

## TMJ-Related Disorders: From Diagnostic Indices to Digital Jaw-Motion Registration

**Daniela Nerstheimer\***

Smile Creators, Oberstadt 5/ Schaffhausen, Switzerland  
Dental Zentrum Brugg, Fröhlichstrasse 14/ Brugg, Switzerland  
Zahn24Arzt, Langfeldstrasse 24/ Zuchwil, Switzerland  
Implantatzentrum Bern, Nydeggestalden 2/ Bern, Switzerland

**\*Corresponding author:** Med. Dent. Daniela Nerstheimer Smile Creators, Oberstadt 5/ Schaffhausen, Switzerland  
Dental Zentrum Brugg, Fröhlichstrasse 14/ Brugg, Switzerland Zahn24Arzt, Langfeldstrasse 24/ Zuchwil, Switzerland  
Implantatzentrum Bern, Nydeggestalden 2/ Bern, Switzerland

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### Abstract

Temporomandibular joint disorders (TMD) are heterogeneous musculoskeletal and psychosocial conditions. Diagnostic approaches have evolved from Helkimo Index over RDC/TMD to the validated DC/TMD dual-axis model. We summarize indices, symptom clusters, and comparative accuracy/precision evidence. But the Indices do not include treatment option or deep anamnestic diagnostic; we need more information about what happens in the TMJ – and why. Therefore, we are going to overview the digital motions system on the market at this time – like: DMD/Ignident, zebris, MODJAW, PROAXIS, PROSYSTOM, ITAKA - they enable objective kinematics for diagnosis and CAD/CAM integration. Among these, DMD offers a fully digital workflow with micrometer-scale resolution.

Yet all those diagnostic methods and classification indices do not include the necessary therapy options. Therefore, is a very deep knowledge of the pathology and dynamic of the healthy and pathological TMJ.

The methods are analog, mixt (analog and digitally) and fully digitally.

### Keywords

Temporomandibular joint disorders; Heterogeneous; Musculoskeletal; Digital jaw-motion; Diagnostic Indices.

## Abbreviations and Explanations

- TMJ – Temporomandibular Joint (Kiefergelenk)
- TMD – Temporomandibular Disorders (Kiefergelenkserkrankungen / Funktionsstörungen)
- CMD – Craniomandibular Dysfunction (Übergeordneter Begriff für funktionelle Störungen des Kausystems, wie ihn z. B. Christiansen verwendet)
- RDC/TMD – Research Diagnostic Criteria for Temporomandibular Disorders (Forschungsdiagnostische Kriterien für TMD, 1992 eingeführt)
- DC/TMD – Diagnostic Criteria for Temporomandibular Disorders (Diagnostische Kriterien für TMD, 2014 publiziert, klinischer Standard)
- DOF – Degrees of Freedom (Bewegungsfreiheitsgrade, hier meist 6: Translation + Rotation in allen Achsen)
- CBCT – Cone Beam Computed Tomography (Digitale Volumentomographie)
- IOS – Intraoral Scanner (3D-Scanner für intraorale Abdrücke)
- CAD/CAM – Computer-Aided Design / Computer-Aided Manufacturing (Computergestütztes Design und Fertigung)
- GCPS – Graded Chronic Pain Scale (Skala zur Einstufung chronischer Schmerzen: Intensität + Beeinträchtigung)
- JFLS – Jaw Functional Limitation Scale (Skala zur Messung funktioneller Einschränkungen des Kiefers)
- PHQ-9 – Patient Health Questionnaire – 9 items (Screening für Depression)
- GAD-7 – Generalized Anxiety Disorder – 7 items (Screening für generalisierte Angststörung)
- OBC – Oral Behaviors Checklist (Liste zur Erfassung oraler Parafunktionen, z. B. Pressen/Knirschen)
- SCi – Sagittal Condylar Inclination (Sagittale Kondylarbahnneigung; wichtig für Artikulatorprogrammierung)

## Introduction

TMD affects the TMJ, masticatory muscles, and associated structures, frequently coexisting with psychosocial factors. Standardized indices facilitate consistent diagnosis and research comparability.

## Diagnostic Indices

### Helkimo index (1974)

The Helkimo Index is one of the first standardized tools for assessing temporomandibular disorders (TMD). It is divided into two components: Helkimo Index – Overview the Helkimo Index was introduced by Helkimo in 1974 as one of the first standardized indices for temporomandibular disorders. It is still referenced today in epidemiological studies and sometimes in clinical screening.

### The index consists of three components:

Anamnestic Index (Ai) – Based on the patient's self-reported symptoms.

- Ai 0 – no symptoms reported.
- Ai I – mild symptoms: occasional pain in jaw muscles, joint noises, stiffness, fatigue.

- Ai II – severe symptoms: difficulties opening, locking, luxation, pain in masticatory muscles and/or TMJs.

**Clinical Dysfunction Index (Di) – Based on clinical examination of the masticatory system. – Five domains are scored (0 = normal, 1 = mild deviation, 5 = severe deviation).**

- Impaired range of motion (maximum opening, protrusion, laterotrusion).
- TMJ function (deviation on opening/closing, locking).
- Muscle pain on palpation.
- TMJ pain on palpation.
- Pain during mandibular movement.

**The scores are summed and classified:**

- Di 0 – no dysfunction.
- Di I – mild dysfunction (1–4 points).
- Di II – moderate dysfunction (5–9 points).
- Di III – severe dysfunction (10–25 points).

**Occlusal Index (Oi) (sometimes included) – Evaluates occlusal relationships that may predispose to TMD:**

- Number of teeth in contact,
- Interferences in laterotrusion/protrusion,
- Overbite/overjet,
- Presence of crossbite or open bite. Clinical Use & Limitations

**Strengths:**

- Simple and fast to apply in both clinical and epidemiological studies.
- Provides a global picture (symptoms + signs + occlusion).
- Useful for prevalence studies and comparison across populations.

**Limitations:**

- Considered less specific and less valid compared to DC/TMD.
- Lumps different TMD categories together (does not differentiate muscle vs. joint disorders precisely).
- Occlusal parameters today are understood as less directly causal than assumed in the 1970s.
- Has moderate inter-examiner reliability (depends heavily on calibration).

**This means:** Helkimo is still important historically and for large-scale screenings. DC/TMD has largely replaced it for precise diagnosis.

### **DC/TMD (Diagnostic Criteria for TMD, 2014)**

The DC/TMD is the current international gold standard for diagnosing temporomandibular disorders. It is a dual-axis diagnostic system:

Structure of DC/TMD Like RDC/TMD, the DC/TMD uses a dual-axis model:

#### **Axis I – Physical Diagnoses Focuses on symptom questionnaire + standardized clinical examination.**

Symptom Questionnaire (SQ):

- Screens for pain in jaw, face, temples, or ears in last 30 days.
- Screens for joint noises (clicking, popping, crepitus).
- Screens for locking or catching of the jaw.

#### **Clinical Examination Protocol: Conducted by calibrated examiners (in ~20 min). Standardized instructions and methods:**

Mandibular range of motion:

- Maximum unassisted opening, assisted opening, lateral, and protrusive excursions.
- Deviation/deflection on opening.

#### **TMJ sounds:**

- Clicking, popping, or crepitus during opening/closing, lateral, and protrusive movements.

Muscle palpation (extra- and intraoral):

- Temporalis (anterior/middle/posterior), masseter (origin/belly/insertion), medial pterygoid, submandibular, sternocleidomastoid, trapezius.

#### **TMJ palpation:**

- Pain upon lateral pole or posterior palpation.

Provocation tests:

- Joint or muscle pain reproduced during movement.

#### **Diagnostic Algorithms (Axis I):**

Provide validated criteria for:

- Pain-related TMD: myalgia, local myalgia, myofascial pain, myofascial pain with referral, arthralgia, headache attributed to TMD.

- Intra-articular TMD: disc displacement with reduction, disc displacement without reduction (with/without limited opening), degenerative joint disease (osteoarthritis/osteoarthrosis), subluxation.

## **Axis II – Psychosocial Assessment Captures the biopsychosocial dimension of TMD**

### **Standardized instruments**

- Graded Chronic Pain Scale (GCPS v.2): pain intensity, pain-related disability.
- Jaw Functional Limitation Scale (JFLS): measures functional limitations (chewing, speaking, mobility).
- PHQ-9: depression screening.
- GAD-7: anxiety screening.
- Oral Behaviors Checklist (OBC): parafunctions such as clenching, grinding, posture habits.

### **Purpose**

- Identifies psychosocial distress and functional impact.
- Predicts prognosis and treatment outcome.
- Supports interdisciplinary care (dentist + psychologist/physiotherapist).

### **Validation and Performance**

Multi-center Validation Project (2014):

- Sensitivity  $\geq 0.86$ , specificity  $\geq 0.98$  for most pain-related diagnoses.
- High inter-examiner reliability after calibration training.
- Languages: Translated/adapted into >30 languages with cross-cultural validation
- Clinical efficiency: Full Axis I exam ~20 min; shorter screening tools (5-question screener) also available.

### **Clinical relevance**

For clinicians:

- Provides a structured pathway for consistent diagnosis.
- Useful for differential diagnosis between muscle pain, joint pain, and headaches.

For research

- Enables comparability across studies worldwide.
- Standardizes patient populations in clinical trials.

For epidemiology

- Allows international prevalence and risk factor studies.

### Limitations

- Some rare intra-articular disorders (ankylosis, neoplasia) not included.
- Requires calibration training for reliable Axis I clinical exam.
- Psychosocial instruments (Axis II) increase time burden, but essential for full assessment.
- Imaging (MRI, CBCT) may still be required for confirmation of structural diagnoses (e.g., disc displacement, arthritis).

### RDC/TMD (Research Diagnostic Criteria, 1992)

The RDC/TMD was the precursor of the DC/TMD and provided the first internationally standardized research criteria for TMD. It introduced the two-axis model (Axis I: clinical diagnosis, Axis II: psychosocial factors). Although replaced by the DC/TMD, it is still cited in long-term studies.

Like its successor (DC/TMD), it was based on a dual-axis system:

#### Axis I – Physical Diagnosis Focus: clinical signs and symptoms of TMD

Domains examined:

- Pain in muscles of mastication.
- TMJ pain on palpation.
- Range of motion (maximum unassisted and assisted opening, lateral, protrusive).
- TMJ sounds (clicks, crepitus) during movement.
- TMJ locking or subluxation.

Classification into 3 Groups:

- Group I – Muscle disorders: myofascial pain, myofascial pain with limited opening.
- Group II – Disc displacements: with reduction, without reduction (with or without limited opening).
- Group III – Arthralgia, arthritis, arthrosis.

#### Axis II – Psychosocial Assessment Focus: psychological status and pain-related disability

Tools used:

- Graded Chronic Pain Scale (GCPS) for pain intensity and disability.
- Psychological distress: depression and somatization (via SCL-90 items).

Emphasized that psychosocial factors play a critical role in TMD onset, maintenance, and treatment outcomes.

#### Purpose of RDC/TMD

- Developed to create a reliable research tool for clinical studies, ensuring uniform diagnostic criteria across sites.

- Provided operational definitions for both Axis I (clinical signs) and Axis II (psychosocial profile).
- Aimed to resolve inconsistencies in earlier studies caused by lack of standardized criteria.

### Strengths

- Innovation (1992): First to recognize TMD as a biopsychosocial disorder rather than purely occlusal/mechanical.
- Standardization: Provided uniform case definitions for multicenter clinical trials.
- Widespread use: Translated into many languages and adopted in research for more than two decades.
- Foundation for DC/TMD: Its strengths and weaknesses directly informed the 2014 revision.

### Limitations

Diagnostic validity issues:

- Good reliability for myofascial pain and arthralgia.
- But poor sensitivity/specificity for some intra-articular conditions (disc displacements, degenerative joint disease).
- **Time-consuming:** Full application required ~30–45 minutes, less practical for everyday clinical use.
- **Axis II limited:** Focused mainly on depression and somatization, not as comprehensive as later tools (PHQ-9, GAD-7, JFLS).
- **Outdated concepts:** Heavy emphasis on occlusion/structural features, which later research showed are less predictive.

### Clinical Use & Legacy

- RDC/TMD is now mostly historical, but it shaped the modern approach to TMD diagnosis.
- Still occasionally used in epidemiological studies for comparability with older datasets.
- Superseded by DC/TMD (2014), which addressed its limitations (better diagnostic validity, shorter exam, expanded psychosocial assessment).

## Krogh-Poulsen Test/Index (1960s) Originally developed in Scandinavia, the Krogh-Poulsen index is a simple clinical screening tool for TMD

### Purpose

- Designed as an epidemiological screening tool to estimate the prevalence and severity of masticatory system dysfunction in populations.
- Focused mainly on clinical signs rather than psychosocial dimensions.

### Parameters assessed the Krough-Poulsen index considered the following functional signs:

- Mandibular Movement Abnormalities

- Limited range of motion.
- Deviations/deflections during opening.

### **TMJ Sounds**

- Clicking or crepitus during mandibular movements.

### **Muscle and joint tenderness**

- Pain on palpation of the masticatory muscles.
- Pain on palpation of the TMJ.

### **Occlusal interferences/malocclusion factors**

- Considered occlusal disharmonies as risk contributors. Each parameter was scored (usually present/absent or mild/severe), and the sum indicated the degree of dysfunction.

### **Scoring**

Exact scoring schemes varied in studies, but typically:

- 0 = No signs of dysfunction
- 1 = Mild dysfunction
- 2 = Moderate dysfunction
- 3 = Severe dysfunction

This provided a global dysfunction score similar in spirit to Helkimo's later Clinical Dysfunction Index.

### **Strengths**

- One of the first systematic attempts to classify TMJ/masticatory dysfunction.
- Simple, quick, and usable in large population-based surveys.
- Highlighted the importance of functional signs (not just occlusion).

### **Limitations**

- No psychosocial assessment (unlike RDC/DC-TMD).
- Low diagnostic specificity — lumps together different TMD entities.
- Scoring criteria were less standardized and sometimes inconsistently applied.
- Largely superseded by Helkimo Index and RDC/TMD, but still cited in historical comparisons.

### **Clinical and research role today**

- Rarely used in contemporary clinical practice.
- Sometimes appears in epidemiological studies (especially Scandinavian literature) for historical comparison.
- Its main legacy: paved the way toward multidimensional assessment of TMD.

## Clinical Function Status (Ahlers/Möller, DGFDt)

This index was introduced by Ahlers and Möller and is recommended by the German Society for Functional Diagnostics and Therapy (DGFDt). It is mainly used in Germany as a standardized clinical examination form.

### Background

- Developed in the 1990s–2000s by Oliver Ahlers and Ingo Möller, based on earlier functional concepts and refined under the DGFDt (German Society for Functional Diagnostics and Therapy).
- Aim: provide a standardized, clinically applicable examination protocol for functional disorders of the masticatory system.
- Adopted widely in Germany and recommended by the DGZMK (German Society of Dentistry and Oral Medicine).
- Represents the most common standardized clinical examination form in German functional diagnostics.

### The Clinical Function Status examines:

#### Anamnesis (Patient History)

- Pain symptoms: localization, quality, intensity (numeric scale).
- Functional complaints: difficulty in chewing, speaking, yawning, or opening.
- Parafunctions: bruxism, clenching, habits.
- History of trauma, stress, or systemic factors.

### Clinical findings

#### 1. TMJ Examination

- Palpation of lateral and posterior TMJ poles.
- Auscultation for noises: clicking, crepitus (noted as R = rubbing, K = clicking).
- Pain provocation on loading or movement.

#### 2. Musculature examination

- Palpation of masticatory muscles (temporalis, masseter, medial/lateral pterygoid).
- Examination of neck muscles (sternocleidomastoid, trapezius).
- Tenderness graded (0 = none, 1 = mild, 2 = painful).

#### 3. Mobility of the Mandible

- Active and passive maximum opening (mm).
- Protrusion, retrusion, lateral excursions (mm).
- Deviations and deflections during movement.

#### 4. Occlusion

- Static contacts (intercuspidation, premature contacts).

- Dynamic occlusion: canine guidance, group function, interferences.
- Vertical and horizontal relations (overjet/overbite).

## 5. Additional Findings

- Tooth wear (attrition, abrasion).
- Mucosal imprints (tongue, cheeks).
- Signs of parafunction (linea alba, hypertrophy of masseter).

## Evaluation

Findings are documented in a structured form (the DGFDT Funktionsstatus sheet, last updated 2012).

The exam leads to a structured diagnosis:

- Muscular dysfunction.
- Intra-articular dysfunction (disc displacement, arthralgia).
- Combined dysfunctions.

GOZ billing positions in Germany (e.g., 8000 ff.) are linked directly to this structured exam.

## Strengths

- Clinically oriented: practical, can be done in 20–30 minutes.
- Systematic: ensures no area is overlooked (muscles, joints, occlusion).
- Widely accepted in Germany (DGZMK guideline).
- Useful for screening, diagnosis, and treatment planning (splint therapy, physiotherapy, prosthetics).
- Standardized documentation → useful medico-legally and for insurance.

## Limitations

- Primarily sign- and symptom-based; does not include standardized psychosocial assessment (as in DC/TMD Axis II).
- Diagnostic specificity lower than imaging (e.g., MRI for disc displacements).
- Best used in combination with psychosocial screening or DC/TMD when research-level validity is required.

## Clinical role today

- In German-speaking countries: the most widely used clinical standard in general dentistry for TMD screening.
- Often combined with instrumental methods (axiography, kinematic analysis, digital jaw tracking).
- Forms the basis for treatment planning: splint therapy, physiotherapy, prosthetic adjustments

## CMD Index

The CMD Index is a practical screening tool often integrated into dental software systems. It combines patient history with basic clinical findings. the CMD Index is another important tool, especially in the German-speaking world. It is frequently confused with “CMD diagnosis” in general, but in fact, the CMD-Screening Index (CMD-SI) and the CMD-Diagnostik Index were developed to provide structured ways of assessing the likelihood of a craniomandibular dysfunction (CMD).

### Background

- Developed by Ahlers, Jakstat, Türp, Hugger, and others in the late 1990s/2000s.
- Published as the CMD-Screening Index (CMD-SI) and later as the CMD-Diagnostik Index (CMD-DI).
- Supported by the DGFD (German Society of Functional Diagnostics and Therapy) and integrated into clinical routine and insurance/billing in Germany.
- Purpose: provide a quick, standardized, evidence-based screening for CMD in dental practice.

### CMD screening index (CMD-SI)

- Goal: to detect patients who are at risk of CMD and who need further examination.

#### Method:

- Dentist palpates muscles and TMJs, checks range of motion, and asks about pain and noises.
- 7–10 items are scored as positive (1) or negative (0).

#### Examples:

- Palpation pain in masseter or temporalis.
- Joint noises (clicking/crepitus).
- Limited mouth opening (< 40 mm).
- Pain on jaw movement.
- Deviations/deflections during opening.

Score  $\geq 3$  positives  $\rightarrow$  patient is “CMD-Suspect”  $\rightarrow$  recommend full functional analysis (Funktionsstatus nach Ahlers/Möller or DC/TMD).

- Time required: ~3–5 minutes.
- Strengths: quick, reproducible, validated for screening.
- Limitation: not a full diagnosis, only a filter tool.

### CMD-Diagnostik index (CMD-DI)

Developed as an extension of the CMD-SI for more detailed diagnosis.

Includes weighted scoring of symptoms/signs:

- Palpation pain intensity.
- TMJ noises type and frequency.

- Range of motion (exact measurement).
- Psychosocial red flags (stress, parafunction).

Generates a severity score (mild, moderate, severe CMD). Useful for treatment planning (splints, physiotherapy, orthodontic/ prosthetic adjustments).

### **Clinical role**

- CMD-SI: screening tool for general dentists. Often used in insurance documentation ("CMD-Screening included in dental exam").
- CMD-DI: more detailed index for specialists, prosthodontists, or orofacial pain clinics.
- Often combined with the Klinischer Funktionsstatus (Ahlers/Möller) or DC/TMD for full assessment.
- Supports standardization and medico-legal documentation in Germany.

### **Strengths**

- Practical: short chairside screening (~5 minutes).
- Reproducible: clear yes/no criteria.
- Cost-effective: prevents overdiagnosis, identifies patients needing full functional analysis.
- Bridge between practice and research: integrates with DC/TMD and Clinical Function Status

### **Limitations**

- Not internationally standardized (mainly used in German-speaking countries).
- Not as validated as DC/TMD in large multicenter projects.
- Limited psychosocial assessment compared to Axis II of DC/TMD.
- Cannot differentiate specific TMD subtypes (myalgia vs. arthralgia vs. disc displacement).

## **Christiansen's Symptom Systematics (CMD Ingolstadt)**

### **Background**

- Developed and taught by Dr. Gerd Christiansen (CMD-Compact, CMD-Institut Ingolstadt, Germany).
- Christiansen emphasized that CMD is not limited to the jaw joint but represents a multisystem functional disorder involving muscles, joints, posture, and sometimes systemic/vegetative symptoms.
- His approach is less about quantitative indices and more about qualitative systematics of symptoms, guiding differential diagnosis and interdisciplinary management.

**Core idea CMD should be understood as a symptom complex that extends beyond the TMJ itself**

Christiansen organized these into systematic clusters:

**Orofacial/TMJ cluster**

- Pain in TMJ area.
- Clicking, popping, crepitus.
- Restriction or deviation on opening.
- Myofascial pain (masseter, temporalis, pterygoids).
- Teeth sensitivity, bite changes.

**Cervical/spinal cluster**

- Neck pain (HWS complaints).
- Shoulder tension.
- Postural asymmetries.
- Occipital headaches.
- Limited cervical mobility.

**Neuro-otological cluster**

- Tinnitus (ringing or noise in ears).
- Vertigo/dizziness.
- Ear pressure or fullness.
- Balance disturbances.

**Ophthalmologic cluster**

- Visual disturbances (blurred vision, double vision).
- Eye pain or pressure.
- Photophobia.

**General/vegetative cluster**

- Headaches (tension-type, migraine-like).
- Fatigue, poor sleep.
- Stress-related complaints.

**Christiansen's diagnostic principles**

- Screen broadly: Always ask for symptoms outside the stomatognathic system.
- Link findings: Connect orofacial dysfunctions with neck, ear, and eye symptoms.

**Functional movement analysis:**

- Computer-assisted registration of mandibular movements (e.g. opto-electronic methods).
- Observation of functional patterns (smooth vs. restricted vs. asymmetric).

**Therapy concept:**

- Initial: reversible measures (splints, physiotherapy).
- Supportive: posture training, physiotherapy, stress management.
- Interdisciplinary: ENT, neurology, ophthalmology, orthopedics if systemic clusters dominate.

**Clinical use**

- Used as practical screening in CMD-specialized clinics (e.g. CMD-Institut Ingolstadt).
- Complements structured indices (DC/TMD, Clinical Function Status).
- Useful for patient communication: patients often recognize their symptoms in these clusters ("Yes, I also have tinnitus and neck pain").
- Helps identify cases requiring multidisciplinary care (not just dental splint therapy).

**Strengths**

- Holistic: Recognizes CMD as more than a local TMJ problem.
- Patient-centered: Easy to explain and connect to patient's complaints.
- Interdisciplinary: Encourages collaboration with ENT, orthopedics, neurology, physiotherapy.
- Qualitative rather than quantitative (not a numeric index).
- Not validated like DC/TMD (no sensitivity/specificity studies).
- Depends heavily on clinician's interpretation and experience.

**Recording Devices/ Methods****DMD / Ignident**

- Magnetic 3D tracking; small intraoral sensors; facebow-free reference.
- Fully digital workflow; export to CAD/CAM, virtual articulators.
- Resolution reported up to 0.001 mm; high sampling for smooth trajectories.
- Use: dynamic occlusion and physiotherapy (follows-up), splint design (bio-dynamic jaw reposition splint), prosthetics/orthodontics software linked (all digital).

Manufacturer: <https://www.ignident.com/>

**Zebris JMA / JMA Optic**

- Ultrasonic/optical tracking with cranial reference and bite fork.
- Mixed analog/digital; export to articulators/CAD.
- Validated for condylar path/SCi; widely used in prosthodontics.

Manufacturer: <https://www.zebris.de/en/dental/functional-analysis/>

## MODJAW

- Optical real-time 4D tracking; external cameras + markers.
- Mixed workflow; direct CAD integration; dynamic occlusion visualization.

Manufacturer: <https://modjaw.com/en/>

## PROAXIS (Axiography)

- Optical axiograph; mechanical frame records condylar paths.
- Partly analog; digital readout for articulator programming.

Manufacturer: <https://www.proaxis.de/>

## PROSYSTEM (Digital Axiography)

- Digital axiography platform (e.g., Axiograph Life Package).
- Mixed; used for complex functional diagnostics and articulator settings.

Manufacturer: <https://prosystem.com/>

## ITAKA / Cyclops JTS

- Photometric optical tracking with cameras + intraoral markers.
- Mixed; used for vertical dimension and dynamic occlusion.

Manufacturer: <https://www.itakawaymed.com/>

## Summary

From all those systems, DMD/Ignident (the fully digital, kinematic 3D-registration system) and Christiansen's CMD-systematic are indeed the only fully digitalized, closed-loop diagnostic-to-therapy concepts currently available. What makes them stand out compared to other systems:

### 1. Digital Diagnostics

- Capture of mandibular dynamics (real-time 3D movement tracking, synchronized with occlusal contacts and sometimes even muscle activity).
- Objective, reproducible data instead of purely manual interpretation.

### 2. Deep Anatomical and Functional Basis

- Both rely on an advanced understanding of TMJ anatomy, neuromuscular control, and individual jaw motion patterns.
- Interpretation is crucial — training and clinical experience are mandatory to avoid misdiagnosis.

### 3. Therapy Integration

- Bio-dynamic repositioning splints: designed digitally, tailored to patient-specific kinematics.

- Connection to further therapy: prosthetic rehabilitation, orthodontics, or functional adaptation.

#### 4. Versatility and Modernity

- Systems allow not only diagnostics but also immediate translation into digital splint design and follow-up therapy.
- Digital records enable monitoring of therapy success and modification if needed.

#### 5. Training and Expertise Requirement

- They demand much more than just technical skills — a clinician must be well-versed in TMD pathophysiology, functional anatomy, and therapeutic biomechanics.
- Without this background, the danger of “over-engineering” therapy exists.

While traditional indices (Helkimo, RDC/TMD, DC/TMD, etc.) are useful for screening and classification, DMD/Ignident and Christiansen’s systematic stand out as the only comprehensive digital workflow from diagnosis/ functional analysis/ splint therapy/ long-term rehabilitation and forensic reproducibility. Combined with adjuvans therapy, this workflow makes the system both modern and versatile. It bridges the gap between precise digital functional analysis and individualized therapy design, ensuring that clinical decisions are guided by objective, reproducible data rather than purely subjective assessment and makes it a real game changer.

Christiansen’s Symptom Systematics is not an “index” but a holistic framework grouping CMD symptoms into orofacial, cervical, otological, ophthalmological, and general/vegetative clusters. It helps clinicians recognize CMD as a multisystem condition and promotes interdisciplinary diagnosis and therapy. On this holistic systematic Petra Clauss (Ignident) developed the DMD – that allouds a full digital jaw tracking system Digital Jaw-Motion Registration Systems Digital systems capture mandibular kinematics (often 6 DOF) and integrate with CBCT/IOS/facial scans to build a dynamic virtual patient.

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