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Evaluation of Facial Paralysis Using Face Model

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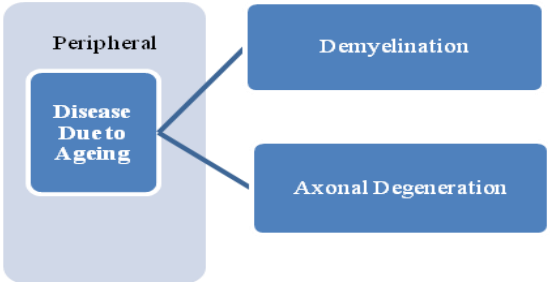
Abstract: ***Facial paralysis is a common cause of uneven face dimensions. It is very challenging to diagnose the exact level of facial paralysis. The entity is less recognized in facial palsy and in literature as well. The aim of the study is to investigate the recovery rate of an individual suffering from facial paralysis. The Material and Methods was an observational, manual study done for a period of two years at PGIMS Rohtak. The cases having initial stroke were studied for Conduction velocity changes showing in the form of waveform for Cranial nerve. All the data were analyzed and studied by using fuzzification and MATLAB 7.Total 100 cases of facial paralysis studied for EMG changes. The average age was from 17 to 68 years. The men age group affected was from 17 to 26 years. The clinical representation was pain behind the ear and uneasiness. Other symptoms were pain behind the ear, nausea, stuffiness, changed sense of taste, dropping of mouth, difficulty to close eye etc. The compound motor action potential were recorded with the use of single pair and two pair electrodes in Pathology laboratory. Fuzzy model was used to analyze the system and to detect the exact recovery rate of facial paralyzed patient. If grading system is used to investigate the model followed by fuzzification will help to detect level of facial paralysis and also to detect the exact recovery rate.***

Index Terms: ***Classification of paralysis, Conduction Velocity, Grading system, Fuzzification, 2D and 3D.***

I. INTRODUCTION

Paralysis is well described entity among the cases of contraction of vertebras in spinal cord. Various clinical presentations were noted which are related to Central Nervous System (CNS) manifestation [1]. In terms of spinal cord no improvement was noticed in the neurological deficits of ASAS following iv steroid infusion [2]. Facial paralysis is a neuro muscular disorder which is due to improper or non-functioning of facial muscles. Early invention is required to avoid fatal complications hence the role of CT Scan and MRI is important in the prompt diagnosis
[3,4]. Following are the common Changes due to ageing:

- Slow muscles movements
- Reduced nerve velocity
- Reduces muscular performance
- Decrease in number of fiber due to degeneration.

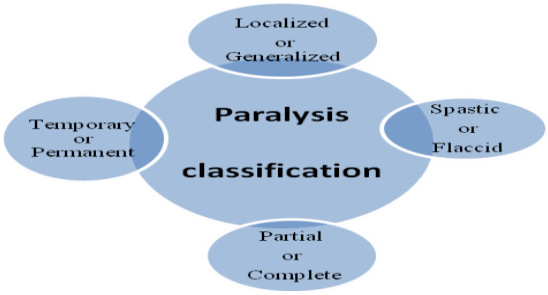


[Table/Fig-1]: Classification of peripheral disease

Peripheral diseases are categorized in two types as shown in "Fig.1" which can be caused due to ageing [1].
Demyelination: When there is damage to the myelin sheath which surrounds the nerve fiber due to the damage to myelin sheath the nerve conduction will work as a continuous nerve impulse rather than its jump from one node of Ranvier to other node of the Ranvier.
Axonal Degeneration: When there is sudden breakdown of nerve conduction which can be due to focal injury to the nerve fibers that leads to the axonal degeneration Axon once damaged cannot be replaced if its cell body is damaged.

II. CLASSIFICATION OF PARALYSIS

Paralysis is a disorder in movements of muscles. When the facial muscles slow down there functioning or stop working then it is termed as facial paresis or facial paralysis. Facial paralysis is further categorized in to two parts [5]. Facial Palsy: When there is weakness in VIIth Cranial nerve or weakness in branches of Facial nerve it results in non-functioning/uneven dimensions of particular facial region like: Eyes, Lips due to which there is a change in the dimensions of muscles while performing facial expressions.
Bell's palsy: When there is damage in the Facial nerve which results in non-functioning of half portion of face whether it is left side or right side of face [8]. Paralysis is classified in to four ways



[Table/Fig-2]:Paralysis Classification

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Localized or Generalized: Disorder is said to be Localized when specific body part is affected e.g. Hand, Leg, Arm. Generalized is when more area is involved e.g. one limb. Generalized is further classified in to four classes:
Monoplegia: When one part of the body part is not working or slow working of muscles.
Paraplegia: When lower portion of body parts are not working or weakness in muscles due to which slow working.
Quadriplegia: When both legs and both arms are affected.
Hemiplegia: When half side of the body parts get affected. Either left side or right side of body.
Temporary or Permanent: Disorder is said to be temporary or permanent when there is some serious injury like Spinal injury. disorder can be recovered by taking precautions as early as possible. If the treatment is delayed then it can leads permanent paralysis.
Partial or Complete: Partial paralysis occurs when muscles of a particular region of body unable to work properly but sensation is there in the affected region. Complete paralysis occurs when muscles can't work which results in non-functioning of body parts.
Spastic or Flaccid: Spastic paralysis means when there is a constant contraction of muscles e.g. in the upper motor neuron lesions the part become stiff and unable to work in a proper way. Flaccid paralysis means when there is less or no muscular tone in the muscular due to lesion at the neuromuscular junction. Facial paralysis is a common neuromuscular disorder which is remarkably not uniform. In some cases bell's palsy, medical history revealed that patient was diagnosed with bell's palsy but did not seek any medical treatment due to financial constraints [5]. The evaluation of degree of facial paralysis is carried out by SPSA algorithm and FFBPNN [6]. In terms of medical science corticosteroids initiated within 3 days of facial palsy results in the recovery very quickly [7]. Lagophthalmos is the inability to close the eyelids which results to facial nerve palsy [8]. To analyze the facial paralysis IECM algorithm is used to calculate the difference of one side of face with another side of face model [9]. It has been clearly notified that the etiology remains unclear in terms of Bell's palsy [11]. For facial reanimation 3D imaging is obvious advantageous over traditional 2D imaging of face model [12]. Weight and obesity do not have any significant impact on nerve conduction parameters [13]. Hence conduction velocity results in more precise results with the help of waveforms to detect the affected branch of facial nerve. 3D imaging provides a deeper understanding of facial perception [14]. There is no evidence to suggest that electric simulation is beneficial to patients with acute Bell's palsy [15]. Thus more techniques are required to achieve the goal. To detect the difference number of facial landmarks must be placed on face regions [16, 17]. 3D face analysis was done using the concept of Bosphorous database which might include facial expressions or face at rest [19-21]. Facial muscles play a great role in analyzing facial palsy. 3D-Ultrasonography is used for analyzing and detecting the affected branch of facial nerve [22, 23]. Another scale for assessment of facial paralysis was used but did not assess the function of buccinators muscles [24]. Facial paralysis also affects jaw incase of acute Bell's palsy [25]. For analyzing facial paralysis ENT, medicine and neurology department plays an initial role [26].

III. MATERIAL AND METHODS

An observational study was conducted at Pathology lab in PGIMS. Total 82 individual affected bt Bell's palsy out of which some patients have acute bell's palsy and some have mild bell's palsy. At very initial stage the patients were examined at pathology lab. 42 patients participated in this study and agreed for consent about the case study.
One ENT specialist and one Neuro expert were involved in the study. All were aware about the method of assessment of facial paralysis. These specialists were aware about the manual method to detect the level of facial paralysis: House Brackmann Grading System.
Data were collected through ENT and pathology information which helps to find the actual patients' suffering form facial paralysis.

IV. PREPARATION OF THE PATIENT

Regular examination of patient was done in ENT at very initial step. Before giving conduction velocity electrodes were placed in one pair or two pair depending on the affected face regions. 20-50 mA current was applied by simulator in motor nerve conduction. In case of sensory nerve conduction 5-30 mA current has been passed with the use of simulator. After evaluation of affected branch of facial paralysis Consent form was submitted by the patient to further participate in the study. Use of MAMDANI Model helps to detect the progress rate of facial paralyzed patient.

V. RESULTS

The total 76 cases were studied. The common clinical presentation was drooling. Corticosteroids were given to the patients at initial stage which results in the complete recovery of facial paralyzed patients whereas patients who were not taken the proper care as per medical expert were suffered from acute Bell 's palsy and not yet recovered completely. 42 patients were recovered completely in which questionnaire plays a great role to take accurate follow-up whereas 34 patients were unable to recover completely. Fuzzy logic model MAMDANI model helps to calculate the difference between the facial landmarks which clearly detects that whether patient will be able to recover completely or not. Using Image processing and MAMDANI Model the proposed method will clearly detect that whether facial paralyzed patient can be cured or not.

[Table/Fig-3]: Face at rest.

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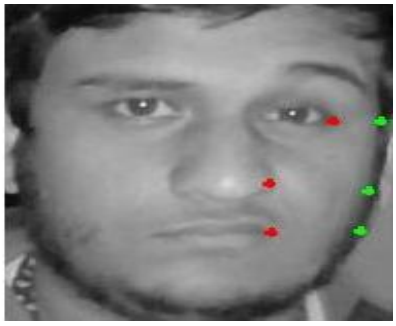
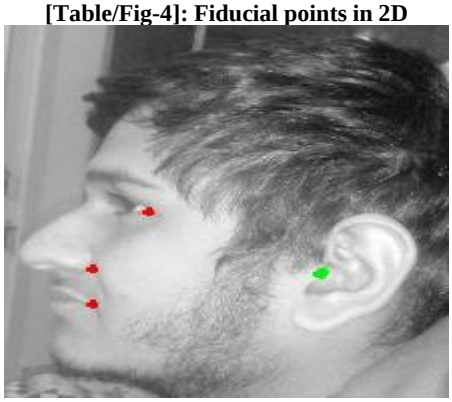
The case of bell's palsy results in more deviation on face due to which patient suffers from lot of difficulty. Corticosteroids were given to the patient but due to irregular prescriptions taken by patient the bell's palsy was not recovered completely. Again consent was taken from patient and further evaluation has been done in terms of Medical science, Image processing and regular follow-up. In Image processing technique facial landmarks were putted on face model:

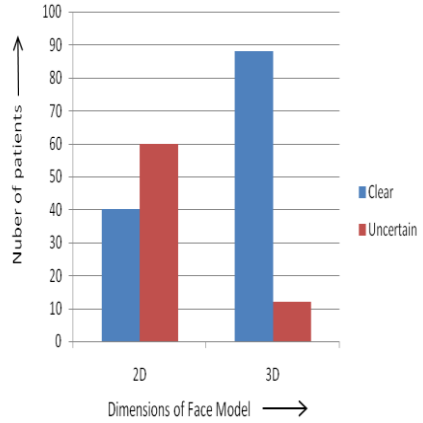


[Table/Fig-4]: Fiducial points in 2D



[Table/Fig-5]: Fiducial points in 3D

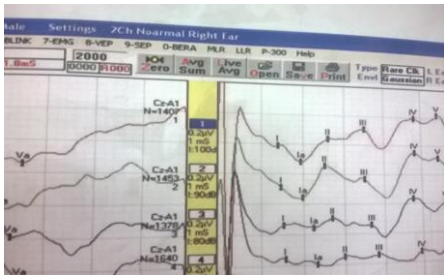
Similar procedure was followed by individual patient and total 100 patients were examined manually as well as technically in terms of 2Dimension face and 3 Dimension face model which results in clear upgardation in the accuracy and detection of recovery rate.



[Table/Fig-6]: Variation between 2D and 3D

VI. DISCUSSION

Facial paralysis is common disease in clinically practice and in medical science. It is quite challenging to diagnose the recovery rate of facial paralysis. Clinically HBGS is commonly used scale designed to systematically quantify facial nerve function recovery before and after surgery [10]. House Brackman Grading system is used manually in medical science to evaluate the grade of facial paralysis which patients is suffering. House Brackman grading system only detect the unevenness of face but it was unable to identify which branch of facial nerve is affected due to which face dimensions were changed. Thus Conduction velocity played a vital role in detecting the affected face region.



[Table/Fig-7]: Right ear of facial paralyzed patient.

Total of 4 electrodes were placed and with the help of simulator current has been passed via electrodes to the muscles as they respond well results in propoer functiong of that region and indicates no damage on that face region. Further questioonaire is required to take regular follow-up of patient after 7 days which helps to show the clear picture of recovery from facial paralysis.Additional to same image processing technique has been used to overcome from the problem to detect the progress rate of patient. Also it clearly indicates that 3 Dimensional imaging will overcome the problem of variant facial landmarks. Tragus has been considered and distance from every face region to tragus has been considered which indicates that all tha facial landmarks are fixed and no such approximation was considered as in 2 Dimensional imaging. In the present study the common facial paralysis symptom observed was drooling and difficulty in clising eyes. The pain wsa mostly behind the ear which affects all the facial muscles of respective side of face. Patient elaborate the episode of traima or stroke by which face dimensions has been changed. It was further noticed that if a person recovered from facial paralysis may have more chances to get the stroke again because of weakness of fcaila muscles. In the study the common age affected was in the age group of 16 to 24 years, 28 cases (48%). The conduction velocity is used to detect the waveforms which were recorded on a system with the help of electrodes in Pathology lab. The conduction velocity plays important role in analyzing the affected facial regions.

VII. LIMITATION

The conduction velocity in terms of facial paralysis is very challenging and time consuming which is unable to detect the level of facial paralysis. However HBGS is well used in the study to detect the Grade of facial paralysis in current state but it is unable to detect the recovery rate from facial paralysis. Also there is abundant of reported cases which may be related to failure to suspect and diagnose the recovery rate of facial paralysis.

VIII. CONCLUSION

Sudden pain behind ear is usually overloaded and is subject to various routine manners on which patient doesn't want to consider.

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The awareness of facial paralysis should be kept by the neurologist and its rare medical surgery. A conduction velocity is simple to use and additional to this questionnaire plays a great role to detect the exact follow-up which helps to determine the recovery rate. Appropriate treatment of facial paralysis within 3 days will be effective and it will help facial paralyzed patient to improve completely.

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