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Knowledge Based System for Diagnosing Tooth Disorder

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Abstract: Background: Despite the role that all causes can play in both gum and dental injury returning from problems, the vast majority of dental pain is due to caries. And because prevention is better than cure, taking care of oral hygiene is the best way to face gum problems and toothache For a person's teeth without them, no one can eat or chew food or even speak letters and speech correctly, they are teeth which are considered to be from the solid parts of the body where they consist of collagen proteins and some minerals such as calcium. ***Objectives:*** This paper will solve the problems of treatment of tooth through correct diagnosis and treatment. ***Methods:*** In this research, we provide an expert system for the diagnosis of tooth which will help doctors to explore everything related to the problems of tooth. We look forward to providing simplified answers to tooth.

Keywords: Artificial Intelligence, Expert Systems, SL5 Object, tooth problem.

1. INTRODUCTION:

Oral and dental health means safety from pain that affects the mouth and face, and diseases that affect the periodontal teeth (gums), tooth decay and loss, and other diseases and disorders that affect the mouth and gums. Among them - also - cancers affecting the mouth and throat, mouth ulcers and birth defects, such as the upper lip and palate. The bacteria are found in the mouth and most of them are harmless, which are defensive to the natural body and good oral health care such as brushing and flossing daily to make these bacteria under control, however harmful bacteria can sometimes grow out of control and cause oral infection such as caries Teeth and gum disease. There is a strong relationship between oral health and the food or drink we eat. There is also a relationship between tooth decay and eating sugars, sweets and sweetened soft drinks, as they contain a high percentage of sugar, and they also contain citric acid and phosphorous, which in turn harms the tooth.
Among the symptoms are dental problems:

- Feeling pain, whether in or around the teeth themselves, intermittently or continuously.
- Pain that is felt only when touching or pressing the teeth.
- Swelling in the area surrounding the affected teeth.
- Having pain when trying to open the mouth.
- High body temperature or fever.
- Headache or acute pain in the ear.
- Exudate from the affected teeth or the surrounding area.
- Feeling bad taste in the mouth

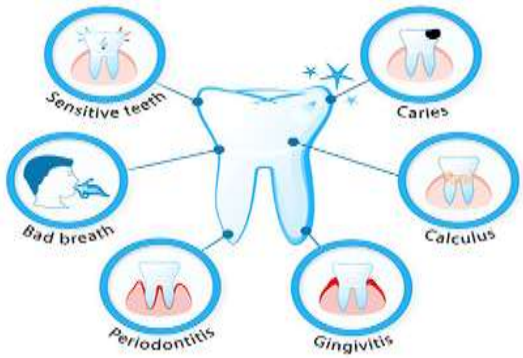

Figure 1: Dental problems.

Gingivitis is what causes redness or swelling, and thus makes it more prone to bleeding when washing teeth. But the occurrence of bleeding in the gums as a result of using a toothbrush or flossing force strongly is not a matter of concern, if it does not indicate a satisfactory condition often, then the bleeding will be a natural result, and to avoid this must always clean the teeth and gums gently and carefully. The vast majority of people with this problem postpone treatment because they often do not feel pain, but neglecting the treatment of gingivitis can then lead to greater problems in the gum tissue. The biggest problem that you should pay attention to early is that the gums, jaw bones, and tissues surrounding the teeth and molars are infected with long-term bacterial infections.

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Figure2:Gingivitis

2. EXPERT SYSTEM:

In artificial intelligence, an expert system is a computer system that emulates the decision-making ability of a human expert. Expert systems are designed to solve complex problems by reasoning through bodies of knowledge, represented mainly as if–then rules rather than through conventional procedural code. The first expert systems were created in the 1970s and then proliferated in the 1980s.Expert systems were among the first truly successful forms of artificial intelligence (AI) software.[1]

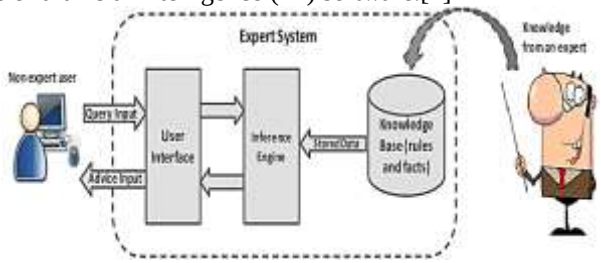

Figure 3: The figure presents the Main Components of Typical Expert System

The proposed system of experts for the tooth has been implemented using disease diagnosis using the SL5 Object tone that remains for the simple Level 5 object. The SL5 object tone is mostly the final tone - that is, the SL5 Object program for arranging statements around the world, rather than the rundown of executable commands, The SL5 Object engine is implemented in Delphi Embarcadero RAD Studio XE6

3. LITERATURE REVIEW:

A knowledge-based system (KBS) is a form of artificial intelligence (AI)[11..20] that aims to capture the knowledge of human experts to support decision-making. Examples of knowledge-based systems include expert systems [21..50], which are so called because of their reliance on human expertise. The typical architecture of a knowledge-based system includes a knowledge base and an inference engine. The knowledge base contains a collection of information in a given field Knowledge-based systems also include an interface through which users query the system and interact with it [61..68].

4. MATERIALS AND METHODS :

The suggested KBS is capable of diagnosing several teeth and gum diseases of different stages of the human life starting by asking the patient many questions based on their pain symptoms as in figure 3. This KBS gives the patient clear idea about the disease and the diagnosis of his/her pain. At the end, the proposed KBS provides recommendation of how to treat the disease.

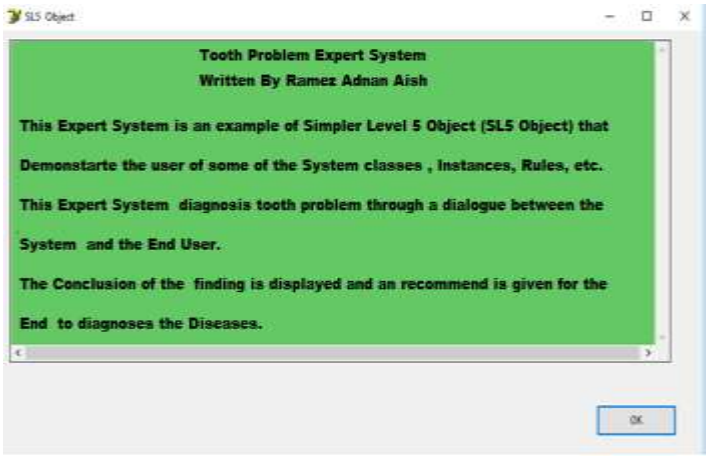

Figure4: The figure presents the screen expert system

The proposed expert system will ask the user to choose the correct answer in each screen. Figure 4 shows how the users get the diagnosis and advice.

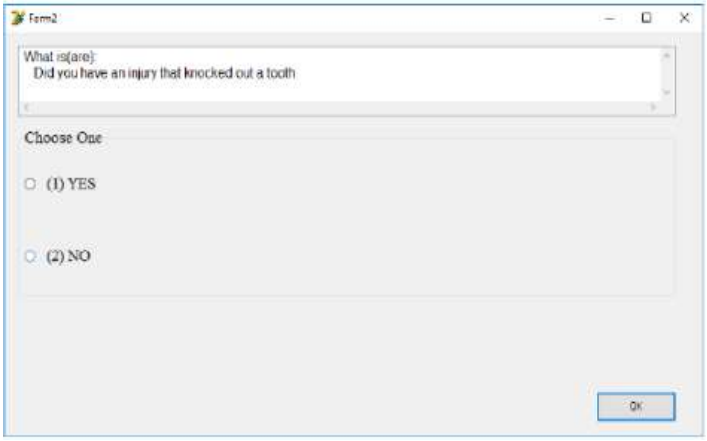

Figure 5: The figure shows when the system asks the user.

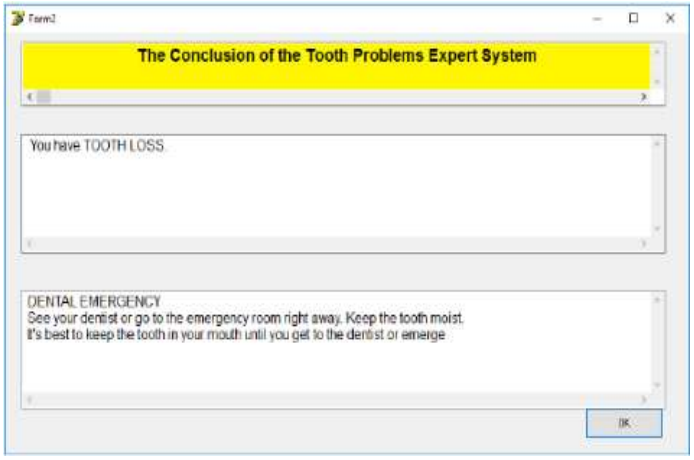

Figure 6: The figure shows diagnosis and advice of the expert system..

5. KNOWLEDGE REPRESENTATION

Humans are best at understanding, reasoning, and interpreting knowledge. Human knows things, which is knowledge and as per their knowledge they perform various actions in the real world. **But how machines do all these things comes under knowledge representation and reasoning**. Hence we can describe Knowledge representation as following:

- Knowledge representation and reasoning (KR, KRR) is the part of Artificial intelligence which concerned with AI agents thinking and how thinking contributes to intelligent behavior of agents.
- It is responsible for representing information about the real world so that a computer can understand and can utilize this knowledge to solve the complex real world problems such as diagnosis a medical condition or communicating with humans in natural language.
- It is also a way which describes how we can represent knowledge in artificial intelligence. Knowledge representation is not just storing data into some database, but it also enables an intelligent machine to learn from that knowledge and experiences so that it can behave intelligently like a human.[3]

Tooth decay :
Tooth decay is the infection of parts with rot, which may cause small holes or increase their size depending on the case. It occurs as a result of lack of dental hygiene and eating sweets and drinks containing sugar, which may increase pain.

Figure7: **Tooth decay**:

How do we deal with the problem of caries? Treatment can be done by using fluoride or compound fillings, or by resorting to dislocation of the affected tooth. Be sure to visit the doctor continuously. Eat healthy foods, and stay away from sweetened drinks as much as possible. Use antibacterial agents, if necessary. And finally the crown is installed and it is a complete tooth cover.
Dry mouth The problem of dry mouth, especially with age, poses a great risk to the health and safety of teeth and gums, as saliva helps clean teeth and equals the acids formed, and thus prevents them from destroying the tooth enamel.
How do we get rid of dry mouth?

- Once you feel the problem of dry mouth, consult your doctor immediately.
- Some medicinal drugs can be replaced by ones that do not cause dry mouth, so you should see a doctor about this problem.
- Chew sugar-free gum, as the chewing process increases the flow of saliva into the mouth.

Bad breath:
Residues from the food crumbs accumulated in and around the teeth can cause mildew smell. Eating foods that contain volatile fats (essential oil) is an additional reason for breath stinking and an unpleasant smell from the mouth. Onions and garlic are the most common of these foods, but some other vegetables and spices can also cause bad breath.
After eating and digesting these foods, the fats that cause severe bad breath are absorbed into the circulatory system, and from there you reach the lungs and then exhale through the breath, until they are completely removed from the body. Onions and garlic can cause self-stinking for up to 72 hours after eating them.

Figure8: **Bad breath:**

Protection from the smell of a thousand:

- Rubbing teeth after eating helps get rid of the smell of the mouth.
- Cleaning between teeth with dental floss, at least once a day, helps get rid of bad breath.
- Rub the tongue and clean it with the prepared tools so it helps us get rid of bad breath.
- Cleaning the gums is one of the most important procedures to follow to get rid of bad breath.

- Drinking more water also helps reduce or eliminate bad breath.
- Using a toothbrush in a good and non-weary condition: It is very important to use the tools designed to clean the teeth, which are in a good and non-weary condition to contribute to getting rid of bad breath.
- Undergo regular dental check-up
- Chewing fresh parsley is one of the methods available to everyone to get rid of bad breath

Acid decomposition:
Starches and sugars are the most serious threat that teeth can face. On tooth enamel erosion, creating very subtle gaps that later develop into dental mites. Even worse than starchy and sugary foods are soft drinks, as the carbon dioxide in them increases acid levels in the mouth.
How to get rid of the problem of acid decomposition? Reducing the use of soft drinks, sugary foods and starches. Avoid eating between meals, allowing acid levels to be consistently high in the mouth. When you feel a craving for sweetened foods, eat sugar-free gum. Brush your teeth at least twice a day for two minutes or more. Visit the dentist at least every six months.

Stains and pigmentation of teeth:
Some foods or drinks, such as tea and coffee, can change the color of the teeth, also tobacco quality (chewing gum and cigarettes) also stains the teeth. Except that tooth pigmentation is an aesthetic problem rather than a healthy one. However, these tinctures are usually formed in the places of plaque stains, so it is important to remove them as part of the periodic examination of the teeth.

Figure9: **Stains and pigmentation of teeth**

What is the solution to the problem of pigmentation? Avoid eating foods that stain your teeth. Brush your teeth regularly to remove stains and resist new ones. Keep brushing your teeth with a professional doctor every six months to remove what the brush cannot remove

Tooth sensitivity:
is to feel pain in the teeth when eating something cold or hot, or even when in contact with the cold air of the teeth and in some cases as a result of sweetened or acidic drinks, this is the pain of tooth sensitivity, and it is one of the most common dental problems usually in the age of 25-30 years, and it occurs as a result The weakening of the enamel layer and the appearance of the dentin layer, in addition to the retraction of the gums and the revelations of the roots, causing the dental nerve to cause that pain,

Figure10: **Tooth sensitivity**
and tooth sensitivity occurs as a result of the following: Intense cleaning of the teeth. Gum disease and congestion. Cracked and broken teeth. Tension and pressure on the teeth, which weaken the enamel. Teeth whitening products and some types of mouthwashes that contain acids.
To reduce the sensitivity of the teeth by maintaining the hygiene and health of the mouth and teeth by using a brush with soft bristles, a special toothpaste for sensitive teeth and supported with fluoride to strengthen the enamel, as well as to avoid eating acidic foods and avoiding excessive pressure and tension on the teeth

6. LINITATIONS

The proposed current expert system specializes in diagnosing dental diseases and identifying symptoms: tooth decay, bad breath, pigmentation, gingivitis, dry mouth, and tooth sensitivity.

7. SYSTEM EVALUATION

According to initial development, medical students tested this proposed expert system and were satisfied with its performance, efficiency, accuracy, reliability, user interface and ease of use, and expressed the greatest comfort for this expert system

8. CONCLUSION

This paper has presented an expert system for diagnosis the tooth problem, which provides the patients with the diagnosis, recommendation and treatment; based on the expert system knowledge base and data collected from the patients. This expert system saves the patient the time and effort by allowing the patient to diagnose the tooth faster

more accurate than the traditional diagnosis. This expert system does not need intensive training to be used; it is easy to use and has user friendly interface. It was developed using SL5 Object Expert System language.

9. FUTURE WORK

This expert system is considered to be a base of future ones; more tooth diseases are planned to be added and to make it more accessible to users from anywhere at any time.

10. 10- EXPERT SYSTEM SOURCE CODE

! Written by Ramez Adnan Aish,

```
ATTRIBUTE start SIMPLE
ATTRIBUTE The patient suffers from a dental injury SIMPLE
ATTRIBUTE The patient suffer from pain that is specific to one tooth SIMPLE
ATTRIBUTE The patient suffer from has a broken tooth, or is the tooth loosely in its cavity SIMPLE
ATTRIBUTE The patient suffers from pain when eating cold foods or liquids SIMPLE
ATTRIBUTE The patient has redness or swelling around one or more teeth in your gums or in the face SIMPLE
ATTRIBUTE The patient suffers from redness and swelling in large areas of the gums, or is the skin inside the peeling of the mouth SIMPLE
ATTRIBUTE The patient suffers from a headache or pain near his ear, a headache, or heard a crackling sound when biting SIMPLE
INSTANCE the domain ISA domain
  WITH start := TRUE
INSTANCE the application ISA application
 WITH title display := introduction
 WITH conclusion display := Conc
INSTANCE introduction ISA display
  WITH wait := TRUE
  WITH delay changes := FALSE
  WITH items [1 ] := textbox 1

INSTANCE textbox 1 ISA textbox
  WITH location := 10,10,800,350
  WITH pen color := 0,0,0
  WITH fill color := 100,200,100
  WITH justify IS left
  WITH font := "Arial"
  WITH font style IS bold
  WITH font size := 14
  WITH text=: "
   Mouth Problem Diagnosis Expert System
                Written By Ramez Adnan Aish
This Expert System diagnoses Mouth Problems through a dialogue between the System and the End User
The Conclusion of the finding is displayed and an Advise is given for the End User to solve the problem".

INSTANCE Conc ISA display
  WITH wait := TRUE
  WITH delay changes := FALSE
  WITH items [1] := title textbox
  WITH items [2 ] := problem textbox
  WITH items [3 ] := advise textbox

INSTANCE title textbox ISA textbox
  WITH location := 20,10,800,70
  WITH pen color := 0,0,0
  WITH fill color := 200,200,100
  WITH justify IS center
  WITH font := " Arial"
  WITH font style IS bold
  WITH font size := 12
  WITH text := " The Conclusion of the tooth problems Diagnosis Expert System"

INSTANCE problem textbox ISA textbox
  WITH location := 20,110,800,130
  WITH pen color := 0,0,0
  WITH fill color := 170,170,170
  WITH justify IS left
  WITH font := " Arial"
  WITH font size := 12
  WITH text " --===--"=:

INSTANCE advise textbox ISA textbox
  WITH location := 20,280,800,130
  WITH pen color := 0,0,0
  WITH fill color := 170,170,170
  WITH justify IS left
  WITH font := "Arial"
  WITH font size := 12
  WITH text" --===--" =:
```

RULE R0

IF start

THEN ASK The patient suffers from a dental injury

RULE R1

IF The patient suffers from a dental injury

THEN ASK The patient suffer from pain that is specific to one tooth

RULE R2

IF The patient suffers from a dental injury

AND The patient suffer from pain that is specific to one tooth

THEN ASK The patient suffer from has a broken tooth, or is the tooth loosely in its cavity

RULE R3

IF The patient suffers from a dental injury

AND The patient suffer from pain that is specific to one tooth

AND The patient suffer from has a broken tooth, or is the tooth loosely in its cavity

THEN ASK The patient suffers from pain when eating cold foods or liquids

RULE R4

IF The patient suffers from a dental injury

AND The patient suffer from pain that is specific to one tooth

AND The patient suffer from has a broken tooth, or is the tooth loosely in its cavity

AND The patient suffers from pain when eating cold foods or liquids

THEN ASK The patient has redness or swelling around one or more teeth in your gums or in the face

RULE R5

IF The patient suffers from a dental injury

AND The patient suffer from pain that is specific to one tooth

AND The patient suffer from has a broken tooth, or is the tooth loosely in its cavity

AND The patient suffers from pain when eating cold foods or liquids

AND The patient has redness or swelling around one or more teeth in your gums or in the face

THEN ASK The patient suffers from redness and swelling in large areas of the gums, or is the skin inside the peeling of the mouth

RULE R6

IF The patient suffers from a dental injury

AND The patient suffer from pain that is specific to one tooth

AND The patient suffer from has a broken tooth, or is the tooth loosely in its cavity

AND The patient suffers from pain when eating cold foods or liquids

AND The patient has redness or swelling around one or more teeth in your gums or in the face

AND The patient suffers from redness and swelling in large areas of the gums, or is the skin inside the peeling of the mouth

THEN ASK The patient suffers from a headache or pain near his ear, a headache, or heard a crackling sound when biting

RULE R7

IF The patient suffers from a dental injury

AND The patient suffer from pain that is specific to one tooth

AND The patient suffer from has a broken tooth, or is the tooth loosely in its cavity

AND The patient suffers from pain when eating cold foods or liquids

AND The patient has redness or swelling around one or more teeth in your gums or in the face

AND The patient suffers from redness and swelling in large areas of the gums, or is the skin inside the peeling of the mouth

AND The patient suffers from a headache or pain near his ear, a headache, or heard a crackling sound when biting

THEN text OF problem box: = ""The patient has teeth pain"

AND the text of the text box text: = "Advice: Go to your doctor so that complications do not occur."

ELSE text problem: = "The patient does not have teeth pain."

AND the text of the text of the text box is Advice: = "Advice: Keep good health, clean your mouth, and do a periodic check."

END

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