MAJALAH ILMIAH FISIOTERAPI INDONESIA

ORIGINAL ARTICLE

Volume 13, Number 1 (2025), Page 80-84
P-ISSN 2303-1921, E-ISSN 2722-0443

Facial Muscle Strength and Recovery in Bell's Palsy: A Cross-Sectional Insight

Anastasia Putu Martha Anggarani[1]*, Herdianty K. Handari[2], Retno Widaningrum[3]

[1]STIKES Katolik St. Vincentius a Paulo Surabaya, East Java
[2]Poltekkes Kemenkes Surakarta, Central Java
[3]RS Katolik St. Vincentius a Paulo Surabaya, East Java
*Corresponding author: anastasiamartha88@gmail.com

Submitted: 31 October 2024 | Accepted: 15 March 2025 | Published: 16 March 2025
DOI: https://doi.org/10.24843/mifi.2025.v13.i01.p15

Abstract

Introduction: Bell's palsy causes unilateral facial weakness due to seventh cranial nerve damage, affecting motor function and impairing basic movements such as smiling, closing the eyes, and lip movement. This condition reduces the quality of life, making facial muscle strengthening essential for improving function and rehabilitation outcomes.
Methods: This cross-sectional study assessed facial muscle strength using Manual Muscle Testing (MMT) and facial function using the House-Brackmann (HB) scale. Data were collected retrospectively from medical records (2017–2024) and analyzed from June to August 2024. Of 219 cases of facial paralysis, 125 met the inclusion criteria. Participants were Bell's palsy patients referred for physiotherapy at RS Katolik St. Vincentius a Paulo.
Results: Facial muscle strength scores ranged from 0 to 1.8, with weakness observed in the frontalis, corrugator supercilii, and orbicularis oris muscles. Spearman's correlation analysis revealed a significant relationship between facial muscle strength and function, with HB scores indicating moderate to severe dysfunction ($p = 0.000$).
Conclusion: Facial muscle strength is significantly associated with functional ability in Bell's palsy patients. Gradual strengthening exercises should be included in rehabilitation programs. Further research with larger samples is needed to explore additional influencing factors.

Keywords: muscle strength, facial function, bell's palsy, house-brackmann

Introduction

Bell's palsy is a unilateral paralysis of the facial nerve (cranial nerve VII) with an unknown cause. It occurs due to swelling and compression of the nerve at the stylomastoid foramen, leading to nerve obstruction and damage.[1] Bell's palsy is classified as a type of peripheral paralysis that is non-suppurative, non-neoplastic, and non-primary degenerative.

Bell's palsy can also result from swelling of the facial nerve (distal facial canal). Several studies suggest that HSV infection is one of the causes of Bell's palsy.[2] This condition is characterized by sudden weakness or paralysis on one side of the face due to damage to the seventh cranial nerve, impairing the motor function of facial muscles. As a result, patients experience difficulty performing simple movements such as moving their lips, closing their eyes, and smiling.[3]

Bell's palsy can affect individuals of all ages and genders, with an annual incidence ranging from 11.5 to 53.3 per 100,000 people worldwide.[4] The prevalence of Bell's palsy in Indonesia is relatively high, although the exact number remains uncertain. It has been reported that 19.55% of all neurological disorders in Indonesia occur most frequently in individuals aged 20 to 50 years, with incidence rates increasing in those over 60 years old. Data from four hospitals in Indonesia indicate that idiopathic cases account for 19.55% of occurrences, with the highest frequency in individuals aged 21–30 years.[5,6] Although the male-to-female ratio is similar, females aged 10–19 years are more susceptible to infection than males.[7]

According to the World Health Organization's 2001 International Classification of Functioning, Disability, and Health (ICF), Bell's palsy leads to a decline in facial muscle strength, resulting in facial dysfunction. Patients may experience difficulties chewing on one side, closing their eyes, drinking, smiling, and whistling.[8] The facial asymmetry caused by weakened facial muscles contributes to social challenges and reduced self-confidence.[9,10] Consequently, this condition can significantly impact Bell's palsy patients' quality of life and social interactions.

Addressing facial muscle weakness is a key priority in the rehabilitation of Bell's palsy patients. Facial muscle weakness affects multiple functional aspects, including facial symmetry, movement coordination, reflex control, facial motor skills, emotional expression, and verbal and nonverbal communication participation. These functions are highly dependent on facial muscle strength.[11] Therefore, facial muscle strength and functional facial ability are closely related in Bell's palsy patients.

Despite this, there remains a gap in understanding the relationship between facial muscle strength and various aspects of facial function, such as emotional expression, speech, chewing ability, and eye closure. Most studies have

focused on the effectiveness of rehabilitation therapies or comparisons between intervention methods, while quantitative research on the correlation between muscle strength and facial function recovery remains limited.

This study aims to fill this gap by analyzing the relationship between facial muscle strength and facial function in Bell's palsy patients. Understanding this relationship is essential for determining appropriate therapeutic strategies. Thus, this research explores the association between facial muscle strength and functional facial ability in individuals with Bell's palsy.

Methods

This study employs a cross-sectional research design, measuring variables at a single point in time without intervention. This approach allows for a rapid and efficient assessment of variable relationships, optimizes resource utilization, and provides prevalence data without requiring long-term follow-up. The study received ethical approval from the Research Ethics Committee (KEPK) of STIKES Katolik St. Vincentius a Paulo Surabaya under approval number 001/Stikes Vine/KEPK/V/2024. Retrospective data collection was conducted using medical records from 2017 to 2024, with data recruitment and collection from June to August 2024. A total of 219 cases of facial paralysis were identified. However, 69 patients met the exclusion criteria, leaving 150 eligible respondents. Among these, 25 respondents dropped out, resulting in 125 respondents included in the final analysis. Data from medical records included gender, age, occupation, onset, work and daily activities, facial muscle strength, and facial function.

The study population was individuals diagnosed with Bell's palsy at RS Katolik St. Vincentius, a Paulo Surabaya. Inclusion criteria included individuals with a confirmed diagnosis of Bell's palsy and those referred for physiotherapy treatment. Exclusion criteria included incomplete medical records. The inclusion criteria ensured that participants had a definitive diagnosis of Bell's palsy and were undergoing physiotherapy, making the collected data relevant to the study objectives. The exclusion criteria were applied to prevent bias due to incomplete data, which could hinder the analysis of the relationship between facial muscle strength and functional ability. The study was conducted following established protocols at the research site.

Facial muscle strength was assessed using Manual Muscle Testing (MMT), while facial function was evaluated using the House-Brackmann (HB) grading system. The facial muscles assessed included the frontalis, corrugator supercilii, orbicularis oculi, zygomaticus major, orbicularis oris, nasalis, buccinator, and risorius. Muscle strength was rated on a 0–5 scale, where 0 indicated complete paralysis, 1 represented weak muscle contraction, 3 showed moderate muscle contraction, and 5 reflected normal muscle contraction. Facial function was categorized using the House-Brackmann grading system, ranging from 1 to 6, with 1 indicating normal function, 2 representing mild dysfunction, 3 for moderate dysfunction, 4 for moderate-severe dysfunction, 5 for severe dysfunction, and 6 indicating total paralysis. The HB assessment was conducted through observation and interpretation by research assistants who had undergone perception alignment training to ensure consistent evaluation.

Data analysis began with a normality test using the Kolmogorov-Smirnov test, as the sample size exceeded 50 respondents. If $p > 0.05$, the data were considered normally distributed. Spearman's correlation test was applied to examine the correlation between facial muscle strength and facial function. A p-value < 0.05 indicated a significant relationship between the variables. Additionally, the correlation coefficient (r) was used to determine the strength and direction of the relationship.[12]

Results

The selection of study participants followed predefined inclusion and exclusion criteria. Individuals diagnosed with Bell's palsy were included, while those with incomplete data were excluded. The recruitment process began with an initial sample of 150 respondents. After applying the exclusion criteria, 69 participants were removed due to incomplete data. Additionally, 25 participants dropped out due to incomplete evaluations. As a result, the final number of respondents included in the study was 125. The detailed selection process is illustrated in Figure 1—flowchart of Participant Selection.

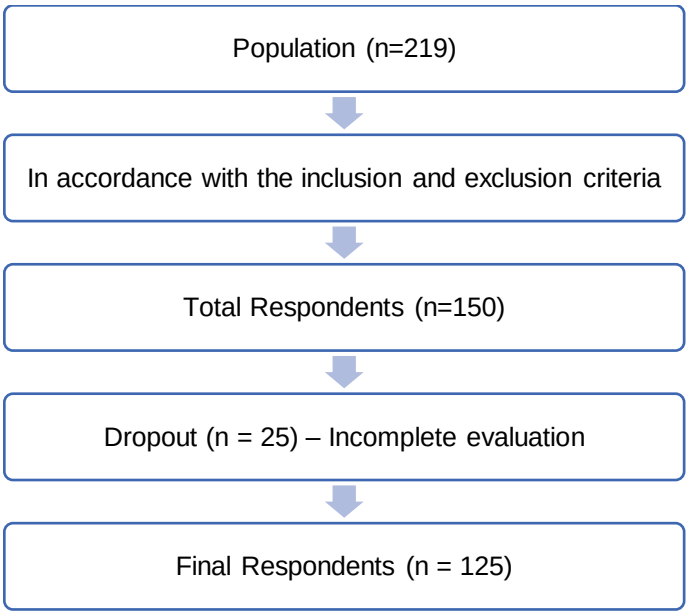

Figure 1. Flowchart of Participant Selection

The sample size was relatively large compared to standard research requirements, with a large effect size (d = 1.71). All subjects underwent facial functional assessment using the House-Brackmann (HB) grading system and facial muscle strength evaluation using Manual Muscle Testing (MMT). The assessed facial muscles included the frontalis, corrugator supercilii, orbicularis oculi, zygomaticus major, orbicularis oris, nasalis, buccinator, and risorius.

The characteristics of the respondents are presented in Table 1. The mean age of the respondents was 42.6 years (±15.07), with the majority being female (56.8%). The average HB score was 4.32 (±0.884), indicating moderate to severe facial dysfunction. The range of facial muscle strength was between 0 and 1.8, suggesting severe muscle weakness.

Table 1. Characteristics of Respondents

Category	Mean ± SD
Age (years)	42.6 ± 15.07
Gender	
Male	54 (43.2%)
Female	71 (56.8%)
Comorbidities	
Hypertension	29 (23%)
High cholesterol	11 (8%)
Diabetes mellitus	19 (15%)
Others	11%
No comorbidities	75 (43%)
Facial Function (HB)	4.32 ± 0.884
Facial Muscle Strength (MMT)	
Frontalis	1.376 ± 1.452
Corrugator supercilii	1.568 ± 1.405
Orbicularis oculi	1.840 ± 1.433
Zygomaticus major	1.040 ± 1.247
Orbicularis oris	1.128 ± 1.225
Nasalis	0.864 ± 1.166
Buccinator	1.208 ± 1.138
Risorius	0.888 ± 1.072

Table 1 shows that most respondents were female (56.8%), averaging 42 years. The mean HB score of 4 indicates moderate to severe facial dysfunction, while the muscle strength scores ranging from 0 to 1.8 suggest severe facial muscle weakness. The Spearman correlation analysis results in Table 2 indicate that all variables had a p-value < 0.05, confirming a significant relationship between facial muscle strength and facial function.

Table 2. Correlation Between Variables

Variables	p-value	Correlation Coefficient (r)
Facial Function & MMT Frontalis	0.000	-0.664
Facial Function & MMT Corrugator Supercilii	0.000	-0.681
Facial Function & MMT Orbicularis Oculi	0.000	-0.636
Facial Function & MMT Zygomaticus Major	0.000	-0.668
Facial Function & MMT Orbicularis Oris	0.000	-0.703
Facial Function & MMT Nasalis	0.000	-0.577
Facial Function & MMT Buccinator	0.000	-0.654
Facial Function & MMT Risorius	0.000	-0.604

Based on the data, there is a significant correlation between facial muscle strength and facial function. The correlation coefficients (r) indicate a strong relationship between the two variables. Additionally, the negative correlation suggests that as facial muscle strength increases, facial function (HB score) improves. A lower HB score indicates better facial function, meaning stronger facial muscles are associated with better functional outcomes.

Discussion

Subject Characteristics

The subject characteristics influencing Bell's palsy include a history of comorbid conditions. In this study, 19 subjects (15%) had diabetes mellitus. Individuals with diabetes mellitus are more susceptible to Bell's palsy due to mononeuropathy.[13] Other comorbid conditions among the subjects included hypertension in 29 subjects (23%), high cholesterol in 11 subjects (8%), and other conditions in 11%. The respondents in this study had more than one comorbid condition. However, most respondents had no history of comorbid conditions, totaling 75 subjects (63%). Previous studies have indicated that hypertension increases the risk of Bell's palsy in individuals over 40 years old.[14] Another study also found that Bell's palsy poses a risk for individuals with hypertension and diabetes mellitus.[15]

The respondents exhibited a decline in facial muscle strength, with the following mean values: *m. frontalis* (1.376±1.452), *m. corrugator supercilii* (1.568±1.405), *m. orbicularis oculi* (1.840±1.433), *m. zygomaticus major* (1.040±1.247), *m. orbicularis oris* (1.128±1.225), *m. nasalis* (0.864±1.166), *m. buccinator* (1.208±1.138), and *m. risorius* (0.888±1.072). These results indicate that Bell's palsy patients experience facial muscle paralysis. Bell's palsy is an acute neurological condition that leads to unilateral facial paralysis. The decline in facial muscle strength in Bell's palsy

patients is due to dysfunction of the facial nerve (*nervus facialis* or cranial nerve VII), which controls facial expression muscles. Inflammation or compression of the facial nerve disrupts neural signal transmission to facial muscles, leading to disuse atrophy, reduced muscle strength, and impaired motor control. In the acute phase of Bell's palsy, inflammation increases pressure around the nerve, restricting blood supply and oxygenation to nerve fibers. This results in ischemia, contributing to the loss of facial muscle contraction ability.[16]

The respondents exhibited a decline in facial function, as indicated by an average House-Brackmann (HB) score of 4.32±0.884, which reflects moderate to severe dysfunction. Bell's palsy is primarily caused by inflammation that compresses the facial nerve within the Fallopian canal, exerting additional pressure on the nerve and reducing its ability to transmit motor signals effectively. When neural transmission weakens, facial muscles fail to function normally, causing an increase in House-Brackmann scores, which correlate with the severity of muscle weakness. Facial muscle paralysis results in asymmetry, as the affected muscles cannot contract efficiently. This imbalance disrupts synchronized facial expressions and impairs nonverbal communication abilities.[17]

Relationship Between Facial Muscle Strength and Functional Facial Ability in Bell's Palsy Patients

This study found a significant relationship between facial muscle strength and functional facial ability in Bell's palsy patients, with the following correlation coefficients: *m. frontalis* (r=-0.664), *m. corrugator supercilii* (r=-0.681), *m. orbicularis oculi* (r=-0.636), *m. zygomaticus major* (r=-0.668), *m. orbicularis oris* (r=-0.703), *m. nasalis* (r=-0.577), *m. buccinator* (r=-0.654), and *m. risorius* (r=-0.604) (p=0.000). The *m. frontalis* functions to raise the eyebrows and wrinkle the forehead, conveying surprise or concern. The *m. corrugator supercilii* draws the eyebrows downward and inward, expressing concentration, worry, or anger, and helps shield the eyes from sunlight by positioning the eyebrows closer together. The *m. orbicularis oculi* plays a crucial role in blinking, eye reflexes, and facial expressions like smiling or sadness. The *m. zygomaticus major* lifts the corners of the mouth upward and outward, creating a smiling or laughing expression. The *m. orbicularis oris* functions to close and pucker the lips, which is crucial for activities such as kissing, whistling, eating, and speaking. The *m. nasalis* assists in dilating or constricting the nostrils, while the *m. buccinator* presses the cheeks inward to prevent food from escaping during chewing and helps with blowing air or whistling. The *m. risorius* pulls the mouth corners outward, creating a subtle or small smile without engaging the *m—m-zygomaticus* for a full smile[18]. Bell's palsy leads to sudden weakness or paralysis of facial muscles on one side of the face, typically due to inflammation or facial nerve dysfunction. This condition significantly impacts the patient's quality of life, impairing essential facial functions and expressions.[19]

The decline in facial muscle strength directly affects functional ability.[20] Muscle weakness disrupts fundamental motor functions, such as emotional expression (smiling or laughing), protective functions (eye closure), and other expressions like sadness, concentration, worry, and friendliness. In Bell's palsy patients, muscle weakness results in facial asymmetry, affecting sensory and motor functions.[21] Previous studies have reported that facial muscle size increased following facial exercise interventions in middle-aged women. Additionally, facial skin function improved after isometric facial exercises.[20] Another study reported that facial muscle strengthening exercises performed before a mirror led to increased facial muscle strength and improved facial expression ability.[22]

This study found that lower facial muscle strength (lower measurement values) correlates with reduced functional facial ability (higher measurement values). This is due to the direct dependence between muscle strength and the ability to perform precise, controlled movements. Stronger facial muscles enhance the ability to execute functional tasks, such as raising the eyebrows, smiling, or wrinkling the forehead.[23] Several factors influence facial muscle strength and function in Bell's palsy patients, including nerve involvement onset duration and severity. Patients with longer onset durations and more extensive nerve involvement typically exhibit weaker muscle strength, leading to greater functional impairment.[24]. Additionally, psychological factors play a role in facial muscle strength and function in Bell's palsy patients. Mental health is crucial, as the inability to control facial expressions often leads to stress or depression, which can reduce motivation for rehabilitation exercises. Psychological support during recovery enhances motivation and consistency in facial muscle training.[25]

The findings of this study highlight the relationship between facial muscle strength and functional ability in Bell's palsy patients, emphasizing the importance of routine facial muscle strength evaluations as a potential indicator of functional progress. Adequate facial muscle strength enhances a patient's ability to perform daily activities involving facial muscles, ultimately improving quality of life. Rehabilitation programs incorporating facial muscle strengthening exercises, neural stimulation techniques, and psychological support hold great potential for accelerating recovery. These findings further support the need for early intervention and structured rehabilitation in Bell's palsy patients to enhance muscle strength and maintain or improve functional facial ability.

Despite these significant findings, this study has several limitations. The researchers did not restrict respondent age distribution or disease duration, resulting in wide data variability. Furthermore, the study did not differentiate the causes of Bell's palsy, whether due to nerve compression or facial nerve damage. Additionally, variations in facial muscle strength and functional facial assessments may exist in medical records before 2024 due to differences in measurement tools.

Conclusion

The results of this study indicate a significant relationship between facial muscle strength and functional ability in patients with Bell's Palsy. The decline in facial muscle strength directly affects functional skills such as emotional expression, speech, eating, and swallowing. Therefore, restoring facial muscle strength through appropriate therapy is essential for improving overall facial function, ultimately contributing to a better quality of life for patients.

Based on these findings, it is recommended that rehabilitation programs include progressive and consistent facial muscle-strengthening exercises to accelerate functional recovery. Further research with a larger sample size and

a longitudinal study design is needed to evaluate long-term recovery progress. Additionally, future studies should identify other influencing factors, including psychosocial aspects, and analyze various facial therapies to enhance muscle strength and function. This will help develop more effective and evidence-based rehabilitation strategies.

Acknowledgments

The authors thank the Indonesian Association of Physiotherapy Higher Education Institutions (APTIFI) for funding this research. The funding from APTIFI was used to support the study design, data collection, and result analysis. However, the funding institution had no role in data interpretation or research conclusions. Additionally, the authors extend their appreciation to STIKES Katolik St. Vincentius a Paulo Surabaya and Poltekkes Kemenkes Surabaya as their affiliated institutions, as well as to RS Katolik St. Vincentius a Paulo Surabaya as the research site and affiliated institution. The authors declare no conflicts of interest in this study.

References

1. Heckmann JG, Urban PP, Pitz S, Guntinas-Lichius O, Gágyor I. The diagnosis and treatment of idiopathic facial paresis (Bell's palsy). Dtsch Arztebl Int. 2019 Oct 11.
2. Moch B. Bell's palsy (BP). Saintika Med. 2017 Mar 18;7(2).
3. Babl FE, Mackay MT, Borland ML, Herd DW, Kochar A, Hort J, et al. Bell's palsy in children (BellPIC): protocol for a multicentre, placebo-controlled randomized trial. BMC Pediatr. 2017 Dec 13;17(1):53.
4. Zhang W, Xu L, Luo T, Wu F, Zhao B, Li X. The etiology of Bell's palsy: a review. J Neurol. 2020 Jul 28;267(7):1896–905.
5. Amanati S, Gani P, Abidin Z. Pengaruh infra red dan electrical stimulation serta massage terhadap kasus Bell's palsy dekstra. J Fisioter Rehabilitasi. 2017;1(1):9–15.
6. Teixeira LJ, Valbuza JS, Prado GF. Physical therapy for Bell's palsy (idiopathic facial paralysis). Cochrane Database Syst Rev. 2011 Dec 7.
7. Baugh RF, Basura GJ, Ishii LE, Schwartz SR, Drumheller CM, Burkholder R, et al. Clinical practice guideline: Bell's palsy. Otolaryngol Head Neck Surg. 2013 Nov 4;149(S3).
8. Afandi GE, Rahman I. Penatalaksanaan fisioterapi pada kasus Bell's palsy sinistra dengan modalitas infra red dan massage di RSUD Cikalong Wetan Kabupaten Bandung Barat. Excell Midwifery J. 2021;4(2):44–9.
9. Thielker J, Geißler K, Granitzka T, Klingner CM, Volk GF, Guntinas-Lichius O. Acute management of Bell's palsy. Curr Otorhinolaryngol Rep. 2018 Jun 21;6(2):161–70.
10. Pratiwi SI, Karlina, Rahman I. Penatalaksanaan fisioterapi pada kasus Bell's palsy sinistra dengan modalitas infra red, electrical stimulation (faradik) dan massage di RSUD Cililin. J Health Sci Physiother. 2021;3:103–10.
11. Martha AP, Dilla Tedju SO, Astuti MS, Eltaria M, Saraswati MS. Penatalaksanaan fisioterapi pada pasien Bell's palsy. J Fisioter Rehabilitasi. 2023;8(1):57–63.
12. Brydges CR. Effect size guidelines, sample size calculations, and statistical power in gerontology. Sands LP, editor. Innov Aging. 2019 Aug 1;3(4).
13. Pecket P, Schattner A. Concurrent Bell's palsy and diabetes mellitus: a diabetic mononeuropathy? J Neurol Neurosurg Psychiatry. 1982 Jul 1;45(7):652–5.
14. Savadi-Oskouei D, Abedi A, Sadeghi-Bazargani H. Independent role of hypertension in Bell's palsy: a case-control study. Eur Neurol. 2008;60(5):253–7.
15. Romadhoni, Herianti SO, Yekti M, Khamsiyati SI. Diabetes mellitus and hypertension are associated with Bell's palsy. Magna Neurol. 2024 Jan 1;2(1):5–8.
16. Chikly B, Doubblestein D. Idiopathic Bell's palsy: a case study of lymph drainage therapy (LDT) treatment. 20(11).
17. Ronthal M, Shefner JM. Bell's palsy: pathogenesis, clinical features, and diagnosis in adults. 2012.
18. Soekanto A, Rianti EDD, Putut Laksminto Emanuel E, Hardiyono H. Mapping perubahan anatomi musculus face pada pemberian paparan inframerah dengan akupuntur. Briliant J Riset Konseptual. 2022;7(3):778.
19. Hohman MH, Warner MJ, Varacallo M, Busby TH. Bell palsy (nursing) [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 [cited 2025 Mar 15]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK568812/
20. Abe T, Loenneke JP. The influence of facial muscle training on the facial soft tissue profile. Cosmetics. 2019 Aug 11;6(3):50.
21. Gatidou AM, Kottaras A, Lytras D, Gatidou C, Iakovidis P, Kottaras I. Physiotherapy management of Bell's palsy: a review of evidenced-based physiotherapy practice. Int J Adv Res Med. 2021 Jan 1;3(1):402–6.
22. Martono M, Isnaeni A, Hartono H. Assessment of the effectiveness of facial expression exercises stimulation using mirror media in increasing facial muscle strength in hemiparetic stroke patients. Open Access Maced J Med Sci. 2022 Oct 23;10(A):2543–8.
23. Pavese C, Giordano A, Dalla Toffola E, Nardone A, Franchignoni F. Facial Disability Index in adults with peripheral facial palsy: Rasch analysis and suggestions for refinement. Arch Phys Med Rehabil. 2022 Aug;103(8):1544–50.
24. Zalfa F, Santoso TB, Fauzan M. Meningkatkan kekuatan otot dan fungsional pada kasus Bell's palsy: a case report. In: Academic Physiotherapy Conferences. Sukoharjo: Universitas Muhammadiyah Surakarta; 2024. p. 39–48.
25. Vargo M, Ding P, Sacco M, Duggal R, Genther DJ, Ciolek PJ, et al. The psychological and psychosocial effects of facial paralysis: a review. J Plast Reconstr Aesthet Surg. 2023 Aug;83:423–30.