

## ROLE OF DIGITAL FACIAL MOTION TRACKING APPS IN EARLY DETECTION AND REHABILITATION MONITORING OF BELL'S PALSY

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### ABSTRACT

Idiopathic palsy, another name for Bell's palsy, is a type of facial paralysis that only affects one side of the face. Its impact on the face easily aggravates it. The impact not only results in total loss but also greatly distresses the patient. The beginning and length of steroid treatment also greatly enhance recovery. The impact of the nerve has traditionally been evaluated through clinical observation and objective measurements like the House-Brackmann scale.

Applications for digital facial motion tracking have been made possible by recent developments in mobile health technology and artificial intelligence. These smartphone-based gadgets provide an objective evaluation of facial symmetry and muscle activity using machine learning algorithms and the camera landmark detection system. By enabling the patient to monitor facial recovery at home and giving the doctor useful information, these applications improve patient engagement and continuity of care. This review discusses the technological foundation, applications, advantages and disadvantages, and potential future developments for digital facial motion tracking applications in the early diagnosis and rehabilitation follow-up of Bell's palsy patients.

### Keywords

Bell's palsy, facial nerve paralysis, digital health, facial motion tracking, rehabilitation monitoring, telemedicine

### INTRODUCTION

Bell's palsy is thought to be the most frequent cause of acute facial nerve paralysis, with an estimated yearly incidence of 20 to 30 cases per 100,000 people worldwide.(1) Symptoms include asymmetry when speaking or smiling, difficulty

closing one eye, abrupt onset of facial weakness, and diminished ability to furrow one's brow. (2) Facial paralysis can significantly affect daily activities and one's emotions, even though it may be a temporary condition.(3)

Early intervention is essential because corticosteroid therapy will significantly improve facial nerve function and prevent incomplete recovery if it is started within the first 72 hours.(4) At the moment, the evaluation is carried out using subjective assessment, which is graded using scales like the one suggested by House and Brackmann. This approach necessitates a high level of expertise.(5) In light of this, a variety of assessment technologies are being developed. Applications for digital assessment of facial motion are a novel approach that uses artificial intelligence to assess facial symmetry and movement.(6)

### Methods

A narrative literature review was carried out using electronic databases such as IEEE Xplore, PubMed, and Scopus to identify relevant publication between 2010 and 2025. Bell's palsy, facial paralysis, facial motion tracking, digital rehabilitation, and smartphone apps were some of the key terms used during the search. The studies included had to be peer-reviewed, utilize human subjects, and use digital facial assessment tools.(7) On the other hand, papers related to other types of unrelated digital tools or non-human models were excluded. The compilation of the most recent information on the functionality of applications in the field of facial motion tracking for early detection and rehabilitation follow-up was done rather than a statistical meta-analysis.

### Technological Principles of Facial Motion Tracking Applications

There are three basic components that are combined in the applications related to digital facial motion tracking, and these include image capturing based on the camera, facial landmark detection, and the use of AI technology in analysis.(8)

Standardized facial actions include smiling, eyebrow raise, eyelid closure, and pursing of the lips, which are recorded using smartphone or tablet cameras. Identifying crucial facial features such as eyebrows, eyelids, lip corners, and nasolabial folds is performed using facial landmark algorithms that also track dynamic changes in these features.(8) Finally, after analysis of asymmetry, amplitude of

movement, and dynamic changes, machine learning algorithms yield graphical and scoring outputs that determine facial nerve function.(9)

### Role in Early Detection of Bell's Palsy

Mild facial weakness may not be evident during a routine clinical examination in early or mild cases of Bell's palsy.(2) Applications for tracking facial motion can pick up subtle differences in lip movement, smiling, or blinking that patients or medical professionals may not notice.(9) These tools may facilitate early medical consultation and initiation of early corticosteroid therapy, which is associated with improved outcomes, through the warning of early functional changes in users.(4)

### Rehabilitation Monitoring

Recovery from Bells palsy can take weeks or months and also requires rehabilitation so that symmetry in facial functions can be achieved and synkinesis can be prevented.(10) By applying applications of facial motion tracking so that facial exercises performed on a day-to-day basis can be tracked, patients can monitor their progress objectively (10). Feedback will enable patients to have motivation in following up rehabilitation processes, and the data collected can also enable modifications in rehabilitation strategies by health providers.(11)

### Patient-Centered Benefits

The emotional health, as well as self-perception, of patients may be greatly affected by facial paralysis.(3) During this period, they will be less worried yet more confident because of the digital tracking application they use to view tangible evidence of their improvement. (12)Furthermore, remote monitoring minimizes revisits to healthcare facilities, which ultimately results in more patient-centered care and improves convenience, especially in areas where many people live far away from healthcare facilities.(12)

### Limitations

Although digital facial tracking applications have their potential, there are certain drawbacks associated with them. The precision of measurements may be affected by factors like

patient position, lighting conditions, and camera quality.(13) In addition, the lack of comprehensive studies for validating these applications, as well as concerns about data protection, are some of the factors acting as major hindrances against their adoption. (14) More specifically, these applications should ideally support, rather than replace, professional clinical evaluation.(15)

### Future Directions

Advances in three-dimensional facial analysis, integration of sensor technology, and development of artificial intelligence algorithms to predict recovery courses will be other areas to be explored in the coming years. (9) Large-scale clinical trials will be required to validate new methods to standardize outcomes in clinical settings to assess their effectiveness. FacioMover tracking apps will become more important in treating Bell's palsy with the growing field of digital health.

### Conclusion

Bell's palsy early diagnosis and rehabilitation tracking have greatly improved with the advent of digital facial movement tracking software. Because these software programs can objectively and quantitatively analyze facial movement function, they have significantly enhanced patient involvement in recovery, monitoring of rehabilitation, and diagnosis. Despite their many flaws, these software programs could become indispensable supplemental tools for facial nerve analysis and rehabilitation techniques in the future.

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