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Expert System for the Diagnosis of Seventh Nerve Inflammation (Bell's palsy) Disease

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Abstract: ***Background:*** *The occurrence of any disturbance in the seventh facial nerve in the nerves of the brain called inflammation of the seventh nerve or paralysis in the face of half (Bell's paralysis), where paralysis affects one side of the face, and occurs when the seventh nerve, which controls the muscles of the face loses the patient control of the facial muscles on The side of inflammation is the seventh nerve because it controls the muscles on both sides of the face that enable us to express the smile, laughter, crying and other facial expressions to any injury that affects the facial expressions of the motor.* ***Objectives:*** *This paper will solve the problems of treatment of seventh nerve inflammation through correct diagnosis and treatment.* ***Methods:*** *In this research, we provide an expert system for the diagnosis of seven nerve inflammation which will help doctors to explore everything related to the problems of seventh nerve inflammation. We look forward to providing simplified answers to seven nerve inflammation.*

Keywords: Artificial Intelligence, Expert Systems, SL5 Object, seventh nerve inflammation.

1. INTRODUCTION

The seventh nerve, also known as the facial nerve, is one of the twelfth cranial nerves (twelve pairs of nerves that originate from the brain, unlike the spinal nerves that originate from the spinal cord, known by their names and numbers). This nerve supplies the muscles responsible for facial expressions, such as those responsible for lifting eyebrows, closing eyes, smiling or controlling lips and others, as well as some other facial muscles. It also gives a sense of taste to the front of the tongue, and also functions to feed many of the glands in the head, neck and salivary glands, mucous and tear. The path of the seventh nerve is somewhat complex, and has many branches, and divided into two parts, the first when it is inside the skull, and the second when it comes out to the face and neck, passing through the channel Valopian skull, And then behind The ear opens until it reaches the facial muscles on both sides. Therefore, any disturbance or imbalance in those areas of the seventh nerve may lead to damage or paralysis. The seven nerve inflammation may cause many problems such as causing weakness in parts of the face, the appearance of facial expressions, and the difficulty of speech clearly, the difficulty in eating and drinking, in addition to it may cause the difficulty of closing the eye, which may lead to the destruction of the cornea and cause problems in them. It is the most common causes of facial paralysis and seventh nerve inflammation. It accounts for 80% of the cases, and may cause 15% of the cases to weakened only parts of the face (recovery is completed in 85% of the patients after six to nine months of treatment with steroids),

All age groups, including children, have an equal ratio of men and women, but increases in the last stages of pregnancy, and increases in the incidence of diabetes. It can also hit both sides of the face at the same time. And increase in winter.

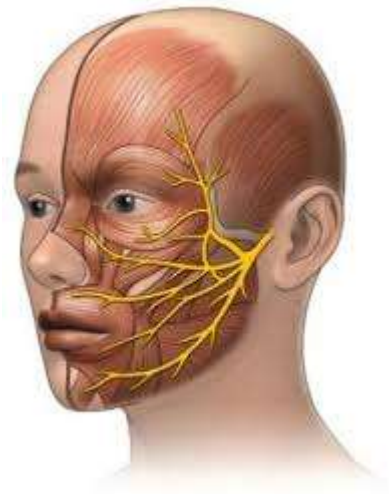

Figure 1: The figure show of *seven nerve inflammation*

2. EXPERT SYSTEM

A system that uses human experience, which simulates thinking through the application of knowledge and interfaces and the use of expert knowledge as databases and data within the system and dealing with the ability to solve problems in a human expert. This type of system seeks to exploit specialized skills or information held by a group of people in specific areas. It can be considered as a service advisory computerized. It can also be called system routing information. These systems are used to explore for medical diagnosis or as educational aids.

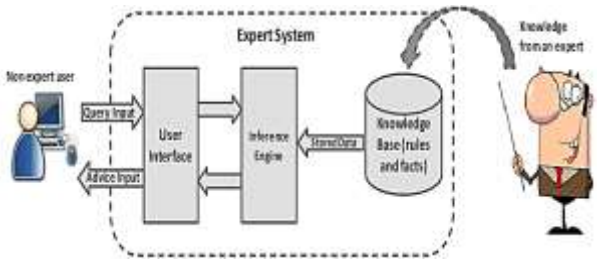

Figure 2: The figure presents the Main Components of Typical Expert System

The proposed system of experts for the seventh nerve inflammation 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

Here is a summary of expert systems found in the literature:

- An Expert System for Endocrine Diagnosis and treatments using JESS [68] was developed to help in diagnosing endocrine glands diseases.
- A Proposed Expert System for Skin Diseases Diagnosis [66] was developed using CLIPS(C Language Integrated Production System) to help user diagnose the following skin diseases (Psoriasis, Eczema, Ichthyosis, Acne, Meningitis, Measles, Scarlet Fever, Warts, Insect Bites and Stings).
- Male Infertility Expert System Diagnoses and Treatment [45] for male infertility diagnosis which helps men to explore everything related to the problems of infertility and infertility diseases such as: Azoospermia, O.T.A syndrome which mean oligo-terato-astheno spermia, Aspermia and Sexual transmitted disease.
- An expert system for diagnosing eye diseases using clips [36] provides the patient with background for suitable diagnosis of a few of the eye diseases.
- An Expert System for Mouth Problems in Infants and Children [48] ask the user to answer the questions about the symptoms of the patient and end up with some information about the disease and some advices telling the user how to deal with the baby.
- Knowledge Management in ESMDA: Expert System for Medical Diagnostic Assistance [39] deals with the design of a prototype expert system that assists patients to diagnose their diseases and offer them the suitable advice.
- Knowledge Based System for Long-term Abdominal Pain (Stomach Pain) Diagnosis and Treatment [59] was made to aid internist physicians in diagnosing numerous of the abdomen diseases for example: gastritis, hiatal hernia, ulcer or heartburn; the proposed expert system offers a summary about abdomen diseases are given, the cause of diseases are drew and the cure of disease when possible is shown up.
- A Ruled Based System for Ear Problem Diagnosis and Treatment [50] was used to classify ear problems into three main sets: a- Inflammation of the inner ear b- Middle ear problems c- External ear problems.
- Lower Back Pain Expert System Diagnosis and Treatment [43] can be used to positively diagnose low back pain concentration.
- A Proposed Expert System for Foot Diseases Diagnosis [62] diagnoses eighteen foot problems of all phases of the human life beginning with baby to the grownup by examining with yes/no questions.
- A Knowledge Based System for Neck Pain Diagnosis [48] can diagnose seven neck diseases of different phases of the human life beginning by asking the user many questions according to their pain symptoms.
- An expert system for shoulder problems using CLIPS [60] can help in diagnosing shoulder problems.
- Expert system urination problems diagnosis [64] can diagnose some of the Urination diseases (Pyelonephritis, Kidney Stone, Bladder infection, Prostatitis, Urethritis, Gonorrhea, Interstitial cystitis, Stress incontinence, Trauma in kidney or bladder).
- A Proposed Rule Based System for Breasts Cancer Diagnosis [52] was developed to help people in preventing and early detecting breast cancer; since it is known that this disease does not have medication or cure yet.
- Knowledge Based System for Ankle Diseases Diagnosis [46] recognized seven ankle diseases: Ankle Sprain, Fracture (of Fibula), Rheumatoid Arthritis, Rheumatoid Fever, Gout, and Osteoarthritis (Degenerative Joint) and they developed the expert system for those ankle diseases using SL5 Object Expert System Language.
- An Expert System for Diagnosing Shortness of Breath in Infants and Children [37] for diagnosing infants and children patients with twelve various shortness of breath in infants and children diseases.
- Polymyalgia Rheumatic Expert System [67] outlined an expert system for classification criteria for PMR, recent advances of diagnostic and therapeutic procedures.
- Expert System for Chest Pain in Infants and Children [53] to assist doctors, parents, and care

giver in diagnosing chest pain in infants and children.

- Rickets Expert System Diagnoses and Treatment [42] assist doctors to discover everything connected to the problems of rickets.
- Expert System for Hair Loss Diagnosis and Treatment [65] for diagnosing eleven diverse hair loss diseases of the human stages from childhood to adults by asking questions with a Yes or No answer.
- Expert System for Problems of Teeth and Gums [40] assist people with teeth and gums problems to diagnose their problems and receive a recommendation for the treatment. This knowledge based system was developed using SL5 Object language.
- Ear Diseases Diagnosis Expert System Using SL5 Object [34] swiftly diagnoses patient's condition and proposes a appropriate answer for the problem.
- An Expert System for Genital Problems in Infants [54] diagnoses genital problems in infants which is one of the most common problems that need quick intervention in the newly born stage.
- An expert system for nausea and vomiting problems in infants and children[56] to aid users in getting the right diagnosis of problems of nausea and vomiting in infants and children (Gastro-esophageal reflux, Gastroenteritis, Systemic Infection, Bowel obstruction, Tumors, A bleeding disease, tonsillitis, and Hepatitis pharynx). Additionally, this expert system offers information about the disease and how to deal with it.
- An expert system for feeding problems in infants and children [38] to diagnose feeding problems in infants and children.
- Detecting Health Problems Related to Addiction of Video Game Playing Using an Expert System [41] to assist users in getting the correct diagnosis of the health problem of video game addictions that range from (Musculoskeletal issues, Vision problems and Obesity). Furthermore, this expert system delivers information about the problem and tells us how we can solve it.
- An expert system for men genital problems diagnosis and treatment [47] to assist men diagnose their genital problems and give them the suitable treatment. Genital problems and injuries usually occur through: recreational activities (such as: Basketball, Football, Hooky, Biking), work-related tasks (such as: contact to irritating chemicals), downhill drop, and sexual activities. SL5 Object expert system language was used to develop this expert system.

Even though, there are many expert systems that are developed for diagnosing human problems; there is no specialized expert system for diagnosing the seventh nerve inflammation disease available free. The proposed expert system was designed and developed specifically to aid doctors in diagnosing the seventh nerve inflammation disease.

4. MATERIALS AND METHODS

The proposed expert system performs diagnosis for seventh nerve inflammation. The proposed expert system will ask the user to choose the correct answer in each screen. At the end of the dialogue session, the proposed expert system provides the diagnosis and recommendation of the disease to the user. Figure 3 shows a sample dialogue between the expert system and the user. Figure 4 shows how the users get the diagnosis and advice.

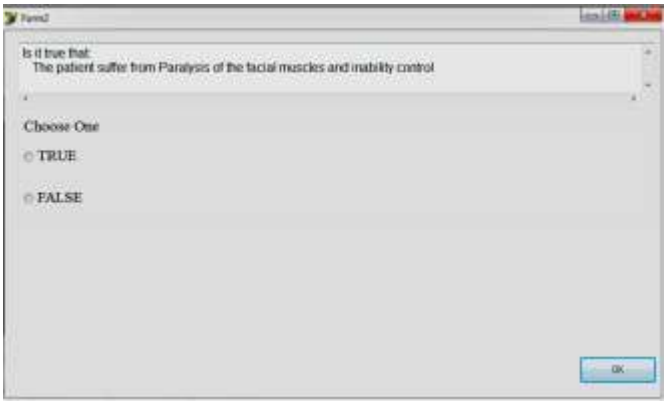

Figure 3: The figure shows when the system asks the user.

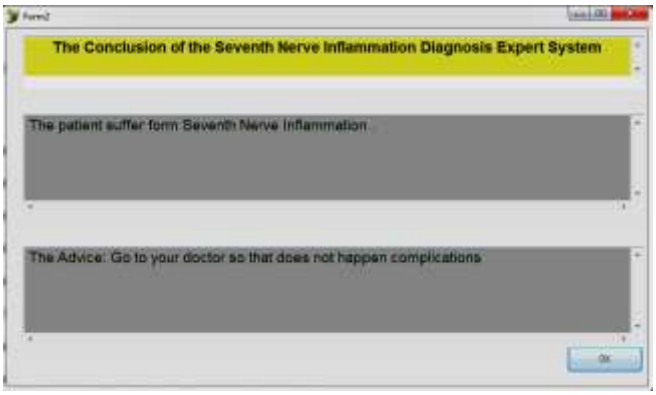

Figure 4: The figure shows diagnosis and advice of the expert system.

5. KNOWLEDGE REPRESENTATION

The main sources of knowledge in this expert system are seventh nerve inflammation. The captured knowledge was converted to the SL5 Object Knowledge syntax (facts, rules, and object). The system of experts currently contains ten rules covering nine symptoms.

Causes of seventh nerve inflammation:

The seventh nerve inflammation or Bell's palsy occurs when the seventh nerve is inflated or exposed to pressure, often as a result of a viral infection. Viral and bacterial infections that may cause Bell's paralysis include:

- Herpes simplex infection, which causes mouth ulcers, genital herpes.
- HIV infection, which destroys the immune system.
- Sarcoid, which causes inflammation of the body organs. Herpes zoster virus, which causes smallpox and the fiery belt.
- Epstein Barr virus, which causes the number of white blood cells.
- Lyme disease.
- Flu Infection.
- Mumps infection.
- German measles infection.
- Infectious gland infection, which causes some respiratory diseases.
- Infectious cytomegalovirus infection.

Symptoms of the seventh nerve inflammation:

- Paralysis of the facial muscles, weakness or tremors and inability to control them.
- Runny saliva (**Drooling**).
- Disturbance in the sense of taste.
- Feeling pain around the jaw, or next to the ear or inside, on the paralyzed side.
- Increase sensitivity to sounds on paralyzed side.
- Suffering from headaches.
- A change in the amount of saliva and the amount of tears.
- Dryness in the eye may cause an inability to close it due to weak facial muscles.
- Inability to speak.

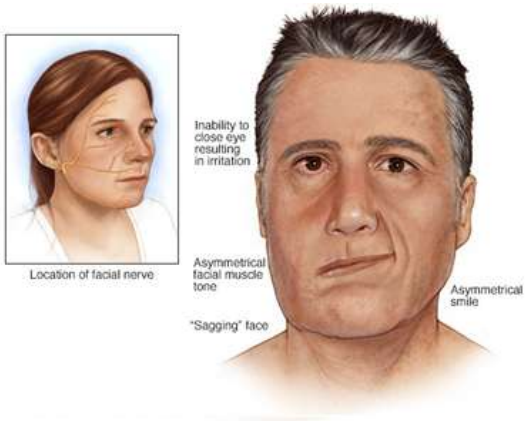

Figure 5: The figure show the symptoms of seventh nerve inflammation

Treatment of seventh nerve inflammation pharmacotherapy:

Most people with Neuritis VII are able to heal after one or two months of infection, especially in mild cases of the disease. It is possible to take some types of drugs to accelerate the treatment of the problem, or to alleviate the symptoms that appear on the patient, including:

- Prednisolone, which works to reduce the secretion of certain substances that contribute to inflammation, and thus helps to accelerate the treatment of the injured nerve.
- Eye moisturizing drops, with the aim of moisturizing the eye which suffers from dehydration for not being able to blink or completely close the eyelid.
- The use of antiviral drugs, for example Acyclovir, which can be used with prednisolone for the treatment of seventh nerve inflammation.

Complications of seventh nerve inflammation

In severe cases, there may be some complications, including the following:

- The seventh nerve was damaged.
- Severe eye dryness, which can lead to eye infection, ulcers or blindness.
- Silkiness occurs when an involuntary movement of one part of the body occurs when another part of the body is moved, such as the closure of the eyelid when the object is closed.

There is a range of home remedies that may help the patient with the seventh inflammation of the nerves to relieve the symptoms:

- Facial exercises, stretching exercises can help strengthen the muscles and improve the patient's condition.
- To maintain the health of the teeth; In the case of loss of the sense of the mouth can cause the accumulation of food between the teeth, and thus decay or even the disease of different gums.
- Eating properly; chewing food well, and eating slowly, as this helps to facilitate the eating and swallowing because the inflammation of the seventh nerve may cause trouble swallowing.

6. LIMITATIONS

The current proposed expert system is specialized in the diagnosis of the disease of the seventh nerve and knowledge of the symptoms of nine: Paralysis of the facial muscles, weakness or tremors and inability to control them, Runny saliva (Drooling), Disturbance in the sense of taste, Feeling pain around the jaw or next to the ear or inside on the paralyzed side, Increase sensitivity to sounds on paralyzed side, Suffering from headaches, A change in the amount of saliva and the amount of tears.

7. SYSTEM EVALUATION

Accordingly a preliminary evolution, medical students tested this proposed Expert System and they were satisfied with its performance, efficiency, accuracy, reliability, user interface, ease of use, and they expressed the severity of the convenience of this expert system.

8. CONCLUSION

This paper has presented an expert system for diagnosis the seventh nerve inflammation, 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 seventh nerve inflammation 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 nerve diseases are planned to be added and to make it more accessible to users from anywhere at any time.

10. EXPERT SYSTEM SOURCE CODE

```
!Written by Alaa Soliman Abu Mettleq
ATTRIBUTE start SIMPLE
ATTRIBUTE The patient suffer from Paralysis of the facial muscles and inability control them SIMPLE
ATTRIBUTE The patient suffer from Runny saliva SIMPLE
ATTRIBUTE The patient suffer from Disturbance in the sense of taste SIMPLE
ATTRIBUTE The patient suffer from pain around the jaw or next to the ear SIMPLE
ATTRIBUTE The patient suffer from Increase sensitivity to sounds on paralyzed side SIMPLE
ATTRIBUTE The patient Suffering from headaches SIMPLE
ATTRIBUTE The patient suffer from change in the amount of saliva and the amount of tears SIMPLE
ATTRIBUTE The patient suffer from Dryness in the eye and inability to close it SIMPLE
ATTRIBUTE The patient suffer from Inability to speak 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 :="
   Seventh Nerve Inflammation Diagnosis Expert System
                Written By Alaa Soliman Abu Mettleq
This Expert System diagnoses Seventh Nerve Inflammation 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 := 14
  WITH text := " The Conclusion of the Seventh Nerve Inflammation 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 := 14
   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 := 14
  WITH text:= "--===-- "

RULE R0
IF start
THEN ASK The patient suffer from Paralysis of the facial muscles and inability control them

RULE R1
IF The patient suffer from Paralysis of the facial muscles and inability control them
THEN ASK The patient suffer from Runny saliva
```

RULE R2
IF The patient suffer from Paralysis of the facial muscles and inability control them
AND The patient suffer from Runny saliva
THEN ASK The patient suffer from Disturbance in the sense of taste
RULE R3
IF The patient suffer from Paralysis of the facial muscles and inability control them
AND The patient suffer from Runny saliva
AND The patient suffer from Disturbance in the sense of taste
THEN ASK The patient suffer from pain around the jaw or next to the ear

RULE R4
IF The patient suffer from Paralysis of the facial muscles and inability control them
AND The patient suffer from Runny saliva
AND The patient suffer from Disturbance in the sense of taste
AND The patient suffer from pain around the jaw or next to the ear
THEN ASK The patient suffer from Increase sensitivity to sounds on paralyzed side

RULE R5
IF The patient suffer from Paralysis of the facial muscles and inability control them
AND The patient suffer from Runny saliva
AND The patient suffer from Disturbance in the sense of taste
AND The patient suffer from pain around the jaw or next to the ear
AND The patient suffer from Increase sensitivity to sounds on paralyzed side
THEN ASK The patient Suffering from headaches

RULE R6
IF The patient suffer from Paralysis of the facial muscles and inability control them
AND The patient suffer from Runny saliva
AND The patient suffer from Disturbance in the sense of taste
AND The patient suffer from pain around the jaw or next to the ear
AND The patient suffer from Increase sensitivity to sounds on paralyzed side
AND The patient Suffering from headaches
THEN ASK The patient suffer from change in the amount of saliva and the amount of tears

RULE R7
IF The patient suffer from Paralysis of the facial muscles and inability control them
AND The patient suffer from Runny saliva
AND The patient suffer from Disturbance in the sense of taste
AND The patient suffer from pain around the jaw or next to the ear
AND The patient suffer from Increase sensitivity to sounds on paralyzed side
AND The patient Suffering from headaches
AND The patient suffer from change in the amount of saliva and the amount of tears
THEN ASK The patient suffer from Dryness in the eye and inability to close it

RULE R8
IF The patient suffer from Paralysis of the facial muscles and inability control them
AND The patient suffer from Runny saliva
AND The patient suffer from Disturbance in the sense of taste
AND The patient suffer from pain around the jaw or next to the ear
AND The patient suffer from Increase sensitivity to sounds on paralyzed side
AND The patient Suffering from headaches
AND The patient suffer from change in the amount of saliva and the amount of tears
AND The patient suffer from Dryness in the eye and inability to close it
THEN ASK The patient suffer from Inability to speak

RULE R9
IF The patient suffer from Paralysis of the facial muscles and inability control them
AND The patient suffer from Runny saliva
AND The patient suffer from Disturbance in the sense of taste
AND The patient suffer from pain around the jaw or next to the ear
AND The patient suffer from Increase sensitivity to sounds on paralyzed side
AND The patient Suffering from headaches
AND The patient suffer from change in the amount of saliva and the amount of tears
AND The patient suffer from Dryness in the eye and inability to close it
AND The patient suffer from Inability to speak
THEN text OF problem textbox := "The patient suffer from Seventh Nerve Inflammation".
AND text OF advise textbox := "The Advice: Go to your doctor so that does not happen complications"
ELSE text OF problem textbox := "The patient does not suffer from Seventh Nerve Inflammation".
AND text OF advise textbox := "The Advice: Keep the good health and Work of physiotherapy sessions"
END

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