

MEDICAL POLICY

MEDICAL POLICY DETAILS	
Medical Policy Title	Computerized Motion Diagnostic Imaging (CMDI)/Gait Analysis
Policy Number	2.01.13
Category	Technology Assessment
Original Effective Date	07/02/99
Committee Approval Date	01/17/19, 01/16/20, 01/21/21, 01/20/22
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Product Disclaimer	<ul style="list-style-type: none"> • If a product excludes coverage for a service, it is not covered, and medical policy criteria do not apply. • If a commercial product (including an Essential Plan or Child Health Plus product), medical policy criteria apply to the benefit. • If a Medicaid product covers a specific service, and there are no New York State Medicaid guidelines (eMedNY) criteria, medical policy criteria apply to the benefit. • If a Medicare product (including Medicare HMO-Dual Special Needs Program (DSNP) product) covers a specific service, and there is no national or local Medicare coverage decision for the service, medical policy criteria apply to the benefit. • If a Medicare HMO-Dual Special Needs Program (DSNP) product DOES NOT cover a specific service please refer to the Medicaid Product coverage line.

POLICY STATEMENT

- I. Based upon our criteria and assessment of the peer reviewed literature, computerized motion diagnostic imaging (CMDI)/gait analysis has been medically proven to be effective and, therefore, is considered **medically appropriate** as part of the preoperative assessment, when the results will be used in surgical planning for children with a diagnosis of cerebral palsy.
- II. Based upon our criteria and the lack of peer-reviewed literature, CMDI/gait analysis has not been medically proven to be effective and, therefore, is considered **not medically necessary** for all other applications, including, but not limited to:
 - A. surgical planning for conditions other than gait disorders associated with cerebral palsy; and
 - B. post-operative evaluation of surgical outcomes and rehabilitation planning and/or evaluation for all conditions.

Refer to Corporate Medical Policy #8.01.12 Physical Therapy (PT).

Refer to Corporate Medical Policy #8.01.17 Occupational Therapy (OT).

DESCRIPTION

Computerized Motion Diagnostic Imaging (CMDI), or gait analysis, uses video recording combined with information from sensor devices, such as surface or needle electromyography or foot pressure-sensing plates, to record and analyze coordinated muscle function.

This technology is proposed for surgical planning, primarily for cerebral palsy, and for evaluation of work-related athletic and automobile accident injuries and back pain.

Spinoscopy focuses on dynamic function of the muscles of the back.

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RATIONALE

A number of motion analysis systems, including the Peak Motus Motion Measurement System, have received Section 510(k) clearance from the U.S. Food and Drug Administration (FDA). The Spinex International spinoscopy device received Section 510(k) clearance in 1988. In 2019, the FDA has granted 510(k) clearance to Scientific Analytics Inc.'s markerless Dari Health System. The manufacturer notes that this is the "world's first and only technology that delivers validated 3D kinematic and kinectic motion analytics without sensors, markers or force plates". A report is produced within minutes of data capture. This markerless system allows a provider to "quantify and graphically display human movement patterns and techniques for uses such as assessment and training of limb and body motion in pre/post rehabilitation evaluation, physical therapy and the like". Scientific Analytics Inc. notes that there is a need for the development of its use in clinical applications and has initiated collaboration with Hospital for Special Surgery (HSS) in New York.

Reports of single-center experience suggest that gait analysis may alter decisions regarding the timing and choice of surgical interventions for children with spastic cerebral palsy. There is insufficient evidence that gait analysis as part of surgical planning improves health outcomes in patients with conditions other than cerebral palsy.

An RCT that was published in 2012 by Wren et al. compared post-surgery health outcomes in children with cerebral palsy who were managed with and without gait analysis. This was a single-center, single-blind study. The trial included 186 ambulatory children with cerebral palsy who were candidates for lower extremity surgery to improve their gait. All participants underwent gait analysis at a gait laboratory. Patients were randomized to a treatment group in which the surgeon received the gait analysis report (the "gait report group") or a control group in which the surgeon did not receive the report. The reports included a summary of test results and treatment recommendations from the gait laboratory physician. The same surgeons treated the intervention and control patients, but only received the gait analysis report for patients in the gait report group. Patients were re-examined on the day before surgery (i.e., following gait analysis) for pre-operative treatment planning. Outcomes were assessed pre-operatively, and approximately one-year post-surgery. There were three primary outcomes: pre- to post-surgical change between groups in the walking scale of the Gillette Functional Assessment Questionnaire, the Gait Deviation Index, and the oxygen cost of walking, a measure of the energy expended while walking (oxygen, cost). A total of 156 of 186 (84%) participants returned for the follow-up examination; analysis was not intention to treat. There was not a statistically significant difference between groups in any of the three primary outcomes. For example, the proportion of patients who improved according to the Functional Assessment Questionnaire was 31% in the intervention group and 25% in the control group ($p=0.38$). On the Child Health Questionnaire (CHQ), there was a significant change in health between the gait report group (56%) and the control group (38%). The authors noted that physicians followed only 42% of recommendations in the gait analysis report for patients in the gait report group, which may partially explain the lack of significant differences between groups in the primary outcomes and most of the secondary outcomes. They further noted that there was a positive relationship between gait outcomes and following gait analysis recommendations.

In 2013, Wren et al. published a secondary analysis of data from a previous RCT to evaluate the impact of gait analysis on the correction of excessive internal hip rotation among ambulatory children with cerebral palsy. In the secondary analysis, the authors included the subset of children for whom the gait laboratory recommended external femoral derotation osteotomy (FDRO) to correct excessive passive and active internal hip rotation and who had both pre- and post-operative data available. As in the primary study, the intervention was receipt of the gait analysis report by the treating orthopedic surgeon for participants in the intervention group (the "gait report group"); in this subset of patients, all patients had had FDRO recommended by the gait analysis report, but the decision to actually perform surgery was up to the treating surgeon. Physical measurements for this sub-analysis included femoral anteversion, maximum hip internal and external rotation range of motion, and rotational alignment during gait. The primary outcome variables included femoral anteversion and mean hip rotation and foot progression in the stance phase of gait. Outcomes post-surgery and change in variables pre- to post-surgery were compared between the gait report group and the control group, with additional analyses based on whether patients in the gait report group had had the gait report recommendations followed. This sub-analysis included 44 children (65 limbs) in whom FDRO was recommended. FDRO was performed on seven of 39 limbs when it was recommended in the gait report group, and FDRO was performed on six of 26 limbs in the control group who did not have knowledge of the gait analysis recommendations. There were no significant differences in outcomes between

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the gait report and control groups on intent-to-treat analysis. However, among children in the gait report group who had FDRO performed (n=7 limbs), the limbs demonstrated greater improvements in femoral anteversion (-32.9° vs -12.2° ; $p=0.01$), dynamic hip rotation (-25.5° vs -7.6° ; $p=0.001$), and foot progression (-36.2° vs -12.4° ; $p=0.02$) than limbs in the control group. The discrepancy between the intent-to-treat and per-protocol results may be related to generally poor compliance with the gait report recommendations, as only seven of 39 recommended FDROs were performed in the gait report group. The authors concluded that outcomes were significantly better for limbs in the gait report group when the recommendations for FDRO were followed. Also, when the recommended FDRO was performed in the gait report group, all outcome measures were corrected to within the normal range. Interpretation of this study's significance is limited by its subgroup analysis design and the small number of patients who received gait analysis and FDRO.

In a systematic review by Rathinam et al. (2014), the reliability and validity of pediatric gait analysis tools were examined and compared to instrumented gait analysis (IGA). In December 2012, the authors conducted a comprehensive search for any type of study reporting observational gait analysis for the pediatric population with neurological, neuromuscular, orthopedic, and other developmental delay due to genetic disorders. Nine studies related to children with cerebral palsy (CP) were included in this review, consisting of five observational gait tools for children with CP. The Edinburgh Visual Gait Score (EVGS) was found to have better reliability and validity than the other tools, but none of the tools accomplished the level of IGA's consistency. Limited studies were available for most of the gait assessment tools. The authors concluded that five video-based gait assessment tools to assess children with CP were not equal to IGA in their objectivity, reliability or validity.

In 2015, Niklasch et al. published a retrospective study evaluating the results of femoral derotation osteotomy (FDO) in children with CP who were examined pre- and one-year post-operatively with standardized clinical examination and 3D gait analysis. A total of 235 affected limbs from 138 children with a mean age of 11 years were included in this analysis. Patients were retrospectively classified into three groups by the amount of derotation in relation to the mean hip rotation (MHR) in stance during gait analysis: Group A had a derotation amount of more than 10 degrees (twice the estimated measurement error) larger than indicated by mean hip rotation in stance (n=57, excessive FDO); Group B had a derotation amount within 10 degrees of gait analysis advice (n=67, moderate FDO); and Group C had a derotation amount more than 10 degrees less than mean hip rotation in stance (n=14, conservative FDO). Improvement of mean hip rotation in stance was calculated by subtracting post-operative from pre-operative mean hip rotation in stance. Results showed that Group B had the greatest benefit, with the highest ratio (86%) of good results. Group C had only 79% good results, but no case of overcorrection or worsening, and Group A had the poorest outcome, with 81% good results, but 14% overcorrection and 3% worsening. The authors concluded that it is less likely to have unsatisfactory outcomes if the amount of FDO is defined according to the findings of gait analysis, compared with clinical examination.

In a retrospective study, Mueske et al. (2018) examined the effects of gait analysis data on pathology identification and surgical recommendations in children with spina bifida. Clinical gait analysis, which included range of motion and strength testing, kinematics and kinetics during walking, and dynamic EMG, was performed on 43 ambulatory children with spina bifida. Data were reviewed by one pediatric orthopedic surgeon and one therapist (kinesiologist or physical therapist), with surgical treatment recommendations and pathology identification performed both before and after gait analysis. Results showed pathology identification changed in at least 18% of cases for both surgeons and therapists after consideration of gait analysis data. Surgery was recommended before or after gait analysis in 56 cases, and the overall recommendation of whether surgery was needed changed in 18% (10/56) after consideration of gait analysis data. At least one change was made to the specific surgical recommendations for 44% of patients. The authors concluded that gait analysis may be particularly helpful in identifying abnormal femoral rotation and excessive hip flexion.

The National Institute for Health and Clinical Excellence (NICE) (United Kingdom) has published guidelines for spasticity in children and young people with non-progressive brain disorders. The guidelines note that, "The decision to perform orthopedic surgery to improve gait should be informed by a thorough pre-operative functional assessment, preferably including gait analysis." The guidelines define gait analysis as "[a] detailed approach to analyzing the component phases of walking using instrumentation or video analysis in addition to clinical observation. This is undertaken to evaluate a child or young person's ability and style of walking and to plan or assess treatment."

According to the National Institute of Neurological Disorders and Stroke (NINDS) for Cerebral Palsy, "Orthopedic surgery is often recommended when spasticity and stiffness are severe enough to make walking and moving about

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difficult or painful. Surgery may not be indicated for all gait abnormalities, and the surgeon may request a quantitative gait analysis before surgery.”

CODES

- Eligibility for reimbursement is based upon the benefits set forth in the member’s subscriber contract.
- **CODES MAY NOT BE COVERED UNDER ALL CIRCUMSTANCES. PLEASE READ THE POLICY AND GUIDELINES STATEMENTS CAREFULLY.**
- Codes may not be all inclusive as the AMA and CMS code updates may occur more frequently than policy updates.

CPT Codes

Code	Description
96000	Comprehensive computer-based motion analysis by videotaping and 3-D kinematics
96001	with dynamic plantar pressure measurements during walking
96002	Dynamic surface electromyography, during walking or other functional activities, 1–12 muscles
96003	Dynamic fine wire electromyography, during walking or other functional activities, 1 muscle
96004	Review and interpretation by physician or other qualified health care professional of comprehensive computer-based motion analysis, dynamic plantar pressure measurements, dynamic surface electromyography during walking or other functional activities, and dynamic fine wire electromyography, with written report
0693T (E/I)	Comprehensive full body computer-based markerless 3D kinematic and kinetic motion analysis and report
0733T (E/I)	Remote real-time, motion capture-based neurorehabilitative therapy ordered by a physician or other qualified health care professional; supply and technical support, per 30 days.
0734T (E/I)	Remote real-time, motion capture-based neurorehabilitative therapy ordered by a physician or other qualified health care professional, treatment management services by a physician or other qualified health care professional, per calendar month
0778T (E/I)	Surface mechanomyography (sMMG) with concurrent application of inertial measurement unit (IMU) sensors for measurement of multi-joint range of motion, posture, gait, and muscle function (<i>Effective 01/01/23</i>)

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HCPCS Codes

Code	Description
No code(s)	

ICD10 Codes

Code	Description
G80.0-G80.9	Cerebral palsy (code range)

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*Key Article

KEY WORDS

Motion Analysis, Spinoscopy, Dynamic EMG, Electrodynamogram, Gait Analysis, Surface EMG

CMS COVERAGE FOR MEDICARE PRODUCT MEMBERS

Based on our review, computerized motion diagnostic imaging, gait analysis, or spinoscopy are not addressed in National or Regional Medicare coverage determinations or policies.