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PREVALENCE OF DEVELOPMENTAL DENTAL DISORDERS AMONG THE PATIENTS VISITING REU CLINICS: A RETROSPECTIVE STUDY

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ABSTRACT

Introduction: Due to increase of population, increasing number of less-experienced dentists more associated information and consequent updates of such information; the need for design of information processing systems to help in better diagnosis of patients with oral disorders becomes more evident. Among other factors, some factors such as age, clinical symptoms, location and shape of lesion could influence the decision to treat salivary gland disorders and determine of their possibility. Up to now, there is no software for differential diagnosis of salivary gland diseases.
Objectives: The objective of present study is to design and develop a software so as to help to differential diagnosis of salivary gland diseases and determine the accuracy and effectiveness of its results.
Methods: Software based on Bayes' theorem was designed with the help of editor application into which the information of 60 salivary gland diseases was inserted. Then, the information of 40reports of salivary gland diseases was added to the software. In the next stage, the information of the chosen cases given to two expert clinicians so as to develop a differential diagnosis. The result was analyzed using menemar and Wilcoxon test.
Results: The results were compared with results of the reports. Almost 60 percent of generated answers by the software and two clinicians included absolute diagnosis of statistically insignificant difference (P-value=0.96).
Conclusion: The results showed the acceptable performance of the software. Although the software cannot act instead of a clinician due to the fact that the software user should be quite familiar with salivary gland diseases and methods of examination, this software can be used to help the clinicians in differential diagnosis and training objectives.

Keywords: Bayes Theorem, Differential Diagnosis, Salivary gland, Software.

INTRODUCTION

Salivary glands in mammals are exocrine glands with ducts that produce saliva. They secrete amylase, which converts starch into maltose. The diversity of the lesions in the salivary glands regarding the variety of symptoms and the non-diagnostic nature of most of them and the less exposure of dentists to most of them makes the differential diagnosis of these lesions mostly difficult. It is confusing and complicated in tumors and other chronic or even acute mucosal lesions (1). Salivary gland disease is diagnosed by taking a detailed history of the patient, clinical examinations, and laboratory tests. Considerable progress has been made in the diagnosis and treatment of salivary gland diseases in recent years (2). Differential diagnosis of several diseases in salivary glands is difficult and requires high expertise and experience due to the high number of symptoms related to the disease (3). The effect of various factors such as the patient's gender or age, the lesion site, and the lesion margin type can be effective in deciding to prepare a list of different diagnoses and determine their probability. Due to the growing number of various studies in this field, the existing number of lesions, and the similarity of their symptoms, like other medical fields, systems are needed that can categorize this information quickly. Many efforts have been made to design such systems.

The high speed of computers and their capability to store very large volumes have targeted these systems to be used for diagnosis and sometimes providing treatment plans in the medical field (4). Additionally, it is essential to design information processing systems to help at the moment due to the increase in the population and the increase in the number of dentists specializing in oral diseases and oral and maxillofacial pathologists with less experience, the growing volume of information, and the updating and changing of information at the moment (1). Limited software has been provided in this field. Most of them are designed for a limited number or category of oral lesions (5). In most cases, they have not been clinically examined to evaluate the efficiency and accuracy of the results (6).

It has faced the problem of proper differential diagnosis due to various and even similar variables. It is necessary to design a diagnostic system to reduce the probability of error in a shorter time to estimate the differential diagnoses of salivary gland diseases. Different algorithms and theories have been used in recent years to make these systems. The present study seeks to design and build software to help perform the differential diagnosis of salivary gland diseases and determine the accuracy and efficiency of its results. Bayesian theory is used due to its ease and previous successful trials in software development (7). In the Bayes-based system, the user answers various questions related to the patient's symptoms in the software, based on the history taken from the patient. Then, the software gives a differential diagnosis based on the statistical information collected from various references. Their overall goal is to establish a connection between the patient's information and the information stored in the software to help the physician in solving the patient's diagnostic and treatment problems. They also seek to create a level of knowledge that can widely provide available information to the user.

A literature review showed that no study has been conducted on this issue. However, there are some studies similar to those described below: Focassi et al (1980) designed a project whose goal was to semi-quantifying salivary gland diseases with the help of computers. It was working based on the results reported from the radioactivity and thermography studies on salivary gland diseases with the help of a computer, and based on mathematical relations, this information was made into a diagram and determined the function of salivary glands as normal or pathological (8). Sibers et al. (2010) sought to design a program for differential diagnosis of parotid gland lesions based on ultrasound. It aimed to distinguish between benign and malignant cases. Thus, 138 cases of parotid gland ultrasound samples of people were included as models. Then, the system diagnoses based on its information and comparison with the entered sample (9). They are also called computer aid systems, expert systems, and decision support systems (10). Their overall goal is to establish a connection between the patient's information and the information stored in the software to help the physician solve the patient's diagnostic and treatment problems. The present study seeks to design and build the software to help perform differential diagnosis of salivary gland diseases and compare its results with the results of clinicians.

Methods

In this diagnostic and evaluative study, samples that were tested by the software included reports of salivary gland diseases. These case reports were collected from authentic magazines and books (11). Datasets and computer networks were used as the data collection tools. A convenience sampling method was used. The samples were selected non-probabilistically among the samples who met the inclusion criteria. The samples included in this study should contain the information required by the software and the clinician to make a correct differential diagnosis. Additionally, the case report should have a definitive diagnosis for the desired disease. If the case report does not meet the inclusion criteria, its information does not include software information and does not have a definitive diagnosis. The sample size was determined using $N=\{z_{1-\alpha/2}+z_{1-B}\}^2 \{p_1(1-p_1)+p_2(1-p_2)\}/d^2$. In this study, the chi-square test was used to compare the answers, and the non-parametric Kuskal-Wallis test to rank the correct answers.

Software for differential diagnosis of salivary gland diseases

In this study, software was designed and built based on the Bayesian theory (12). To evaluate the results, two specialists in oral and maxillofacial diseases were used based on the same information given to the software. Finally, the answers given by these three groups will be used to examine the performance of each of the groups. The obtained information can provide a picture of the performance of each of the groups. First, a list of salivary gland diseases was prepared according to the signs and symptoms of the diseases available in different books and sources, and the opinions of the advisors and supervisors. The options were designed according to the symptoms. Then, the questions and options were entered into the designed Bayesian Hypothesis program, programmed using Visual Studio version 6 software (U.S.A. Microsoft). It runs under the Windows XP operating system and requires at least 64 megabytes of memory and a Pentium 333 or higher processor to run. Different probabilities of various lesions are calculated based on Bayesian theory. We aim to find the probability of each of the n lesions to match the patient's symptoms and evidence. We consider Di as the disease name. We aim to have the probability of the occurrence of any disease in the population (p(Di) (also called the posterior probability of the disease) in our dataset. We want to know the probability of a specific symptom (S) in a patient who has the disease (Di) (P(S/Di) with this information. We can have the probability of occurrence of Di with its symptoms (it is also called the prior probability of the disease). In other words, we can find out the possibility of the diseases or lesions in our dataset by having the probability of each symptom in each disease and the rate and the spread of disease in society. The relationship between these variables can be seen in the following equation.

$$\mathrm{P(Di/S)}=[\, P(Di/S)^{*}\, P(D/Di)]/\sum_{j=1}^{n} P(Di) * P(S/Di)$$

P (S/Di) is the deduction of the result of considering each symbol in the dataset. The denominator of the deduction is the product of the results of the deduction for each disease in the dataset, and j represents the total number of lesions.

The values (P(S/Di) for lesions are collected from reference books and authoritative articles (18, 19, 13, 14, 15, 16, and17), and based on the experience of the software manufacturer since some information related to the prevalence of different symptoms in some lesions was not available.

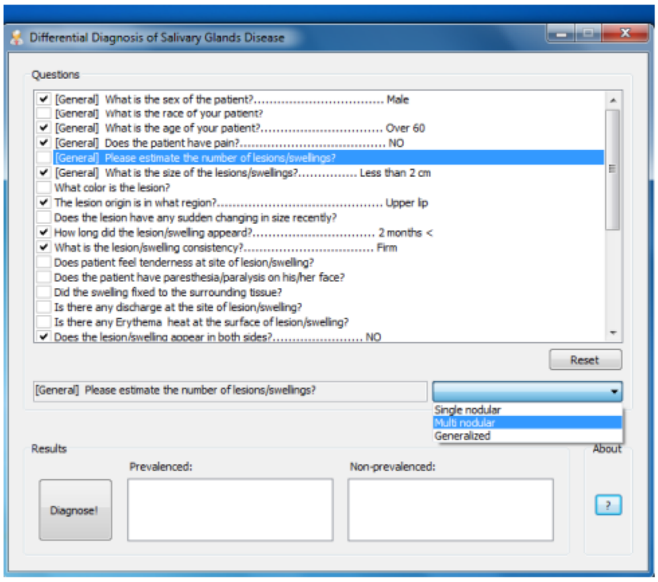

Figure 1- After the user realizes the existence of a lesion, he responds to the items on the software page

A list of 60 common salivary gland lesions was prepared by examining salivary gland lesions in various sources and the opinion of supervisors and advisors. Then, it was entered into the Bayesian Hypothesis program. A prevalence value was considered for each lesion. Accordingly, the probability of different symptoms of the disease was entered in each lesion. For example, if one-third of the patients with a lesion are male, PS/Di for males and PS/Di for females will be 33. The sample information given to the software can be seen in the figure. Figure 2 shows the sample information entered for a lesion. After the user realizes the existence of a lesion, he answers the questions on the software pages by selecting the desired option (Figure 1). The user can neutralize the effect of a question in entering the formula by not choosing an option. The software in the result display shows a list of possible lesions along with their probability percentage about the information entered (Figure 2). This means that the set of signs that have been entered matches with the similar information available for other lesions. However, the results cannot be said to be a presupposition or a clinical differential diagnosis, but they are a suggestion or a template for a differential diagnosis.

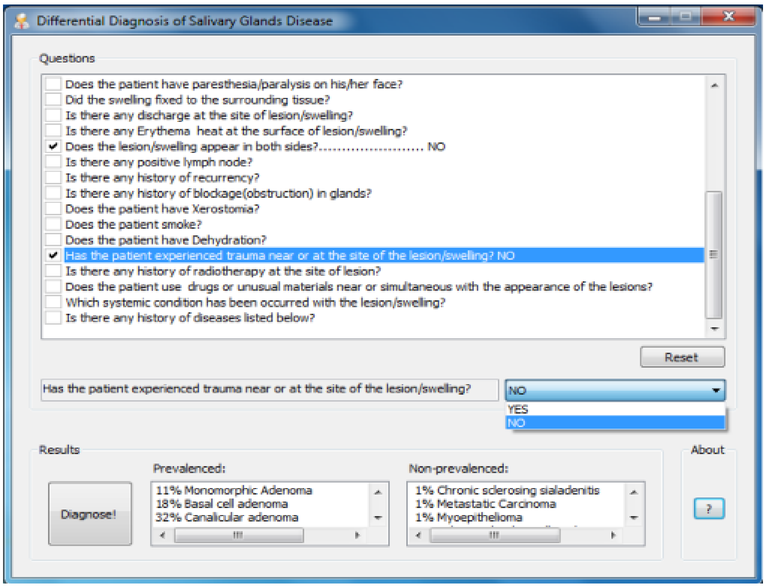

Figure 2- Example of software differential diagnosis results

To increase the accuracy of the study and the results and due to the limited opportunity of the specialists who were responsible for making the diagnoses, among the reports of cases collected from reputable journals and sites providing reports on patients with various salivary gland diseases on the Internet, 40 were separated on the basis that the answers to the maximum questions of the software were available in them. Biopsy was performed in all case reports, and a definitive diagnosis was provided for the lesion. Then, the case report was entered into the software and the results of its differential diagnoses were recorded (Figure 2). Then, the case reports were provided to two oral disease specialists in the form of questions answered in the software (Figure 1). The mentioned person was asked to record the answers to the questions about each case report from the 40 selected case reports in the form of a maximum of five differential diagnoses. Finally, the diagnosis results were compared. The results obtained from the software, as shown in Figure 2, have a probability percentage. However, the differences in oral disease specialists do not have a percentage probability. Finally, three groups of differential diagnoses were created based on what occurred, and statistical tests were performed on them to determine their validity:

1- Software diagnoses

2- The first clinician's diagnoses and the second clinician's diagnoses

Finally, after collecting the data, they were analyzed using McNemar Cochran, Friedman, and Wilcoxon tests.

Results

Forty patients with salivary gland lesions were examined in this study. The definitive results of these cases were specified by the relevant reference.

An example of some differential diagnosis with software

Case 1: A 61-year-old man was referred with a painless swelling on the left side of the upper lip. A firm lesion with a smooth surface of size 1 was found in clinical evaluations. The patient's history reports a one-year history of the lesion and there is no history of any trauma. The information entered into the software is as follows:

Age 60. male. no pain. upper lip. firm. less than 2 cm. Not in both sides No trauma. 2 months <.

The differential diagnosis provided by the software is as follows. The result of pathological tests for this lesion was Canalicular Adenoma according to the existing case report.

Canalicular Adenoma 30%

Basal cell adenoma 17%

Monomorphic adenoma 10%

Ductus papillomas 7%

Hyperplasia 5

Case 2: A 28-year-old man, whose first report indicated the presence of a mass four years ago, was referred. Initial clinical evaluations report a lesion with a firm and stable touch tenderness characteristic with a size of 32 in the maxillary arch area. The patient had no other symptoms and his facial nerve was not damaged. The information related to this item that was given to the software is as follows:

Age 20-40, male, more than 3 cm, retromolar pad region, 2 months <, firm, tenderness, paresthesia. No

Chronic sclerosing sialadenitis 38%

Sialolithiasis 13%

Obstructive sialadenitis 12%

Bacterial sialadenitis 10%

The final diagnosis for this patient was chronic sclerosing sialadenitis.

The number of correct answers among all five differential diagnoses was 24 cases (60 percent) for the first clinician, 25 cases (62.5 percent) for the second clinician, and 24 cases (60 percent) for the software. We used McNemar's test to compare the percentage of correct answers given by the first clinician, and the second clinician, and software with a definite diagnosis. Tale 1 shows the frequency distribution of the correct or incorrect answers given by the first clinician, the second clinician, and the software:

Table (1): Frequency distribution of correct or incorrect answer status by the first clinician, the second clinician, and software

Status of answers	Software		First clinician		Second clinician	
	N	%	N	%	N	%
Correct	24	60	24	60	25	62.5
Incorrect	16	40	16	40	15	37.5

The McNemar test showed that the percentage of correct answers by the software, and the first and second clinicians (p-value <0.001) had a significant difference with the definite answer. However, the Cochran test showed no significant difference between the percentage of correct answers of the software and the two clinicians (p-value=0.99).

Figure 3 shows the percentage of correct answers given by the software, the first clinic, and the second clinic:

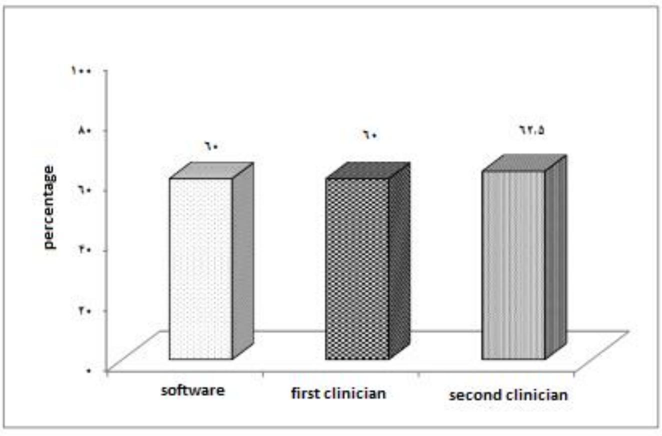

Figure (3)- Frequency of correct answers by software, the first clinician, and the second clinicians

Table 2 shows the frequency distribution of the first, second, third correct answers or lack of correct answers by the software, the first clinician, and the second clinician:

Table (2): Frequency distribution of the first, second, and third correct answers or lack of correct answers, by the software, the first clinician, and the second clinician

Status of answers	Software		First clinician		Second clinician	
	N	%	N	%	N	%
First correct answer	12	30	21	52.5	14	35
Second correct answer	3	7.5	3	7.5	4	10
Third correct answer	4	10	0	0	4	10
Forth correct answer	2	5	0	0	2	5
Fifth correct answer	3	7.5	0	0	1	2.5
Incorrect answer	16	40	16	40	15	37.5
sum	40		40		40	

Friedman's test compared the first and second Clinician software regarding the number of correct answers in the first five priorities. As shown in Table 2, the first clinician was slightly better than the software, and the second clinician regarding the number of correct answers in five priorities. Comparing the answer status of the software, the first clinician, and the second clinician with the definitive diagnosis using the Wilcoxon test showed that the answer status of the first clinician and the second clinician software had a significant difference with the definitive diagnosis (P-value<0.001). However, Friedman's test showed no significant difference between the software, the first clinician, and the second clinician (p-value=0.193).

Discussion

Due to the large number and symptoms associated with the disease, performing an accurate differential diagnosis for salivary gland disorders is mostly a difficult process and requires a high level of expertise and experience (3). It is necessary to design information processor systems to help diagnose patients with oral disorders due to the growing volume of information and the updating and changing of this vast amount of information (5,6). Thus, it was necessary to conduct a study to evaluate the accuracy of such software to provide differential diagnosis. Their overall goal is to establish a relationship between the patient's information and the information stored in the software to help the physician in solving the patient's diagnostic and treatment problems. They also seek to create a level of knowledge that can widely provide available information to the user. Another goal of such software is to create a level of knowledge that can widely provide available information to the user.

The present study compares the results of the differential diagnoses of this software and the diagnoses of two clinicians and the definite diagnosis reported in each case. The definitive diagnosis was confirmed by biopsy and pathology in each report. The results of the software diagnoses on 40 cases of salivary gland diseases reported in authentic books and magazines were compared with the results of two clinicians' diagnoses and definitive diagnosis results. The first hypothesis of this study was that there is no significant difference between the number of correct answers of the software and the number of correct answers of the clinicians. This hypothesis was confirmed as mentioned in the fourth chapter. This means that the number of correct answers among all five differential diagnoses was 24 (60%) for the first clinician, 25 (62.5%) for the second clinician, and 24 (60%) for the software. This result could be because the signs in the reports did not include all the software questions, or we chose cases whose information is close to the software questions. These reasons may have led to the similarity of the diagnosis results of clinicians and software diagnosis.

As reported in the study by Weiner and Sorgel (20), the results of these types of software cannot be used for judgment or decision, and is still a long way to go to obtain a complete software with the current facilities and calculation methods. The second hypothesis of this study that there is no significant difference between software answers and definitive diagnosis of the case report was rejected. This means that the differential diagnosis of the software was significantly different from the definite diagnosis. The third hypothesis of this study was also rejected and there was a significant difference between the answers of clinicians with definite diagnoses. In a study on oral diseases, the software had 91.6% correct diagnosis and the performance of the software seemed appropriate (21). A study by Rajab Hassan and Shariful Hassan concluded that this system could be a support system for physicians' diagnosis and help save time and prevent possible harm to patients (22). Eslami et al. (2013) developed a computer program to diagnose primary headaches based on the International Classification of Headache Diseases. The software was tested by 80 patients who visited the headache clinic and compared with the answers of neurologists. Out of 80 patients, the software succeeded in correctly diagnosing 78 patients. Software gave more than 97 similar answers to neurologists (23). In another study conducted on head and face pain, the percentage of correct answers given by the software was 75, which is consistent with the efficiency of the software (24). The studies by Burnside and Chaphara reported that the performance of specialist clinicians is better in diagnosis. This study's results do not necessarily confirm the equal performances of software and two clinicians (25). However, the software performance in the present study also seems appropriate and can be used as a helpful tool to provide better diagnoses by clinicians after conducting more studies.

CONCLUSION

It is concluded that these types of software cannot be considered a substitute for a clinician. However, they can be used to gain better information, prevent ignoring rare diseases, train medical students, and faster access to classified statistics, and smart tools to help physicians in diagnosis. To improve the performance of the software, it is recommended to expand the software by increasing the available waste and the possibility of updating the internal dataset of the software and examining the possible improvement of its performance, creating a dataset available in Iran, and localizing the data for statistical examinations, and finally using this type of software in the form of networks in hospitals. Additionally, conducting studies using other studies, for example, providing the software for clinicians and repetition can provide more results about the performance and effect of the software.

REFERENCES

1. Mendonca E. Clinical Decision Support Systems: Perspectives in Dentistry. J Dent Educ 2004;68(6):589-97.
2. Wittekindt C,Burmeister HP,Guntinas-lichuis O. Diagnostic and therapy of salivary gland diseases: relevant aspects for the pathologist from the clinical perspective;2009 Nov;30(6):424-31
3. Greenberg M, Glick M, Jonathan A. Burket's oral medicine. 11th ed. BC Decker, 2008.
4. White Sc, Pharoah M. Oral Radiology Principles and Interpretation. 5th ed. Mosby; 2009.
5. Brickley M, Shepherd J, Armstrong R. Neural networks: a new technique for development of decision support systems in dentistry. J Dent 1998;26(4):305-9.
6. Borra c, Andrade pm, Core L, Novelli MD. Development of an open case-based decision-support system for diagnosis in oral pathology. Eur J Dent Educ 2007;11:87-92.
7. Tina Birk J:[2009 september 28].available from:www.prodstyr.ihh.kvl.dk/vp/2009/slides/byesnet-1-6.pdf
8. De Rossi G, Focacci C.A Computer-Assisted Method for Semi-Quantitative Assessment of Salivary Gland Diseases.in Istitute di medicina Nucleare 1980;5:499-503.

9. Siebers S,Zenk J,et al.Computer Aided Diagnosis of Parotid Gland Lesions Using Ultrasonic Multi-Feature Tissue Characterization. 2010 June 11;1525-1534.
10. White Sc. Decision-support systems in dentistry. J Dent Educ 1996;60(10):47-126. 23-Sinai Cedars.2012:[1 screen][2013 July 17].available from: www.cedars-sinai.edu/Patients/ Health-Conditions/Salivary-Gland-Disease-and-Tumors.aspx
11. Sunil S,Gopakumar D,Sreenivasan B.S.2012: [4screens][cited 2014 Sep 25].Available from:www.ncbi.nlm.nih.gov/pmc/articles
12. Awange DO. Fibrous dysplasia of the jaws: a review of literature. East Afr Med J 1992 Apr;69(4):205-9.
13. Ayangco L, Rogers RS, III. Oral manifestations of erythema multiforme. Dermatol Clin 2003 Jan;21(1):195-205.
14. Govindrao Ghom A Oral medicine.2th.new delhi.Jaypee publishers,2005:561-594
15. Burket lester William. Burket,s oral medicine.2008.11th ed:568 p Brothers Medical
16. Miloro M,G.E.Ghali, larry J .peterson peter E.larsen,peter D.waite.Peterson,s principles of oral and maxillofacial surgery.2008.5th ed:671-693
17. Dalili Zahra, Content of salivary gland lesions, clinical findings and imaging, Rasht: Katibeh 218:200
18. Kovalerchuk B, Vityaev E, Ruiz JF. Consistent knowledge discovery in medical diagnosis. IEEE Eng Med Biol Mag 2000 Jul;19(4):26-37.
19. Nathwani BN, Heckerman DE, Horvitz EJ, Lincoln TL. Integrated expert systems and videodise in surgical pathology: an overview. Hum Pathol 1990 Jan;21(1):11-27.
20. Sorgel W.Girod S,Zammer M.Girod B.Computer aided diagnosis of bone lesions in the facial skeleton.MMIT Media Lab 1998;21(39):139-48.
21. Motaghi A, Designing and developing software for diagnosing oral diseases and determining its validity, supervisor: - A doctorate dissertation in the Faculty of Dentistry, Islamic Azad University, Khorasgan Branch
22. Rajib Hasan Md,Shariful Hasan Md.An Expert system based headache solution.ISCAIE 2012;3(4).
23. Eslami V.Rouhani-Esfahani S,Hafezi-Nejad N,Refacian F.Abdi S,Togha M.A.Computerized expert system for diagnosing primary headache based on International Classification of Headache Disorder(ICHD-II).Springer Plus J 2013;2(1).
24. Etheadi Z, Designing and making software for differential diagnosis of head and face pain and comparing its results with clinical results, supervisor: Motaghi Arash, Doctorate dissertation, School of Dentistry, Islamic Azad University, Khorasgan branch 2014
25. Burnside ES. Bayesian networks: computer-assisted diagnosis support in radiology. Acad Radiol 2005 Apr;12(4):422-30.