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Brief Diagnostic Criteria for Temporomandibular Disorders: Sensitivity and Specificity of Clinical Diagnoses (A Multi-Center Study)

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ABSTRACT

Background: The brief Diagnostic Criteria for Temporomandibular Disorders (bDC/TMD) was recently published to simplify the full Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) protocol.

Objective: To measure the inter-examiner reliability, sensitivity and specificity of bDC/TMD Axis I diagnoses against DC/TMD Axis I diagnoses in primary and tertiary clinic TMD patient populations.

Methods: A multi-center (Finland, Israel) retrospective study on 334 patients' records was conducted. A full DC/TMD clinical examination data was reduced to bDC/TMD items. Five Level 3 calibrated examiners independently determined a bDC/TMD diagnosis. Inter-examiner reliability, sensitivity and specificity were calculated for individual diagnoses, using DC/TMD diagnosis as the reference standard.

Results: Inter-examiner reliability showed excellent to good reliability in all diagnoses except headache attributed to TMD, in which it was fair. Apart from headache attributed to TMD, the sensitivity of individual pain diagnoses was high. The sensitivity was lower in joint diagnoses. The specificity was high in all diagnoses.

Conclusion: The bDC/TMD is a reliable instrument for general practitioner use.

1 | Introduction

Temporomandibular disorders (TMD) are an umbrella term for conditions, disorders and diseases affecting the masticatory muscles, temporomandibular joints (TMJ) and adjacent structures. The severity of symptoms can be mild to debilitating and their intensity shows a natural fluctuation [1, 2]. A recently published meta-analysis revealed a significant prevalence of 34% worldwide [3].

Valid and reliable diagnostic criteria for TMD are necessary for both clinical and research settings. The initial widely accepted tools include the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) [4] and the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) which have been presented in 2014 under the International Network for Orofacial Pain & Related Disorders Methodology (INfORM) [5] and validated through a large population study [6]. Aligning with the biopsychosocial model of TMD [7], the

DC/TMD provides clinically valid and reliable instruments for diagnosing TMD (Axis I) together with assessing the related psychosocial factors (Axis II).

To date, the DC/TMD is considered the standard reference instrument for TMD diagnostics [5, 8]. However, its use in non-specialist settings has remained mostly modest [9, 10]. The DC/TMD Axis I physical examination is considered to be time-consuming, in terms of examiner training, clinical implementation and the challenges of contextualising the psychosocial evaluation into the clinical setting [11].

Recently, INfORM initiated a project aiming towards a shortened version of the DC/TMD. It was carried out through a Delphi process involving numerous worldwide experts and resulted in the brief Diagnostic Criteria for Temporomandibular Disorders (bDC/TMD). The bDC/TMD consists of an abbreviated version of the original DC/TMD Axes I and II [12]. The abbreviations were implemented through a consensus for either retaining, revising, or omitting existing DC/TMD items.

The resulting bDC/TMD Axis I instrument consists of the Symptom Questionnaire (SQ) with the Pain Screener removed, an abbreviated clinical examination, and a simplified Diagnostic Decision Tree with diagnosis grouping as follows: Painful TMDs (myalgia, arthralgia and headache attributed to TMD) and Common joint-related TMDs with functional implications (degenerative joint disease, other disc-based TMD, acute closed lock and subluxation). The bDC/TMD clinical examination consists of six examination items, thereby reducing the number of items in Axis I by 79% compared to the original DC/TMD. The original publication calls for psychometric and field testing of the novel instrument to identify improvement needs and assess feasibility [12].

The present study aims to assess the bDC/TMD with regard to: (I) inter-examiner reliability of the Axis I clinical diagnoses and (II) the sensitivity and specificity of Axis I clinical diagnoses compared to diagnoses from the original DC/TMD instrument in a primary care clinic and a tertiary TMD clinic population, based on patients' records.

2 | Materials and Methods

The study was planned as a retrospective international multicentre study. The centres involved were four centres in Finland and one centre in Israel as follows: Helsinki, Oulu, Kuopio and Turku University Hospitals' Clinics for Oral and Maxillofacial Diseases (Finland), and the students' TMD dental clinics in the Goldschleger School of Dental Medicine, Tel Aviv University (TAU), Israel.

2.1 | Study Population

In Finland, files of patients over 18 years of age from four University Hospital clinics were used (Helsinki, Oulu, Kuopio, Turku; $n = 209$, mean age 43.3 ± 16.3 years, 19.6% males). All patients have been initially examined and received a full DC/TMD diagnosis by Level III calibrated DC/TMD examiners [13, 14], between 2015 and 2019. All clinics are tertiary care clinics with similar admittance criteria for TMD patients. Namely, the TMD pain condition must have lasted over 3 months (chronic condition) without substantial relief of symptoms after adequate conservative TMD management in primary care.

In Israel, files of patients over 18 years old who arrived for dental treatment in the Tel Aviv University (TAU) dental clinics (between 2022 and 2024) underwent an original DC/TMD examination protocol [15], and received a DC/TMD diagnosis were included ($n = 125$, mean age 32.6 ± 11.3, 42.4% males). Patients were initially examined and diagnosed by senior dental students, under close supervision and verification of Level III calibrated DC/TMD senior faculty members. The clinic admits patients for a primary care treatment setting.

2.2 | Study Protocol

Original DC/TMD Axis I data (clinical examinations and diagnoses) were used from all participating centres. The original DC/TMD diagnoses served as a gold standard.

The original databases were used to prepare a reduced database which included only information relevant to the bDC/TMD Axis I protocol [12]. Namely, items/variables which have been omitted from the bDC/TMD protocol were excluded from the database and the original DC/TMD diagnoses were obliterated to prevent researcher's bias. The original DC/TMD diagnoses included: myalgia, arthralgia, myofascial pain with referral, headache attributed to TMD, disc displacement (DD) with reduction, DD with reduction with intermittent locking, DD without reduction with opening imitation, DD without reduction without opening limitation, degenerative joint disease and subluxation. For this study, the diagnoses were set with the newly constructed bDC/TMD data in two different manners: first, using the suggested Diagnostic Decision Tree with grouped diagnoses for Painful TMD's and Other disc-based TMD's was used [12]. Second, the diagnoses were set using the bDC/TMD Diagnostic Decision Tree but determining the original DC/TMD diagnoses separately, to be able to evaluate their psychometrics against the reference standard DC/TMD diagnoses, and to see if an exact diagnosis could be obtained with items in the bDC/TMD only. As the new data was based on the original DC/TMD examination protocols findings, the palpation time in all items' requiring palpation was 5 s, thus it was possible to obtain a diagnosis of myofascial pain with referral.

The bDC/TMD diagnoses were carried out as follows: in Finland, diagnoses according to the bDC/TMD revised database were made by two Level III calibrated examiners (authors L.N. and K.S.) independently. In Israel, three Level III calibrated examiners (authors A.E.-P., E.W., P.F.-R.) evaluated the bDC/TMD database and set their diagnoses independently. Inter-examiner reliability was determined between the two Finnish examiners and the three Israeli examiners for both grouped diagnoses and separate diagnoses. The bDC/TMD diagnoses were compared to the original DC/TMD diagnoses (for each one of the examiners) to determine individual sensitivity and specificity.

The study has received a permit from The Ethics Committee of the Hospital District of Southwest Finland (74/1082/2015), the Helsinki University Central Hospital Head and Neck Center (permit no HUS/53/2023) in Finland, and from the Tel Aviv University Ethical Committee (permit no 0008783-1).

2.3 | Statistical Analysis

1. The inter-rater reliability was evaluated using Fleiss kappa, separately for each group of examiners (Finnish examiners, $n = 2$; Israeli examiners, $n = 3$).
2. Sensitivity and specificity were calculated for each individual bDC/TMD diagnosis, as compared to the original DC/TMD diagnoses which served as the gold standard.

Statistical analyses were performed using IBM SPSS Statistics for Windows (Version 28.0. Armonk, NY: IBM Corp) and R Statistical Software (v4.1.2; R Core Team 2021).

3 | Results

The study included data from a total of 334 subjects: 209 in Finland (19.6% males) and 125 in Israel (42.4% males).

Distribution of the original DC/TMD and the bDC/TMD diagnoses, and interexaminer reliability is presented in Tables 1 and 2. When the Diagnostic Decision Tree with the grouped diagnoses was used, the interexaminer reliability in the Finnish data (two examiners) for grouped diagnoses was lower (0.582 for grouped myalgia diagnoses and 0.699 for grouped disc-based diagnoses) than in the Israeli data (three examiners) (0.854 for grouped myalgia diagnoses and 0.805 for grouped disc-based diagnoses) (Table 1). When diagnoses were determined separately, in the Finnish data, inter-examiner reliability was almost perfect for headache attributed to TMD (0.813), disc displacement without reduction with limited opening (0.819) and disc displacement without reduction (1.000). Amongst the Israeli data, interexaminer reliability was almost perfect for arthralgia (0.835) and myofascial pain (0.802). In both countries, results were substantial for the other diagnoses. The lowest interexaminer reliability was noted for arthralgia in the Finnish group (0.590, moderate) and headache attributed to TMD (0.437, fair) amongst the Israeli group. Table 2.

Detailed sensitivity and specificity, per examiner and per diagnosis, are presented in Table 3. For reference, the Table also includes the sensitivity and specificity of the gold standard DC/TMD instrument, as published by Schiffman et al. [5].

The sensitivity of the various bDC/TMD diagnoses ranged from 0.32 (DD with reduction) to 0.97 (arthralgia) amongst the Finnish examiners and from 0.13 (DD without reduction) to 1.00 (degenerative joint disease) amongst the Israeli examiners.

The specificity of the various diagnoses ranged from 0.56 (arthralgia) to 0.99 (degenerative joint disease) amongst the Finnish examiners and from 0.86 (myalgia) to 0.99 (headache attributed to TMD, DD without reduction, subluxation, degenerative joint disease) amongst the Israeli examiners.

4 | Discussion

The bDC/TMD was developed to provide a simplified instrument for general dental practice in primary health care [12]. The main differences in the clinical examination, compared to the original DC/TMD, are removal of confirmation of anatomical headache location, lateral and protrusive movements, reducing palpation sites into masseter body and anterior temporalis and continuing to other points if necessary and 2 s being the recommended palpation time. In bDC/TMD the diagnoses are grouped into painful TMD's (myalgia, arthralgia, headache attributed to TMD, omitting myofascial pain with referral). Disc-based TMD's are grouped to "other disc-based TMD" (DD with reduction with or without intermittent locking and DD without reduction without opening limitation) and acute closed lock (DD without reduction without limited opening).

In the present study, the bDC/TMD inter-examiner reliability was substantial for nearly all diagnoses when not using the grouped diagnoses, in both countries. Differences between countries were apparent for arthralgia (0.590 in Finland, 0.835 in Israel), and for headache attributed to TMD (0.813 in Finland, 0.437 in Israel) and DD without reduction (1.000 in Finland, 0.653 in Israel). The differences between countries can be explained through clinical setting differences (primary vs. tertiary), sample size impact (about 40% smaller group in Israel, as compared to Finland), and/or the effect of the number of raters (two in Finland vs. three in Israel). Tertiary clinics see more complex/severe cases, as primary clinics encounter subjects with less severe presentations. Also, the Finnish tertiary clinic subjects had markedly more pain diagnoses than the Israeli primary clinic subjects, where disc-related diagnoses were most abundant. A larger sample size might provide more stable reliability estimates and more opportunities to see typical presentation patterns. Additionally, Fleiss Kappa tends to be more stringent with more raters, which could partially explain the lower reliability in the Israeli data.

To the best of our knowledge, no studies have been published yet on bDC/TMD inter-examiner reliability. The inter-examiner reliability in the present study resembled data on DC/TMD diagnoses' inter-examiner reliability [16, 17]. It is noteworthy that the bDC/TMD diagnostic decision tree leaves room for multiple interpretations. During discussions amongst the authors, two conflicting interpretations of the bDC/TMD Diagnostic Decision Tree for painful temporomandibular disorders (TMD) emerged. The key difference centered on how pain location should be evaluated:

First interpretation: Pain related to myalgia or arthralgia could be present in different locations across the diagnostic questionnaire. The pain's specific location in certain examination sections (E2 or E4) would ultimately define whether the diagnosis is myalgia or arthralgia. This approach acknowledges that pain can be referred, meaning a condition in one area might cause pain perception in another area (such as temporal headache).

TABLE 1 | Distribution of original and brief Diagnostic Criteria for Temporomandibular Disorders diagnoses according to country, using grouped diagnoses from bDC/TMD Diagnostic Decision Trees. Numbers and percentages. Fleiss' Kappa for interexaminer reliability.

	Instrument			Fleiss' kappa
	DC/TMD[a]		bDC/TMD[b]	bDC/TMD[c]
Diagnosis	***n* (%)**		***n* (%)**	
Finland ($n = 209$)				
Myalgia	155 (74.2)	Myalgia (grouped with MFP with referral)	142 (67.9)	0.582
Myofascial Pain with referral	152 (72.7)			
Arthralgia	107 (51.2)		162 (77.5)	0.590
Headache attributed to TMD	80 (38.3)		30 (14.4)	0.813
DD with reduction	34 (16.3)	Other disc-based TMD (grouped DDwR, DDwRwIL, DDwoR)	76 (36.4)	0.699
DD with reduction with intermittent locking	5 (2.4)			
DD without reduction	64 (30.6)			
DD without reduction (limited opening)	29 (13.9)		16 (7.7)	0.819
Degenerative joint disease	44 (21.1)		20 (9.6)	0.884
Subluxation	1 (0.5)		0 (0.0)	n.a.
Israel ($n = 125$)				
Myalgia	54 (43.2)	Myalgia (grouped with MFP with referral)	71 (56.8)	0.854
Myofascial Pain with referral	45 (36.0)			
Arthralgia	23 (18.4)		42 (33.6)	0.835
Headache attributed to TMD	43 (34.4)		10 (8.0)	0.437
DD with reduction	50 (40.0)	Other disc-based TMD (grouped DDwR, DDwRwIL, DDwoR)	59 (47.2)	0.805
DD with reduction with intermittent locking	7 (5.6)			
DD without reduction	8 (8.6)			
DD without reduction (limited opening)	0 (0.0)		2 (1.6)	0.658
Degenerative joint disease	4 (3.2)		4 (3.2)	0.792
Subluxation	15 (12.0)		12 (9.6)	0.730

[a]Determined prior to the study according to the DC/TMD criteria. Served as gold standard in for calculation of sensitivity and specificity.
[b]According to majority consensus amongst each counties' examiners as follows: unanimous decision of both two Finnish examiners, unanimous decision of at least 2 out of the 3 Israeli examiners.
[c]bDC/TMD interexaminer reliability, Fleiss' kappa: 0.81–1.00 Almost perfect; 0.61–0.8 Substantial; 0.41–0.6 Moderate; 0.21–0.4 Fair; < 0.2 Slight.

Second interpretation: Pain must be consistently located in the exact same place throughout all sections of the Diagnostic Decision Tree. This stricter interpretation would require pain to be in an identical location in both the anamnestic section (SQ1, SQ5, SQ4, SQ7) and examination sections. However, this approach inherently excludes the possibility of referred pain.

This discrepancy in interpretations can explain some of the differences in inter-examiner reliability.

Regarding the diagnosis of DD without reduction without opening limitation, the differences between countries might be explained by the large difference in the amount of bDC/TMD diagnoses between countries (33.5% in Finland vs. 3.2% in Israel). As a positive diagnosis is set by history taking in the Symptom Questionnaire, it is easy to reach a unanimous decision. The low number of bDC/TMD diagnoses in Israel, together with having three examiners, might have lowered Fleiss' kappa.

Sensitivity and specificity measure the ability of a test to identify individuals who have a particular condition (true positives, sensitivity) and those who do not have it (true negatives, specificity). In diagnostic instruments, high sensitivity ensures that most cases are detected, reducing the risk of missing individuals

TABLE 2 | Distribution of original and brief Diagnostic Criteria for Temporomandibular Disorders diagnoses according to country. Numbers and percentages. Fleiss' Kappa for interexaminer reliability.

	Instrument		Fleiss' kappa
	DC/TMD[a]	bDC/TMD[b]	bDC/TMD[c]
Diagnosis	***n* (%)**	***n* (%)**	
Finland ($n = 209$)			
Myalgia	155 (74.2)	153 (73.2)	0.626
Arthralgia	107 (51.2)	162 (77.5)	0.590
Myofascial Pain with referral	152 (72.7)	92 (44.0)	0.694
Headache attributed to TMD	80 (38.3)	30 (14.4)	0.813
DD with reduction	34 (16.3)	9 (4.3)	0.739
DD with reduction with intermittent locking	5 (2.4)	4 (1.9)	0.799
DD without reduction (limited opening)	29 (13.9)	16 (7.7)	0.819
DD without reduction	64 (30.6)	70 (33.5)	1.000
Degenerative joint disease	44 (21.1)	20 (9.6)	0.884
Subluxation	1 (0.5)	0 (0.0)	n.a.
Israel ($n = 125$)			
Myalgia	54 (43.2)	54 (43.2)	0.762
Arthralgia	23 (18.4)	42 (33.6)	0.835
Myofascial Pain with referral	45 (36.0)	20 (16.0)	0.802
Headache attributed to TMD	43 (34.4)	10 (8.0)	0.437
DD with reduction	50 (40.0)	58 (46.4)	0.797
DD with reduction with intermittent locking	7 (5.6)	8 (6.4)	0.700
DD without reduction (limited opening)	0 (0.0)	2 (1.6)	0.658
DD without reduction	8 (8.6)	4 (3.2)	0.653
Degenerative joint disease	4 (3.2)	4 (3.2)	0.792
Subluxation	15 (12.0)	12 (9.6)	0.730

[a]Determined prior to the study according to the DC/TMD criteria. Served as the gold standard for the calculation of sensitivity and specificity.
[b]According to majority consensus amongst each counties' examiners as follows: unanimous decision of both Finnish examiners, unanimous decision of at least 2 out of the 3 Israeli examiners.
[c]bDC/TMD interexaminer reliability, Fleiss' kappa: 0.81–1.00 Almost perfect; 0.61–0.8 Substantial; 0.41–0.6 Moderate; 0.21–0.4 Fair; < 0.2 Slight.

who need further diagnostic evaluation. High specificity helps in efficiently using resources by ensuring that only those who need further involvement are identified.

Present results showed that sensitivity of bDC/TMD pain diagnoses (myalgia, arthralgia, myofascial pain with referral) was mostly acceptable (over 80%), approximating the sensitivity of the original DC/TMD diagnoses (around 90%). The exception was the sensitivity for headache attributed to TMD, which ranged between 16% and 38%, which is unacceptable for diagnostic purposes. This contrasts with the sensitivity of the original DC/TMD diagnosis (89%) [5]. The difference may be attributed to the removal of subjective confirmation of headache location from the clinical examination and the removal of familiar headache occurring during lateral and protrusive movements. This modification might lead to the inclusion of both primary and secondary headaches affecting the temporal area, thus necessitating further referral for specific headache diagnosis.

With disc-related TMD diagnoses, the sensitivity values were lower, being under 70% for most diagnoses. The exception was DD with reduction amongst the Israeli data, which showed relatively high sensitivity scores. In contrast, DD without reduction showed high sensitivity amongst the Finnish data (91%) and low amongst the Israeli data (ranging 13%–38%). In the original DC/TMD, maximum assisted opening (using limit < 40 mm) is needed to reach either of the DD without reduction diagnoses, whereas in bDC/TMD, unassisted opening (using limit < 35 mm) is considered. These discrepancies possibly explain the low sensitivity of the bDC/TMD as compared to the original DC/TMD diagnoses. However, the DD without reduction diagnosis can be obtained by history taking only in bDC/TMD. This explains the

TABLE 3 | Sensitivity and specificity of the brief Diagnostic Criteria for Temporomandibular Disorders diagnoses (as compared to the Diagnostic Criteria for Temporomandibular Disorders).

	Country					
	Finland—bDC/TMD		Israel—bDC/TMD			
Diagnosis	Sensitivity/specificity		Sensitivity/specificity			
Examiners	1	2	1	2	3	DC/TMD[a]
Myalgia	0.93/0.72	0.93/0.72	0.85/0.90	0.83/0.87	0.87/0.86	0.90/0.99
Arthralgia	0.94/0.58	0.97/0.56	0.80/0.93	0.84/0.91	0.82/0.94	0.89/0.98
Myofascial pain with referral	0.83/0.91	0.85/0.83	0.74/0.97	0.87/0.94	0.87/0.98	0.86/0.98
Headache (attributed to TMD)	0.38/0.92	0.33/0.96	0.19/0.98	0.37/0.90	0.16/0.99	0.89/0.79
DD with Reduction	0.59/0.98	0.32/0.81	0.86/0.80	0.92/0.79	0.84/0.73	0.34/0.92
DD with Reduction with intermittent locking	0.40/0.98	0.40/0.86	0.43/0.96	0.71/0.98	0.86/0.98	0.38/0.98
DD without reduction (limited opening)	0.65/0.98	0.62/0.97	n.a./0.98	n.a./0.98	n.a./0.98	0.54/0.79
DD without reduction	0.91/0.92	0.91/0.92	0.38/0.97	0.13/0.97	0.38/0.99	0.80/0.97
Degenerative joint disease	0.66/0.98	0.55/0.99	1.00/0.98	0.75/0.99	0.75/0.98	0.55/0.61
Subluxation	n.a./n.a.	n.a./n.a.	0.67/0.97	0.73/0.99	0.67/0.98	0.98/10.00

Abbreviations: DD, disc displacement; n.a., not applicable (no positive diagnoses in either instrument).
[a]According to Schiffman et al. [5].

high sensitivity in Finnish data. The low number of diagnoses in Israel increases the effect of a single case with discrepancy, as was also observed in inter-examiner reliability. Patients with limited mouth opening are less likely to seek treatment at primary dental clinics (student clinics) where lengthy examination procedures are required, compared to tertiary specialised clinics. In university dental student clinics, patients must endure prolonged clinical examinations with inexperienced students, which can be particularly challenging for individuals with restricted mouth opening. In contrast, tertiary clinics that specialise in treating complex oral conditions are better equipped to manage patients with such limitations.

In degenerative joint disease, the Finnish examiners' sensitivity was low (ranging 55%–66%) while in the Israeli data it ranged from moderate to excellent (75%–100%). In the original DC/TMD diagnostic decision tree, it is possible to reach a diagnosis for degenerative joint disease through having a positive finding in lateral or protrusive movement only, but not necessarily in opening movement, which in turn is the only TMJ sound assessment in bDC/TMD items. As the Israeli group included patients from primary care, they encountered only four patients with this diagnosis, and all had crepitus upon opening, which might have affected the results.

Amongst the Finnish data, the specificity was acceptable for almost all bDC/TMD diagnoses (ranging between 72% and 100%) except for arthralgia (less than 60%). Specificity was markedly better for the bDC/TMD diagnosis of degenerative joint disease as compared to the DC/TMD [5]. The high specificity values indicate that the bDC/TMD correctly identifies most individuals who do not have the condition, resulting in few false positives. The low specificity of the Finnish data in diagnosing arthralgia can be explained by different interpretations of the brief diagnostic decision tree; namely, that pain in any location is sufficient enough to proceed in the first and second diagnostic boxes, and diagnosis is done by exact location in the third diagnostic box, or if location must be consistent in all three diagnostic boxes (i.e., for arthralgia, pain must be in the TMJ in all three diagnostic boxes).

Comparing the bDC/TMD to the gold standard, original DC/TMD instrument, sensitivity and specificity were similar in myalgia, myofascial pain with referral, and DD with reduction with intermittent locking. In headache attributed to TMD, sensitivity was markedly lower in the brief instrument. According to the original publication, an accurate diagnosis for headache attributed to TMD is not expected in a general practitioner setting [12]. As it was possible to reach nearly the same specificity as in the gold standard DC/TMD when determining the separate bDC/TMD painful TMD diagnoses (myalgia, arthralgia, headache attributed to TMD, and additionally myofascial pain with referral), and taking into account the earlier mentioned differences in interpretation of the current Diagnostic Decision Tree regarding the painful TMD diagnoses, it could be considered to modify the bDC/TMD Diagnostic Decision Tree so that the grouped painful TMDs are separated as stated above.

Myofascial pain with referral was not included in the bDC/TMD diagnostic decision tree. In the present data, examiners were able to reach the diagnosis of myofascial pain with referral because the original palpation time (used for the original DC/TMD diagnosis) was 5 s (DC/TMD) and not 2 s as suggested in the bDC/TMD. Indeed, the sensitivity and specificity of the bDC/TMD tool in the present study were almost like the original DC/TMD instrument amongst all examiners, and their inter-examiner reliability

was excellent. Previous studies have shown that myofascial pain with referral is an important clinical indicator for an association with widespread pain [18] and a more severe psychosocial burden [19], thus indicating the degree of chronicity and complexity of the condition. Indeed, the Finnish study population showed a significantly higher amount of myofascial pain with referral DC/TMD diagnoses (72.7%) than the Israeli population (36.0%). As the bDC/TMD is recommended for general practitioners, it is important to distinguish subjects who need referral to specialist evaluation. In Axis II, the Graded Chronic Pain Scale (GCPS) 2.0 is considered to be a reliable indicator for pain disability and prognosis complexity [20, 21]. Extending palpation time to 5 s would be a sufficient addition to enable the myofascial pain with referral diagnosis, and thus enable the general practitioner to distinguish subjects needing specialist evaluation.

The strength of the study lies in a relatively large sample size. Also, data was obtained with validated translations of the original DC/TMD instrument [14, 15]. Examiners were Level III calibrated examiners, increasing the accuracy of the diagnoses.

One of the study limitations lies in the differences between the clinical populations (primary vs. tertiary, Israeli vs. Finnish, different number of subjects and examiners in each group). Additionally, in the Finnish data, not all sites were necessarily palpated as indicated in the original DC/TMD clinical examination protocol. Palpation was not continued if all obtainable pain diagnoses were met, which is in line with the original examination guide [22]. Differences in the interpretation of the brief diagnostic decision tree between countries might have also affected the results. The present study was based on patient documents and not on actual examination of patients. Further studies should clinically examine subjects with both the DC/TMD and the bDC/TMD clinical protocols.

5 | Conclusion

Apart from headache attributed to TMD, the bDC/TMD is a relatively sensitive instrument for TMD pain diagnoses, but its sensitivity is lower for joint diagnoses. The specificity of the bDC/TMD is relatively high for all diagnoses. In further development of bDC/TMD, myofascial pain with referral may be considered to include in the set of diagnoses, thus better enabling differentiation of subjects who need specialist evaluation.

Author Contributions

L.N.: study design, analysis and interpretation of results, drafting and finalising the manuscript; K.S.: study design, data acquisition, conceptualisation; I.E.: study design, interpretation of results, conceptualisation; P.F.-R., L.K., R.N., S.A.T., J.T., T.T.-O., E.W.: data acquisition; A.K.: data analysis; A.E.-P.: study design, interpretation of results, conceptualisation. All authors have contributed intellectually to the manuscript by commenting and revising it.

Ethics Statement

The study has received a permit from The Ethics Committee of the Hospital District of Southwest Finland (74/1082/2015), the Helsinki University Central Hospital Head and Neck Center (permit no HUS/53/2023) in Finland, and from the Tel Aviv University Ethical Committee (permit no 0008783-1).

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Anonymised data is available from the corresponding author upon reasonable request.

Peer Review

The peer review history for this article is available at https://www.webofscience.com/api/gateway/wos/peer-review/10.1111/joor.13969.

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