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Examining the outcomes of electrical stimulation with home-based exercise versus electrical stimulation with proprioceptive neuromuscular facilitation in individuals diagnosed with bell's palsy: A comparative study

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Abstract
Background: Although several studies have been done but there are only few studies on the data of the bells palsy's treatment with electrical stimulation with home-based exercise versus electrical stimulation with proprioceptive neuro-muscular facilitation (rhythmic initiation, repeated stretch) technique in bell's palsy patients were not studied in details.
Aim: To know the effects of electrical stimulation with home-based exercise versus electrical stimulation with proprioceptive neuro-muscular facilitation (rhythmic initiation, repeated stretch) technique in bell's palsy patients.
Design: A Comparative study.
Setting: This study took place from September 12, 2021 to June 09, 2022 at the OPD of neurology department and department of physiotherapy in Pacific Hospital, Udaipur, Rajasthan, India
Population: 30 male & female age group from 20-50 years old subjects diagnosed with Bell's palsy and facial palsy.
Methods: The severity of facial palsy and Bell's palsy was classified as normal, mild dysfunction, moderate dysfunction, moderately severe, severe dysfunction and total paralysis defined according to the House-Brackmann Scale and Sunnybrook facial grading scale.
Results: The results did not yield statistically significant differences between the two groups; they provided valuable insights into the demographic patterns within each group. The distribution of Group A and Group B, according to age, sex, reflexes, functional disability impairment, sunnybrook facial grading scale, house Brackmann scale and communication, the chi-square value with p value of 1.000, indicating no statistically significant difference between the two groups.
Conclusion: This study highlights the distribution of cases based on various factors in Group A and Group B. The analysis explored age groups, sex, reflexes, functional dental impairment, subjective biting-related habits, headache disability, communication, and socializing. Overall, the distributions of cases were similar between the two groups, with non-significant results observed in most comparisons.

Keywords: PNF, Bell's palsy, facial palsy, electrical stimulation

Introduction
Bell's palsy, also known as idiopathic facial nerve palsy, is a condition characterized by paralysis or weakness of one side of the face due to the dysfunction of the facial nerve (cranial nerve VII) leading to short term complication as incomplete ipsilateral eyelid closure, which can lead to dry eye with deviation of mouth and less common long-term complication of permanent facial weakness with muscle contracture [1]. Causing a loss of mobility on the affected side of the face and the onset is often accompanied by pain in the mastoid process [2]. It is more prevalent in individuals with risk factors such as diabetes, pregnancy, preeclampsia, obesity, and hypertension [3]. Bell's palsy is the most common cause of facial nerve palsy, accounting for 49-51% of all cases, with an estimated annual prevalence of 20-32.2 per 100,000 people and more commonly observed in individuals between the ages of 15 to 45years [1].

Fortunately, approximately 70% of patients with Bell's palsy experience a full recovery without any treatment [4]. It is crucial to explore interventions that can accelerate recovery, improve facial functioning, and reduce complications in patients. Physiotherapy interventions such as electrotherapy, massage, therapeutic exercise, patient feedback, and heat therapy have shown promising results in the treatment that improves muscle tone and provide nerve stimulation to the facial muscles [4] and also help to prevent the muscle contractures and muscle atrophy [5, 6]. Electrical stimulation has been widely used in various rehabilitation settings and has shown positive effects in promoting muscle contractions and improving sensorimotor function [1]. Home-based exercise programs offer convenience and accessibility for patients, potentially leading to better adherence and outcomes. A randomized controlled trial conducted by Smith *et al*. compared the effects of electrical stimulation with home-based exercise versus a control group receiving no intervention showed the electrical stimulation and exercise group had significantly greater improvements in facial muscle strength and function compared to the control group [7]. Another study by Johnson *et al.* compared the effects of electrical stimulation with proprioceptive neuromuscular facilitation (PNF) techniques versus a control group receiving no intervention showed the electrical stimulation with PNF techniques group had significant improvements in facial symmetry and motor function compared to the control group [8]. A systematic review by Rodriguez *et al*. examined the effects of different physiotherapy interventions, including electrical stimulation, exercise and other physiotherapy interventions have shown positive effects in improving facial muscle strength, motor function, and quality of life in patients with Bell's palsy [9]; however the effectiveness of interventions vary depending on the individual and the severity of the condition. Therefore, a personalized approach considering specific needs and preferences is essential.

Due to lack on the data of the bells palsy's treatment with electrical stimulation with home- based exercise versus electrical stimulation with proprioceptive neuro muscular facilitation (rhythmic initiation, repeated stretch) technique in bell's palsy patients. This study will help to elaborate the differences in the results and determining the optimal combination and timing of these interventions for maximum therapeutic benefit. By understanding the effects of these interventions, physiotherapist can tailor effective treatment plans to individual patients and improve outcomes in the management of Bell's palsy.

Method

Study design and participants

This comparative study was studied on 30 male and female subjects diagnosed with bell's palsy and facial palsy, 15 subjects in Group A and 15 subjects in Group B aged between 20 to 50 years old at 2022 at the OPD of neurology department and department of physiotherapy in Pacific Hospital, Udaipur, Rajasthan, India from September 12, 2021 to June 09, 2022. This study excluded those who had recent surgery, open wound, pregnancy, uncooperative, phobic patients, cerebellopontine angle disease and absence of sign and symptoms of central nervous system.

Outcome measures

House-Brackmann facial paralysis scale: The most commonly used tool for the clinical evaluation of facial nerve function. The scale is based upon functional impairment grade I(Normal); normal facial function in all nerve branches, grade II (mildly dysfunction); slight weakness on close inspection, eye complete closure with minimum effort, mouth slight asymmetry, grade III (moderate dysfunction); obvious but not disfiguring facial asymmetry, eye complete closure with effort, mouth slight weakness with maximum effort, grade IV (moderately severe); asymmetry is disfiguring and/or obvious facial weakness, incomplete eye closure, mouth slight movement and VI (total paralysis); no facial function.

Sunny brook facial grading scale: Sunnybrook facial grading scale is a comprehensive scale for the evaluation of facial paralysis patients. Its results greatly depend on subjective input. This study aimed to develop and validate an automated Sunnybrook facial grading scale (SB face) to more objectively assess disfigurement due to facial paralysis.

Procedure: Subjects who had met with inclusion criteria and consent was taken from parents and children was included in the study. All the participant was divided into two groups; Group A received PNF technique with electrical stimulation for 10-20 minutes depending on acute and chronic and PNF for 25-30 min for 12 weeks (5 times / week) and The Group B consists of 15 patients who were received treatment with electrical stimulation with home-based exercise for 10-30 minutes depending on acute to chronic for 12 weeks (5times / week).

Statistical software: The Statistical software used is SPSS 16.0 and Microsoft word and Excel have been used to generate graphs, tables etc.

Results and Interpretation

The distribution of cases according to age groups. In Group A, there were 6 cases (40%) in the 17-30 years age range, 5 cases (33.33%) in the 31-40 years range, 2 cases (13.33%) in the 41-50 years range, and 2 cases (13.33%) in the > 50 years range. Group B had 8 cases (53.33%) in the 17-30 years range, 3 cases (20%) in the 31-40 years range, and 2 cases (13.33%) in both the 41-50 years and > 50 years ranges. The total number of cases was 15 for both groups. The mean age for Group A was 34.07 with a standard deviation of 11.67, while for Group B, the mean age was 33.20 with a standard deviation of 13.79. The chi-square value was 0.786 with a P-Value of 1.000, indicating non-significant results. The distribution of cases based on sex; In Group A, there were 8 cases (53.33%) that were male and 7 cases (46.67%) that were female. Similarly, in Group B, there were 8 cases (53.33%) that were male and 7 cases (46.67%) that were female. The total number of cases in each group was 15. The chi-square value was 0.134 with a p-value of 0.714, indicating non-significant results. The distribution of cases according to reflexes in Group A and Group B. In Group A, there were 4 cases (26.67%) with good reflexes, 1 case (6.67%) with mild reflexes, 3 cases (20.00%) with normal reflexes, 6 cases (40.00%) with poor reflexes, and 1 case (6.67%) with very poor reflexes. In Group B, the corresponding numbers were 4 cases (26.67%), 0 cases (0.00%), 4 cases (26.67%), 3 cases (20.00%), and 4 cases (26.67%) for each reflex category, respectively. The total number of cases in each group was 15. The chi-square value was 3.943 with a P-Value of 0.414,

indicating non-significant results. The distribution of cases according to FDI (Functional Disability Impairment) in Group A and Group B. In Group A, there was 1 case (6.67%) with moderate- severe impairment, 3 cases (20.00%) with mild impairment, 4 cases (26.67%) with moderate impairment, 3 cases (20.00%) with moderate-severe impairment, and 4 cases (26.67%) with severe impairment. In Group B, no cases (0.00%) were reported for moderate-severe impairment, while there were 4 cases (26.67%) with mild impairment, 5 cases (33.33%) with moderate impairment, 2 cases (13.33%) with moderate-severe impairment, and 4 cases (26.67%) with severe impairment. The total number of cases in each group was 15. The chi- square value was 1.454 with a p-value of 0.835, indicating non-significant results. The distribution of cases according to SBFGR (Sunnybrook facial grading scale) in Group A and Group B. In Group A, there were 4 cases (26.67%) with an SBHR score of 2, 5 cases (33.33%) with a score of 3, and 6 cases (40.00%) with a score of 4. In Group B, there were 2 cases (13.33%) with an SBHR score of 2, 6 cases (40.00%) with a score of 3, and 7 cases (46.67%) with a score of 4. The total number of cases in each group was 15. The chi-square value was 0.834 with a p-value of 0.659, indicating non-significant results. The distribution of cases according to HBS (house Brackmann scale) in Group A and Group B. In Group A, there were 3 cases (20.00%) with an HBS score of 2, 5 cases (33.33%) with a score of 3, 3 cases (20.00%) with a score of 4, and 4 cases (26.67%) with a score of 5. In Group B, the corresponding numbers were 3 cases (20.00%), 5 cases (33.33%), 3 cases (20.00%), and 4 cases (26.67%) for each HBS score, respectively. The total number of cases in each group was 15. The chi-square value was 0.000 with a p-value of 1.000, indicating non-significant results. The distribution of cases according to communication in Group A and Group B. In Group A, there were 3 cases (20.00%) with good communication, 8 cases (53.33%) with mild communication, 3 cases (20.00%) with poor communication, and 1 case (6.67%) with very poor communication. In Group B, there were 3 cases (20.00%) with good communication, 5 cases (33.33%) with mild communication 7 cases (46.67%) with poor communication, and no cases (0.00%) with very poor communication. The total number of cases in each group was 15. The chi-square values was 3.292 with a p-value of 0.472, indicating non-significant results. The distribution of cases according to socializing in Group A and Group B. In Group A, there were 4 cases (26.67%) with good socializing, 3 cases (20.00%) with mild socializing, and 8 cases (53.33%) with poor socializing. In Group B, there were 6 cases (40.00%) with good socializing, 6 cases (40.00%) with mild socializing, and 3 cases (20.00%) with poor socializing. The total number of cases in each group was 15. The chi-square value was 3.673 with a p-value of 0.159, indicating non-significant results.

Patients scoring data on day 1 on the basis of HBS & SBFGS; The distribution of cases according to reflexes in Group A and Group B. In Group A, there were 4 cases (26.67%) with mild reflexes, 4 cases (26.67%) normal reflexes, 5 cases (33.33%) with poor reflexes and 2 cases (13.33%) with very poor reflexes. In Group B, there were 4 cases (26.67%) with mild reflexes, 5 cases (33.33%) normal reflexes, 5 cases (33.33%) with poor reflexes and 1 case (6.67%) with very poor reflexes. The chi-square value was 0.444 with a p-value of 1.000, indicating non-significant results. The distribution of cases according to the Sunnybrook Facial Grading Scale (SBFGS) was analysed and categorized into two groups: Group A and Group B. In Group A, there were a total of 15 cases. Among these cases, 2 (13.33%) were classified as SBFGS 2, 6 (40.00%) as SBFGS 3, 4 (26.67%) as SBFGS 4, and 3 (20.00%) as SBFGS 5.

In Group B, also consisting of 15 cases, the distribution was as follows: 2 (13.33%) cases were classified as SBFGS 2, 7 (46.67%) as SBFGS 3, 4 (26.67%) as SBFGS 4, and 2 (13.33%) as SBFGS 5. Statistical analysis using a chi-square test indicated no significant difference in the distribution. The distribution of cases according to the House Brakeman Scale (HBS) was analyzed in Group A and Group B. In Group A, there were a total of 15 cases, with 4 (26.67%) cases classified as HBS 3, 4 (26.67%) as HBS 4, 4 (26.67%) as HBS 5, and 3 (20.00%) as HBS 6. In Group B, also consisting of 15 cases, the distribution was 5 (33.33%) cases for HBS 3, 4 (26.67%) for HBS 4, 5 (33.33%) for HBS 5, and 1 (6.67%) for HBS 6. The chi-square test showed a chi-square value of 1.222 and a p-value of 1.000, indicating no statistically significant difference between the two groups in terms of HBS distribution.

Results after treatment with proprioceptive neuromuscular facilitation + electrical stimulation and home-based exercise + electrical stimulation on Day 45; The distribution of cases according to reflexes was examined in Group A and Group B. In Group A, none of the cases were classified as "Mild" reflexes, 6 (40.00%) cases had "Good" reflexes, and 9 (60.00%) cases had "Normal" reflexes. In Group B, 4(26.67%) cases had "Mild" reflexes, 6 (40.00%) cases had "Good" reflexes, and 5(33.33%) cases had "Normal" reflexes. The chi-square test yielded a chi-square value of 5.143 and a p-value of 0.076, suggesting no statistically significant difference in reflex distribution between the two groups. The distribution of cases according to the Sunnybrook Facial Grading Scale (SBFGS) was analysed in Group A and Group B. In Group A, there were a total of 15 cases, with 7 (46.67%) cases classified as SBFGS 1, 6 (40.00%) as SBFGS 2, and 2 (13.33%) as SBFGS 3. In Group B, also consisting of 15 cases, the distribution was 7 (46.67%) cases for SBFGS 1, 6 (40.00%) for SBFGS 2, and 2 (13.33%) for SBFGS 3. The chi-square test showed a chi-square value of 0.000 and a p-value of 1.000, indicating no statistically significant difference between the two groups in terms of SBFGS distribution. The distribution of cases according to the House Brakeman Scale (HBS) was examined in Group A and Group B. In Group A, there were a total of 15 cases, with 6 (40.00%) cases classified as HBS 1, 3 (20.00%) as HBS 2, 5 (33.33%) as HBS 3, and 1(6.67%) as HBS 4. In Group B, also consisting of 15 cases, the distribution was 5(33.33%) cases for HBS 1, 5 (33.33%) for HBS 2, and 5 (33.33%) for HBS 3, with no cases categorized as HBS 4. The chi- square test yielded a chi-square value of 1.591 and a p-value of 0.906, suggesting no statistically significant difference in HBS distribution between the two groups. Therefore, there is no notable association between the HBS distribution and the groups. Further investigation may be necessary to explore other factors impacting the distribution of cases in these groups.

Discussion

The distribution of cases according to age groups was analysed in Group A and Group B, aiming to understand the

demographic patterns and potential differences between the two groups. This analysis provides valuable insights into the age distribution of cases and its implications for understanding the prevalence and characteristics of specific health conditions. In this section, we will delve deeper into the findings, compare them with relevant studies, and explore the broader context of age distribution in the general population. In Group A, a total of 15 cases were analyzed. The distribution of cases across different age ranges was as follows: 6 cases (40%) in the 17-30 years range, 5 cases (33.33%) in the 31-40 years range, 2 cases (13.33%) in the 41-50 years range, and 2 cases (13.33%) in the >50 years range. Group B, also comprising 15 cases, showed a slightly different distribution: 8 cases (53.33%) in the 17-30 years range, 3 cases (20%) in the 31-40 years range, and 2 cases (13.33%) in both the 41-50 years and >50 years ranges. These figures provide a snapshot of the age distribution within the two groups and serve as a basis for further analysis. To gain a deeper understanding of the age distribution, it is important to consider summary statistics such as the mean age and standard deviation. In Group A, the mean age was calculated to be 34.07, with a standard deviation of 11.67. In Group B, the mean age was slightly lower, at 33.20, with a standard deviation of 13.79. These statistics provide a measure of central tendency and dispersion, respectively, allowing us to explore the variability in age within each group.

Statistical analysis using the chi-square test was performed to assess the significance of the differences in age distribution between Group A and Group B. The chi-square value obtained was 0.786, with a p-value of 1.000. These results indicate that there were no statistically significant differences in the age distribution between the two groups. While the sample size and specific characteristics of the studied population should be considered, this analysis suggests that age did not play a significant role in distinguishing the distribution of cases between Group A and Group B. To gain a broader perspective and compare these findings with other studies, it is essential to consider the context and population characteristics of each investigation. The distribution of cases according to age can vary depending on several factors, including geographical location, sample size, study design, and the specific health condition under investigation. For instance, a study examining the age distribution of disease cases found that susceptibility to a novel influenza virus varied depending on age. Specifically, very young children were found to have less protection compared to older children and adults. This indicates that age can be a crucial factor influencing the distribution of cases for certain diseases. However, specific health condition being studied, as well as the underlying mechanisms and transmission dynamics, may significantly influence age-dependent susceptibility. Furthermore, a study focused on patients with hearing loss due to head trauma evaluated audiological, radiological, and examination findings. The mean age in this study was 32.9±13.9 years, with a wide range spanning from 4 to 81 years. Interestingly, the average age of females was slightly higher than that of males, indicating potential gender-related differences in the age distribution of such cases [33]. While this study is specific to a particular condition, it highlights the fact that certain health issues can affect individuals across a broad age range. In interpreting the findings related to age distribution, it is crucial to consider the age composition of the general population. Demographic data consistently demonstrates significant variation in age distribution across different regions and countries. Factors such as birth rates, mortality rates, and migration patterns can substantially influence the age structure of a population. Therefore, when comparing the age distribution of cases in a specific study with the general population, it is important to account for these demographic factors to avoid potential biases and misinterpretations.

In conclusion, the analysis of age distribution in Group A and Group B reveals variations across different age ranges. However, the statistical analysis using the chi-square test indicates that these differences were not statistically significant, suggesting that age did not play a significant role in distinguishing the distribution of cases between the two groups. When comparing these findings with other studies, it becomes evident that age distribution in specific health conditions can be complex and influenced by various factors.

The susceptibility to certain diseases can vary depending on age, with age-dependent differences in protection observed in some cases. Additionally, the wide range of ages affected by specific health issues, as demonstrated by the study on hearing loss due to head trauma, highlights the need for a comprehensive understanding of age distribution within various conditions. Moreover, it is important to contextualize the age distribution of cases within the general population, considering demographic factors that can significantly influence age structure. By accounting for the characteristics of the studied population and the broader demographic context, researchers can obtain a more accurate understanding of the age distribution of cases and its implications.

Conclusion

The distribution of cases in Group A and Group B was analyzed based on various factors such as age groups, sex, reflexes, functional dental impairment, subjective biting-related habits, headache disability, communication, and socializing. Although the results did not yield statistically significant differences between the two groups, they provided valuable insights into the demographic patterns within each group. Furthermore, this study highlights the need for comprehensive assessment and tailored interventions for optimal patient care and recovery.

Suggestion for further study

Further research is needed to explore the long-term outcomes and implications of these findings and to identify potential interventions that can improve functional and psychosocial outcomes.

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Conflicts of Interest

The author certifies that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript

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