تخصص صناعة الأسنان.

يحتوي النظام على (٤١) شاشة و (٢٥٥) حقلا فيما يتعلق بفحص وتشخيص الحالات الســـريرية، وقد تم تطبيق هذا النظام على المرضى المراجعين لمستشفى صدام الجامعي -كلية طب الأسنان-جامعـة الموصل.

يتصف هذا البرنامج بالسرعة، الخزن، الاسترجاع، العرض، السماح بإضافة أو إلغـاء المعلومـات لبعض الحالات، أو إدخال حالات جديدة كاملة، مع إظهار صور توضيحية لحالات سريرية.

INTRODUCTION

Computers were used to help dentists make decisions in terms of diagnosis and facilitate the productive use of knowledge and information in making decisions about patient management and treatment through advancing technology and individualization of information. [1,2,3]

Inspite of the interest in dental cases documentation in different branches of dentistry, there is still a marked defect in the way of documenting these cases. Since there is no perfect general program that covers all the available information in one chart to give specific diagnosis and suggested treatment or treatments [4]. Several computer programs have been developed to aid in medical decision making. However, few are available for use in dentistry [5]. One of the mean causes of these defects is that, we have no a qualified computer documantion system in Iraq.

So the goals of this study are: -

1. To prepare a diagnostic chart especially for partially edentulous patients.
2. To help dentists make decisions in terms of diagnosis and treatment planning by using visual basic version 5.0.
3. To improve patient care by helping the dentist makes better decisions in vastly increasing field of knowledge in dentistry.
4. To help dentist for future research about the most popular and complex diseases and how to treat it.
5. To help other Ministries (Ministry of higher education, and Ministry of health) and special clinician in the application of Removable Prosthetic diagnostic computer program.

MATERIALS AND METHODS

A new chart was designed using a computer with speed not less than 133 Megahertz, and by using system Visual basic version 5.0 [6,7,8,9] containing 41 program forms (255 fields) of examination and diagnosis including the follow: -

1. Case history (Figure 1).
2. Extra-oral examination.
3. Intra-oral examination (Figure 2).
4. Radiographic interpretation (Figure 3).
5. Cast on surveyor (Figure 4).
6. Cast on articulator.
7. Kennedy classification.
8. Design chart.

9.Cost and prognosis of the case.

10.Date of starting treatment, operator and supervisor names.

This system was applied using information and data taken from patient's files available in the department of prosthodontics-College of Dentistry-University of Mosul.

In order to evaluate this chart, principal components analysis was used. This analysis aims to find the factors or linear combinations called the principal components which are derived (less than the original variables) to take its place and to be able to explain the whole variation to the original data [10,11].

Statistical analysis (Eigen value) was done for the data presented in the previous chart to follow what was done in this test, the correlation matrix (after standardized variables were analyzed) that is we first subtract the mean and divide the standard deviation of each variable [10,11,12,13]. The properties of RPDcP prepared for this study are:

1.High speed to reach limits.

2.Easy to survey or evaluate data according to sex or age groups.

3.The program forms are designed in such simple way that it can be used easily.

4.General and individual statistics can be done in the form of tables or histograms without the need to use ready systems such as Minitab, or SPSS systems.

RESULTS AND DISCUSSION

The chart prepared in this study is more universal in the information used in relation to previous studies, which concentrated on certain factors and ignored others. Results showed a range of percentage of loss of variables from 34% to 100% as shown in table (1) and figure (5) results are in agreement with other studies. [14,15,16,17,18,19,20,21]

The output tells us that the first principal component has variance (Eigen value) 3.9613 which accounts for 19.8% of the total variance tables (2) and (3). The coefficients are listed under (PC1), this mean that:

PC1= +0.048 Sex +0.063 Age + 0.031 Sever illness + ... + 0.037 Size.

Similarly the other principal components. Therefore, the variables taken as shown previously are not enough where ever the variation amount of principal components 19.8 of the total variance.

The results of intra-oral examination represented abutment teeth with and without conservative treatment that was not mentioned before in previous studies that may affect the design markedly. Also radiographic interpretation concerning crown root ratio was used in this study. These results agree with other studies [22,23] who suggested that the practitioner must develop and sequence a sound treatment plan based on clinical and radiographic evidence.

Another important factor used in this study was the data obtained after surveying such as height of contour, undercut measurements, and other data which aid in deciding the tooth preparation suggested to obtain better partial denture design. [24,25,26,27,28,29]

Mounting the cast on an articulator gives an idea about the occlusion, interference area, available space for artificial teeth, and position of teeth. [30]

Clinical applications of RPDcP provide dentists with convenient access to a comprehensive body of knowledge to support clinical decision making in the area of removable partial prosthodontic treatment.

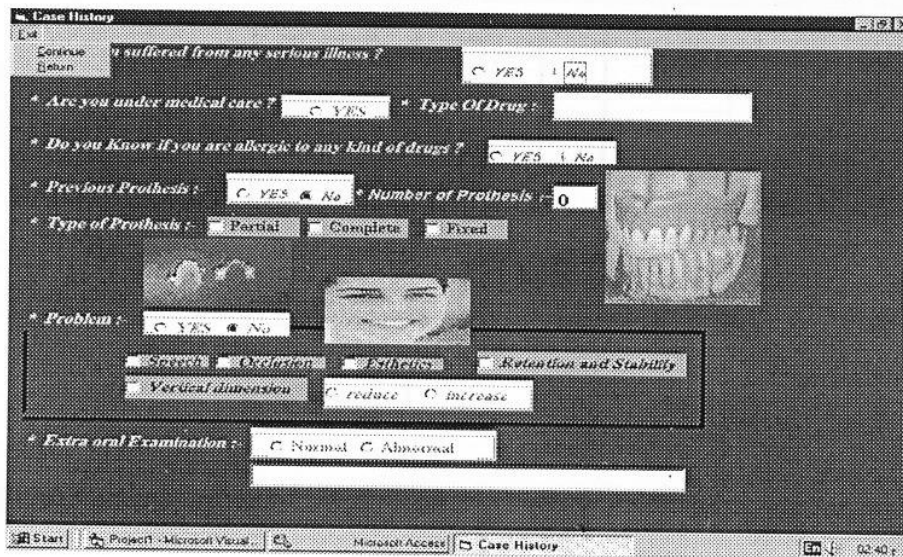Facilities of RPDcP are in agreement with other studies. [5,31,32,33]
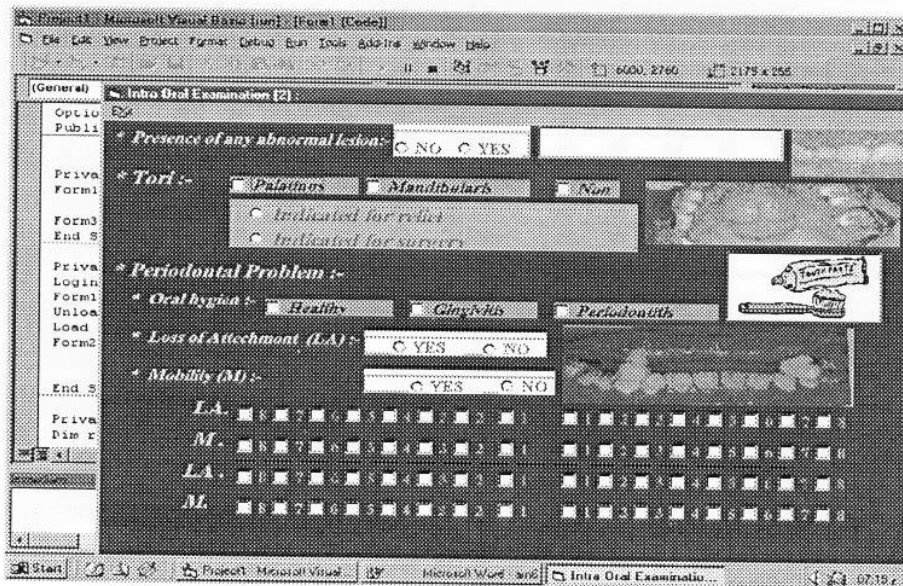
Figure (1): Program form of case history no.1

Figure (2): Program form of intraoral examination

Figure (3): Program form of radiographic interpretation

Figure (4): Program form of cast on surveyor

Table (1): Loss of Data Variables in Diagnostic and Examination Chart.

	Case 1	Case 2	Int. 1	Int. 2	Int. 3	Rad. 1	Rad. 2	C.S. 1	C.S. 2	C.A.	K.C.	Des.	Prog.	N.D.
Grant 1983	86%	0.0%	83%	40%	50%	100%	100%	100%	100%	0.0%	100%	100%	50%	100%
NEILL 1983	0.0%	75%	0.0%	0.0%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Osborne 1986	86%	87%	83%	60%	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Kratochvil 1988	86%	87%	67%	40%	50%	100%	50%	100%	100%	100%	100%	100%	50%	34%
McCracken 1995	29%	38%	100%	100%	100%	0.0%	0.0%	100%	100%	100%	0.0%	0.0%	50%	0.0%
Case sheet Mosul 200	86%	87%	0.0%	0.0%	100%	100%	100%	100%	100%	100%	0.0%	0.0%	100%	67%
RPDeP 2001	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Case 1:Program form of case history number 1.
Case 2:Program form of case history number 2.
Int.1, 2,3: Program form of intraoral oral examination number 1,2, & 3.
Rad.1, 2: Program form of radiographic interpretation 1 & 2 .
C. S.: Program form of cast on surveyor 1 & 2.
C.A.: Program form of cast on articulator.
K.C.: Program form of Kennedy classification.
Des. : Program form of design of removable partial denture.
Prog.: Program form of prognosis of the clinical case.
N.D.: Program form of number and date of starting treatment of the patie

Table (2): Linear Combinations of Variables in case sheet of removable partial   used in Department of Prosthodontics 2000.

VARIABLES	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10
SEX	-.048	-.218	-.271	-.268	.417	.130	-.057	-.291	-.173	.139
AGE	-.063	-.098	-.023	-.029	.272	.554	-.596	.049	.179	.-027
SER. ILL.	.031	-.055	.057	.623	-.292	.117	-.117	.088	.023	-.081
MED. CARE	.182	-.117	-.095	-.505	-.101	-.192	-.107	.072	.300	-.245
HOS.	-.213	-.043	.005	-.27	-.429	.116	-.286	-.207	-.002	-.354
TOOTH POS.	-.026	-.027	.296	-.250	-.469	.256	-.075	-.207	-.309	.280
NO. MISS.	.317	-.305	.107	.037	-.107	.028	-.210	.089	.101	-.166
CARIES	-.432	-.048	-.031	.127	.033	-.124	-.009	-.079	-.022	.041
BE EXT.	.239	.148	-.072	-.036	-.205	-.230	-.497	.009	.113	-.140
SO. TIS.	-.243	.290	-.143	-.154	.067	-.242	-.183	-.213	-.449	-.103
ABN. LES.	.29	.013	.112	0.0	.011	-.101	-.50	-.119	-.305	-.543
TORI	.303	-.063	-.140	-.155	-.215	-.015	-.110	-.060	.022	.389
L.A.	.381	-.175	.028	-.068	-.017	.108	-.044	.126	-.061	-.173
M.	.408	-.163	-.049	-.025	.137	.097	-.121.	.088	-.013	-.146
LUCAT.	-.049	-.217	.565	-.044	.214	-.004	-.115	.231	.009	-.086
CLASS.	.023	.377	.103	-.159	-.049	.495	-.190	.307	-.143	-.152
MOD.	-.048	-.453	-.309	.006	-.039	-.052	.231	-.079	-.105	.285
KIND	-.104	-.025	-.251	-.154	-.078	-.162	.181	.717	-.467	.138
DESIN	-.074	-.348	.451	-.119	.271	-.169	.071	.077	-.234	-.080
SIZE	.037	.380	.248	-.105	.006	-.291	.179	-.199	.345	.128

These facilities include:

1-Ease of retrieval of any data at any time.

2-Statistical analysis of both personal and general frequency can be obtained.[2,3,9,34]

- Personal frequency: this program helps in scheduling the recorded case individually according to any suggested title such as age, sex, number of extracted teeth. . . . etc.
- General frequency: this program helps in scheduling the recorded cases collectively about the followings:

  A- Frequency of sex and age groups for all patients.

  B- Frequency of systemic considerations.

  C- Frequency of missing teeth (as a sum for all patients).

  D- Frequency of tooth position.

  E- Frequency of type of tori.

  F- Frequency of loss of attachment.

  G- Frequency of mobility.

  H- Frequency of all types of Kennedy classification (Maxillary and Mandibular arch collectively, and separately).

3-Browsing record capabilities about missing and carious teeth according to each tooth itself, its number, and position in the arch as follows: -

  A-Frequency and percentage of missing teeth for each tooth.

  B-Frequency and percentage of carious teeth for each tooth (table 4).

  C-Histograms for missing teeth.

  D-Histograms for carious teeth.

4-This program can be used as a data base from which further new researches can be obtained and statistically analyzed using a specific factor for each variable, such as sex, and age groups e.g. 10-19year, 20-29 year. etc. In addition to pictorial representations indicating sex, and age groups.

5-Also, we can retrieve a file to add, delete, or change data and save these changes according to alphabetical sequence.

6-We can add new records of new patients.

7-We can delete records of certain patients completely for any reason such as death.

8-We can use this computer program for teaching purposes keeping in mind the legal and security measures.

9- Help in research, statistical analysis according to the selected variables.

CONCLUSION

1- New universal partially edentulous examination and diagnostic chart was prepared.

2- Principal component of the previous charts account of 19.8%.

3- Removable Partial Diagnostic computer Program was designed specially for this study.

4- RPDcP can be applied clinically with high facilities :

- Ease of retrieval.
- Help in making personal and general frequency test of all variables.
- Browsing record illustrated with histogram.
- Can be used as data base for farther researches.
- Can retrieve files to add, delete, and change some according to alphabetics.
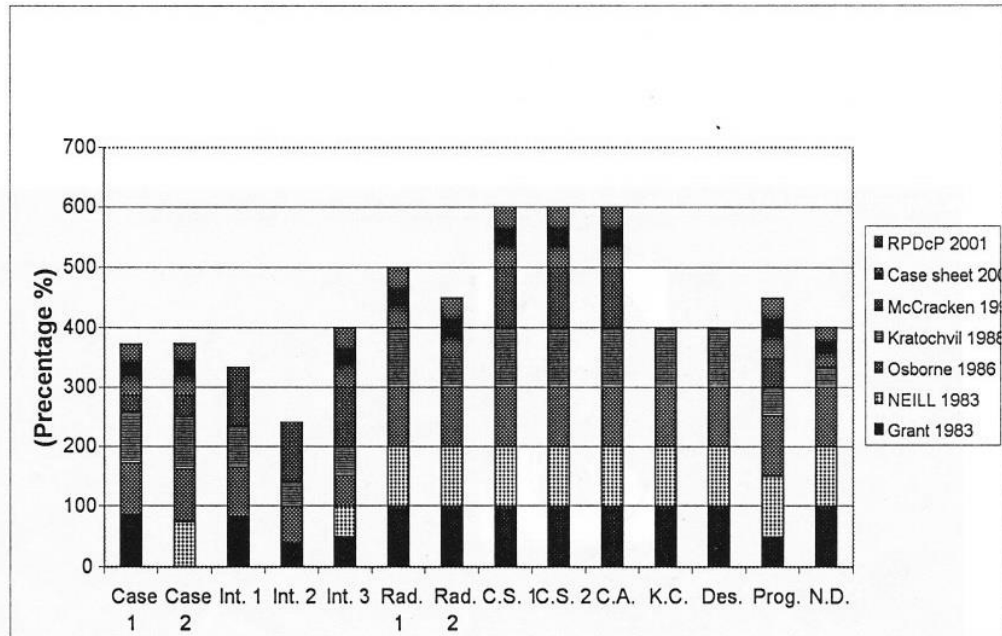- Help for farther researches.

Figure (5): Percentage of absence of variables in diagnosis and examination chart.

	PC1	PC2	PC3	PC4	PC5
Eigen value	3.9613	1.9339	1.7475	1.5216	1.4294
Proportion	0.198	0.097	0.087	0.076	0.071
Cumulative	0.188	0.295	0.382	·0.458	0.530

	PC6	PC7	PC8	PC9	PC10
Eigen value	1.1184	1.0346	0.9613	0.8226	0.7943
Proportion	0.056	0.052	0.048	0.041	0.040
Cumulative	0.586	0.637	0.685	0.727	0.766

Table (3): Principal component analysis of the variables in the
diagnostic chart used in the department of prosthodontics.

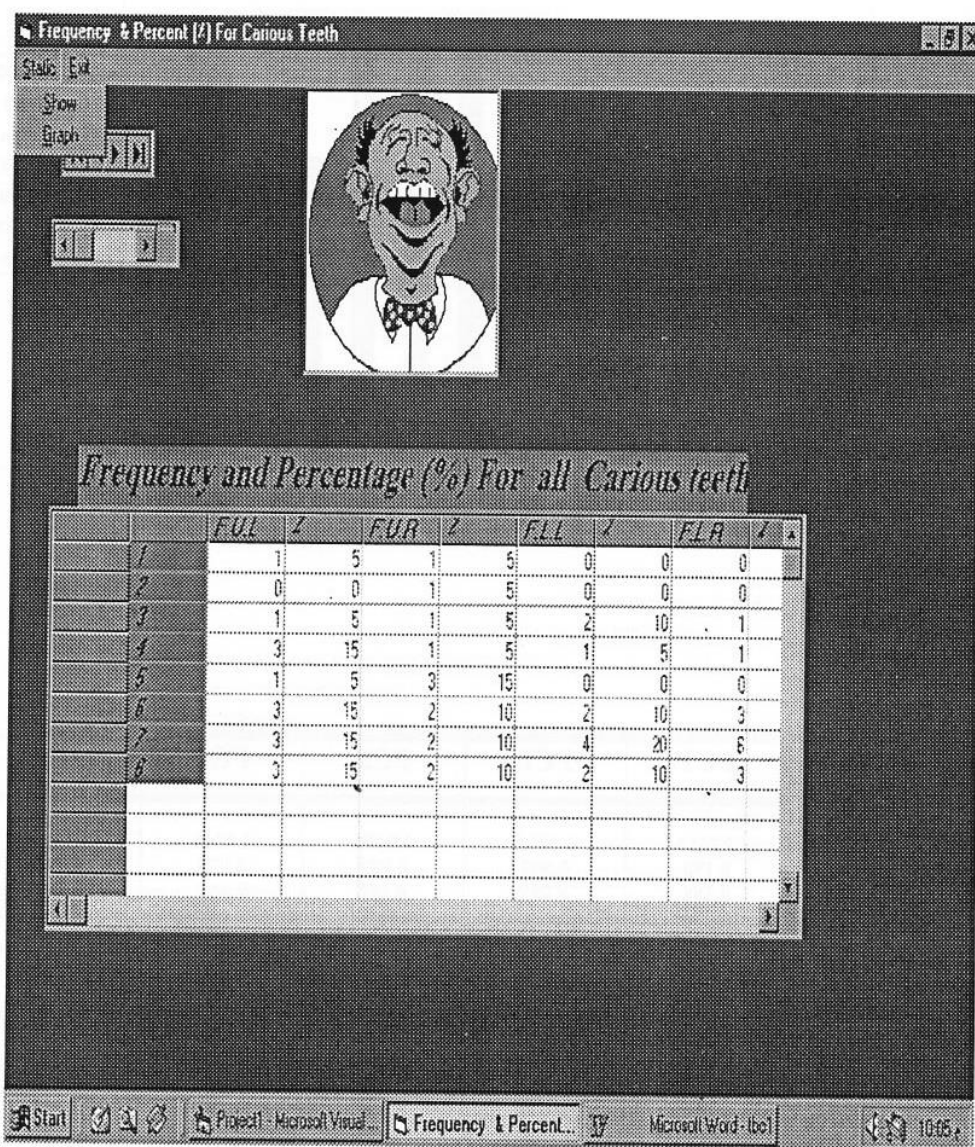|		FUL	Z	FUR	Z	FLL	Z	FLR	Z
1		1	5	1	5	0	0	0	
2		0	0	1	5	0	0	0	
3		1	5	1	5	2	10	1	
4		3	15	1	5	1	5	1	
5		1	5	3	15	0	0	0	
6		3	15	2	10	2	10	3	
7		3	15	2	10	4	20	6	
8		3	15	2	10	2	10	3	

Table (4): Frequency, and percentage of carious teeth.

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