Supplementary Material 1
4D CT Dynamic Carpal Instability — Reader Guide and Assessment Form

Form-guided qualitative cine assessment. Interreader and intrareader agreement study.

This supplement presents the common written guide and complete assessment form used by the three blinded readers, with explanatory notes and Supplementary Table 1. The observations and reporting structure were common to all readers; quantitative thresholds for abnormal motion and a shared normal-motion reference were not specified. The original response options, category labels and operational definitions are preserved. Notes concerning implementation and observed use of the form are identified separately from the instrument.

This document is an operational reader framework, not a set of validated diagnostic criteria and not a diagnostic algorithm. The form recorded anatomical location, dynamic signs and a reader-assigned phenotype as related qualitative observations. None of these observations has been independently validated as a diagnostic criterion, and no fixed one-to-one relationship between a dynamic sign and a phenotype was prescribed or should be inferred.

Part A — Reader Guide

A.1 Reader rule and material presented

Use only the anonymized four-dimensional computed tomography (4D CT) cine sequences. All responses recorded on this form are categorical judgments derived from cine review. The instrument prescribes no standardized quantitative measurement protocol, and no model-based quantitative post-processing forms part of the required assessment; measurement is not a recorded response option on any item of the form. Ad hoc measurement by an individual reader is not prohibited by this instrument; any such measurement is simply not captured as a study variable and is not analyzed as an endpoint.

Material presented to readers for each wrist: 6 cine loops — for each motion arc, coronal and sagittal multiplanar reformats together with three-dimensional volume-rendered images, reconstructed at 0.625-mm section thickness with 18 temporal phases per arc (0.35-s interval). Reviewed on an AW Server workstation (GE Healthcare; software version 3.2) on a diagnostic radiology monitor. Readers could play, loop, step frame by frame, scroll the stack and adjust window and level; oblique re-slicing, segmentation and measurement tools were available on the platform, but their use was neither required nor recorded. No item of the assessment form recorded a measured value. No time limit was imposed. Motion was performed by the patient under verbal guidance from the examiner as a single slow continuous excursion timed to the acquisition through the maximal tolerated range, without axial load or clenched-fist stress; movement was rehearsed before acquisition and adequacy was checked visually during scanning. Patients with pain moved through their maximal tolerated range; no angular measurement was used to determine acquisition adequacy. Quantitative measurements were not supplied as inputs to the qualitative reader assessments.

A.2 Reader blinding

No clinical information was made available to the readers: age, sex, symptoms, trauma history, examination findings, radiographs, magnetic resonance (MR) imaging and MR arthrography, static CT findings, multidisciplinary council decisions, arthroscopy/surgery, follow-up, the other readers' assessments and their own previous-round responses were all withheld. The contralateral wrist was not available for comparison. Laterality is inherent to the images and could not be concealed; the imaged side and hand dominance were not otherwise disclosed.

A.3 Calibration

The original guide specified that, before round 1, all readers would receive the same standardized guide and a calibration set of 6 to 10 cases drawn from outside the analytical cohort, representing normal/no instability and representative scapholunate, midcarpal, lunotriquetral and combined/complex patterns where available. No consensus discussion or feedback was permitted once formal reading began.

The calibration set specified in the guide was not carried out; readers received the written guide only, and no consensus discussion, joint review of example cases or feedback took place before or during the formal readings.

A.4 Round-2 rules

Repeat all cases after a 4- to 6-week washout. Use re-randomized case order and re-coded identifiers. Do not access round-1 responses. Use the same reader guide and the same cine sequences.

A.5 Operational pattern definitions

Verbatim from the reader guide:

Pattern	Operational definition
Scapholunate	Loss of coordinated scaphoid–lunate motion, dynamic opening/closing, or abnormal relative rotation.
Midcarpal	Abnormal translation, rotation, shift, catching, or subluxation between the proximal and distal carpal rows.
Lunotriquetral	Dynamic motion discordance or dissociation between the lunate and triquetrum.
Combined/complex	Definite dynamic instability involving more than one carpal compartment.
Non-specific/indeterminate	Dynamic instability is present, but a dominant anatomical phenotype cannot be reliably assigned.

Footnote on the specificity of these definitions. The guide specified no magnitude threshold, angular or distance anchor, and no reference description of normal carpal motion against which "abnormal" or "loss of coordinated motion" was to be judged; the contralateral wrist was not available to readers. Each reader therefore applied an internal standard of normality. The guide also gave no operational trigger for the nonspecific/indeterminate category, and did not specify when involvement of more than one compartment should be recorded as the dominant phenotype "combined/complex" rather than as a single dominant phenotype with an associated second pattern (§F); both conventions occur in the study data (of 165 positive evaluations, 12 recorded combined/complex — 2 of them without naming a second pattern — while 11 recorded a single named phenotype together with a named second pattern). Note also that the scapholunate definition above reproduces three of the seven core visual criteria for a positive decision in §A.6, so an observation meeting any of those three criteria was sufficient both to call a wrist abnormal and to label it scapholunate; the remaining four criteria carry no such duplication. A related observation: in 4 of the 28 evaluations assigned the nonspecific/indeterminate phenotype, the reader nonetheless named a specific associated second pattern in §F, that is, could not name a dominant compartment but did name a secondary one. The form permitted this combination. These properties of the instrument are stated here because they are relevant to the interpretation of the phenotype-agreement results, and each is specifiable in a revised guide.

A.6 Core visual criteria for dynamic instability

- Dynamic opening/closing of the scapholunate interval.
- Loss of synchronous scaphoid–lunate motion.
- Abnormal rotation of the scaphoid or lunate relative to adjacent carpal bones.
- Abrupt catch-up/catching motion.
- Transient subluxation or abnormal translation.
- Abnormal motion between proximal and distal carpal rows.
- Delayed or abnormal lunate rotation.

A.7 Exclusion criterion for a positive decision (negative criterion)

Static widening on a single frame, a single-frame angular abnormality, chronic deformity, or a fixed anatomical variant is not sufficient by itself to establish dynamic instability.

This criterion is a defining feature of the instrument: a positive decision required an abnormality of *motion*, observed across the arc, and not an abnormal appearance on any individual frame.

Part B — Reader Assessment Form

Reproduced with the response options actually presented to readers. The corresponding dataset variable name is given for each item so that the form and the data file can be mapped without inference.

Case identification

Field	Entry
Study case ID	
Reader ID	☐ R1 ☐ R2 ☐ R3
Reading round	☐ Round 1 ☐ Round 2
Assessment date	_____ / _____ / _____

A. Technical assessability — Assessable

A1. Is the examination technically adequate for dynamic assessment? ☐ 0 — Not assessable ☐ 1 — Assessable

Note: 0 is reserved strictly for overall technical inadequacy and must not be used to record diagnostic uncertainty.

B. Separate motion-axis assessment — FE_Instability, RUD_Instability

B1. Dynamic instability during flexion–extension ☐ 0 — Absent ☐ 1 — Present

B2. Dynamic instability during radioulnar deviation ☐ 0 — Absent ☐ 1 — Present

C. Primary assessment — General_Instability

C1. Is dynamic carpal instability present overall? (mandatory binary choice) ☐ 0 — Absent ☐ 1 — Present

No indeterminate option is available for this item.

D. Reader confidence — Confidence_1to5

D1. Confidence in the overall decision ☐ 1 — Very low ☐ 2 — Low ☐ 3 — Moderate ☐ 4 — High ☐ 5 — Very high

E. Dominant instability pattern — Dominant_Pattern — complete only if C1 = Present

E1. Dominant pattern (single choice) ☐ Scapholunate ☐ Midcarpal ☐ Lunotriquetral ☐ Combined / complex ☐ Nonspecific / indeterminate

When C1 = Absent, the dataset records None.

F. Associated second pattern — Second_Pattern_Present, Second_Pattern

F1. Is an associated second pattern present? ☐ No ☐ Yes

F2. If yes ☐ Scapholunate ☐ Midcarpal ☐ Lunotriquetral ☐ Other

G. Motion in which instability is most evident — Most_Evident_Sequence, Most_Evident_Phase

G1. Motion sequence ☐ Flexion–extension ☐ Radioulnar deviation ☐ Equally evident in both ☐ Only one sequence assessable

G2. Motion phase ☐ Radial deviation ☐ Ulnar deviation ☐ Flexion ☐ Extension ☐ Multiple phases ☐ Indeterminate

H. Anatomical level — Anatomic_Level

H1. Dominant anatomical level ☐ Proximal carpal row ☐ Midcarpal joint ☐ Both / combined

I. Abnormal anatomical relationships — Rel_* — multiple selections allowed

I1. Relationship(s) ☐ Scapholunate (Rel_Scapholunate) ☐ Lunotriquetral (Rel_Lunotriquetral) ☐ Lunocapitate (Rel_Lunocapitate) ☐ Scaphocapitate (Rel_Scaphocapitate) ☐ Other / indeterminate (Rel_Other)

J. Dynamic findings supporting a positive decision — Sign_* — multiple selections allowed

J1. Finding(s) ☐ Dynamic scapholunate opening/closing (Sign_SL_Widening) ☐ Loss of synchronous scaphoid–lunate motion (Sign_SL_Synchrony_Loss) ☐ Catch-up / catching movement (Sign_CatchUp) ☐ Transient subluxation (Sign_Transient_Subluxation) ☐ Abnormal translation (Sign_Abnormal_Translation) ☐ Abnormal or delayed lunate rotation (Sign_Abnormal_Lunate_Rotation) ☐ Abnormal midcarpal motion (Sign_Abnormal_Midcarpal_Motion) ☐ Other (Sign_Other)

K. Dominant kinematic motion type — Kinematic_Movement_Quality

K1. Most prominent motion abnormality ☐ Widening / opening ☐ Rotation ☐ Translation ☐ Catch-up / abrupt catching ☐ Subluxation ☐ Combined motion ☐ Indeterminate

L. Temporal behavior — Temporal_Pattern

L1. Appearance during the motion arc ☐ Transient / phasic ☐ Persistent / continuous ☐ Indeterminate

M. Severity — Severity_1to3

M1. Qualitative severity ☐ 1 — Mild ☐ 2 — Moderate ☐ 3 — Marked

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Notes on the form–dataset mapping

1. Items E through M applied only to evaluations in which C1 = Present. When C1 = Absent these fields are structurally not applicable; the dataset records NA for the categorical fields, None for Dominant_Pattern, 0 for Severity_1to3, and 0 for all Rel_* and Sign_* flags. These values are structural, not observed negative findings, and were never analyzed as such.
2. Two labels differ typographically between the form and the data file and denote the same category: form §K1 “Catch-up / abrupt catching” is stored as Catch-up/abrupt catching; form §L1 “Indeterminate” is stored as Cannot determine.
3. Three permitted response options were never selected by any reader in either round: “Only one sequence assessable” (§G1 — expected, since no evaluation was rated non-assessable), “Indeterminate” (§G2) and “Other” (§F2). They are retained above because they were available to readers.

4. Items I and J are multiple-selection and were not mandatory. In four of the 165 positive evaluations (all in round 2) no item was selected in one of these two sections; in all 80 positive round-1 evaluations at least one relationship and at least one sign were selected.

Part C — Supplementary Table 1. Operational reader framework
Qualitative phenotype-assignment framework, not diagnostic criteria.
Anatomical level (§H), dominant phenotype (§E), abnormal relationships (§I) and dynamic signs (§J) were recorded as **four separate items** on the assessment form and no fixed mapping between them was prescribed; none should be inferred from this table. In the study data, however, anatomical level was fully determined by the dominant phenotype for all four named categories across both rounds (scapholunate with proximal carpal row, 90/90; lunotriquetral with proximal carpal row, 10/10; midcarpal with midcarpal joint, 25/25; combined/complex with both/combined, 12/12) and varied only for nonspecific/indeterminate (proximal carpal row 13, both/combined 12, midcarpal joint 3). The level item therefore carries essentially no information beyond the phenotype label and should not be treated as an independent observation. Note also that the three available level options cannot distinguish the scapholunate from the lunotriquetral articulation, because both lie within the proximal carpal row, and that no radiocarpal or ulnocarpal level option was offered.
The table sets out, for each phenotype category, the operational definition the readers were given, the anatomical structures named in that definition and the §H1 level option to which they belong, and the response options that were available for recording supporting observations.

Supplementary Table 1. Operational reader framework

Anatomical level/joint (§H1 option)	Dominant phenotype category (§E1)	Operational qualitative features (verbatim, §A.5)	Supporting options available on the form (§I1, §J1)
Proximal carpal row—scapholunate relationship between scaphoid and lunate	**Scapholunate**	"Loss of coordinated scaphoid–lunate motion, dynamic opening/closing, or abnormal relative rotation."	Relationship: scapholunate. Signs: dynamic scapholunate opening/closing; loss of synchronous scaphoid–lunate motion; abnormal or delayed lunate rotation; catch-up/catching; transient subluxation; abnormal translation.
Proximal carpal row—lunotriquetral relationship between lunate and triquetrum	**Lunotriquetral**	"Dynamic motion discordance or dissociation between the lunate and triquetrum."	Relationship: lunotriquetral. Signs: abnormal or delayed lunate rotation; catch-up/catching; transient subluxation; abnormal translation.
Midcarpal joint—relationship between the proximal and distal carpal rows	**Midcarpal**	"Abnormal translation, rotation, shift, catching, or subluxation between the proximal and distal carpal rows."	Relationships: lunocapitate; scaphocapitate. Signs: abnormal midcarpal motion; abnormal translation; catch-up/catching; transient subluxation.
Both/combined—cannot be assigned to a single joint	**Combined/complex**	"Definite dynamic instability involving more than one carpal compartment."	Any combination of the relationship and sign options; by definition more than one compartment is involved.
Not assignable to a specific level by definition—any of the three level options could be recorded	**Non-specific/indeterminate**	"Dynamic instability is present, but a dominant anatomical phenotype cannot be reliably assigned."	Any relationship and sign options the reader judged present; the category is defined by the *absence* of a confident compartment assignment, not by a particular sign.

a. Column 1 states the anatomical structures named in the guide's own definition of each phenotype (column 3) and the §H1 level option those structures belong to. The guide does not instruct readers to select a particular level for a particular phenotype; level and phenotype were recorded independently.
b. For **combined/complex** and **non-specific/indeterminate** the correspondence is explicitly not one-to-one.

Combined/complex is defined by involvement of more than one carpal compartment and therefore cannot be assigned to a single joint. Nonspecific/indeterminate is defined by the reader being unable to assign a dominant phenotype, so it carries no anatomical commitment at all; readers recorded all three level options with this phenotype.

c. Column 4 lists the response options that were **available** for recording supporting observations, not the observations required to assign the phenotype. No sign was mandatory for any phenotype, and no sign was exclusive to any phenotype. In the study data, for example, the scapholunate relationship was recorded alongside phenotypes other than scapholunate, and lunocapitate and scaphocapitate relationships were recorded alongside the scapholunate phenotype. The table must therefore not be read as a decision rule.

d. Observed use of the framework in the 80 positive round-1 evaluations, for transparency: the three named single-compartment phenotypes co-occurred with the corresponding anatomical level in every instance (scapholunate with proximal carpal row, 44/44; lunotriquetral with proximal carpal row, 6/6; midcarpal with midcarpal joint, 9/9), and combined/complex co-occurred with "both/combined" in every instance (7/7), whereas nonspecific/indeterminate was distributed across all three levels (proximal carpal row 9, both/combined 3, midcarpal joint 2). The same holds across both rounds (165 positive evaluations; counts given above). This is a description of how these readers used the form, not a rule that the form imposed.

e. For orientation of the reader of this article only, and not part of the instrument the study readers used: the scapholunate and lunotriquetral categories correspond to dissociative instability at the respective proximal-row articulation, the midcarpal category to instability between the carpal rows, and combined/complex to involvement of more than one of these. The midcarpal category was intended to include non-dissociative (palmar) midcarpal instability; no formal mapping onto the CID/CIND/CIC/CIA scheme was intended. This mapping was added for publication; it was not supplied to the study readers and did not influence any assessment.

f. The term *compartment* is used in this framework for brevity to denote one of the three articular relationships to which the phenotype categories refer. The scapholunate and lunotriquetral articulations lie within the proximal carpal row; only the midcarpal joint is a compartment in the strict anatomical sense.

SUPPLEMENTARY MATERIALS
Interreader and Intrareader Agreement of Qualitative Cine 4D CT Interpretation for Dynamic Carpal Instability

All estimates were computed from the reader-level and patient-level source data. Confidence intervals are percentile intervals from wrist-level bootstrap resampling (100 000 replicates, seed 20260812), unless stated otherwise. Every analysis in this supplement is exploratory.

Supplementary Table 2. Exploratory composite clinical classification and operative findings	
A. Composite classification in relation to operative assessment (n = 50 wrists)	
	n (%) of 50
Underwent arthroscopy and/or instability-directed surgery	26 (52)
Managed without operative verification	24 (48)
Composite classification positive	17 (34)
Composite classification negative	33 (66)
The composite classification could become positive only in wrists that underwent operative assessment. All 24 wrists managed without operative verification were therefore classified negative by construction.	
B. Operative or arthroscopic findings among the 26 wrists that underwent arthroscopy or surgery	
Finding	n/26 (%)
Clinically significant scapholunate ligament injury/instability	11/26 (42)
No clinically significant instability-producing ligament injury	9/26 (35)
Clinically significant midcarpal instability/capsuloligamentous laxity	2/26 (8)
Clinically significant lunotriquetral ligament injury/instability	2/26 (8)
Combined clinically significant intercarpal instability	2/26 (8)
C. Instability-directed procedure among the 26 operated wrists	
Procedure	n/26 (%)
Scapholunate repair, reconstruction or stabilization	11/26 (42)
Diagnostic arthroscopy without instability repair	9/26 (35)
Combined repair or stabilization	2/26 (8)
Lunotriquetral repair or stabilization	2/26 (8)
Midcarpal stabilization or capsuloligamentous procedure	2/26 (8)
D. Clinical phenotype among the 17 wrists classified as clinically significant	
Phenotype	n/17 (%)
Scapholunate	11/17 (65)
Midcarpal	2/17 (12)
Lunotriquetral	2/17 (12)
Combined	2/17 (12)
No reader saw any of these data. Verification was selective and this classification is not a uniform reference standard; it was not used to assess diagnostic accuracy.	

Supplementary Table 3. Pairwise phenotype agreement and the distribution of discordant category pairs (round 1)

A. Pairwise cross-tabulations of the six-category dominant phenotype

These are agreement tables. Neither reader in any pair is treated as a reference, and an off-diagonal entry is a disagreement rather than an error. Rows are the first-named reader, columns the second.

Reader 1 (rows) vs. reader 2 (columns)

	None	Scapholunate	Midcarpal	Lunotriquetral	Combined/complex	Non-specific/indeterminate
None	20	3	1	0	1	1
Scapholunate	1	10	0	0	0	1
Midcarpal	0	2	1	0	0	1
Lunotriquetral	0	0	0	1	0	0
Combined/complex	0	1	0	0	1	0
Non-specific/indeterminate	0	1	0	1	1	2

Reader 1 (rows) vs. reader 3 (columns)

	None	Scapholunate	Midcarpal	Lunotriquetral	Combined/complex	Non-specific/indeterminate
None	20	3	2	0	0	1
Scapholunate	3	8	0	1	0	0
Midcarpal	0	1	1	1	1	0
Lunotriquetral	0	0	0	1	0	0
Combined/complex	0	1	0	0	1	0
Non-specific/indeterminate	0	2	0	0	0	3

Reader 2 (rows) vs. reader 3 (columns)

	None	Scapholunate	Midcarpal	Lunotriquetral	Combined/complex	Non-specific/indeterminate
None	18	2	1	0	0	0
Scapholunate	4	10	0	1	1	1
Midcarpal	0	0	1	1	0	0
Lunotriquetral	0	0	0	1	0	1
Combined/complex	1	1	0	0	1	0
Non-specific/indeterminate	0	2	1	0	0	2

B. Pairwise Cohen κ for the six-category dominant phenotype

Reader pair	Cohen κ (95% CI)
Reader 1 vs. reader 2	0.561 (0.388–0.725)
Reader 1 vs. reader 3	0.525 (0.335–0.699)
Reader 2 vs. reader 3	0.507 (0.323–0.679)

Confidence intervals (CIs) from wrist-level bootstrap resampling (100 000 replicates, seed 20260812), consistent with the agreement analyses in the main manuscript.

C. Overall discordance

Comparison set	Discordant	Proportion (95% CI)
All 150 pairwise comparisons, six-category label	48	32.0% (22.0–42.7)
Comparisons in which both readers judged the wrist positive	24 of 68	35.3% (20.0–50.9)

Of the 48 discordances across all comparisons, 24 involved the "none" category and therefore reflect the binary decision rather than the choice of compartment; the most frequent single pattern was none vs. scapholunate (16 of 48). CI, confidence interval.

D. Categories involved in the 24 discordances among positive–positive comparisons

Each discordance involves two categories, so these groupings overlap and do not partition the 24. All percentages are of the 68 positive–positive comparisons.

Categories involved	n	Proportion (95% CI)	Contributing wrists
Scapholunate	16	23.5% (11.0–37.2)	9
Non-specific/indeterminate	12	17.6% (6.7–30.4)	7
Two named compartments	7	10.3% (1.7–20.6)	4
Combined/complex	6	8.8% (0.0–19.1)	3

The two smallest groupings rest on four and three contributing wrists, so their intervals are unreliable and the 0.0% lower limit is a boundary artifact. CI, confidence interval.

E. Individual discordant category pairs among the 68 positive–positive comparisons

Category pair	n
Non-specific/indeterminate vs. scapholunate	7
Combined/complex vs. scapholunate	4
Midcarpal vs. scapholunate	3
Midcarpal vs. non-specific/indeterminate	2
Lunotriquetral vs. non-specific/indeterminate	2
Lunotriquetral vs. midcarpal	2
Lunotriquetral vs. scapholunate	2
Combined/complex vs. midcarpal	1
Combined/complex vs. non-specific/indeterminate	1

F. Category-level concordance

Counted over the positive–positive comparisons in which either reader used a given label, the number in which both readers used it

Label	Shared/either reader used it	Wrists with three-reader concordance on this label
Scapholunate	28/44	7
Non-specific/indeterminate	7/19	2
Midcarpal	3/11	0
Lunotriquetral	3/9	1
Combined/complex	3/9	1

Midcarpal never achieved three-reader concordance. Midcarpal, lunotriquetral and combined/complex were each used in fewer than 12 of the 68 comparisons, so no category-specific agreement coefficient was estimated.

Supplementary Table 4. Distribution of dominant phenotype assignments and additional severity estimate

A. Distribution of dominant phenotype assignments (150 assignments per round)

Category	Round 1, n (%)	Round 2, n (%)
None (overall judgment negative)	70 (46.7)	65 (43.3)
Scapholunate	44 (29.3)	46 (30.7)
Non-specific/indeterminate	14 (9.3)	14 (9.3)
Midcarpal	9 (6.0)	16 (10.7)
Combined/complex	7 (4.7)	5 (3.3)
Lunotriquetral	6 (4.0)	4 (2.7)

B. Additional severity estimate

Among the 21 wrists judged positive by all three readers in round 1 (63 severity grades: mild 12, moderate 25, marked 26), the unweighted Fleiss κ for the ordinal severity grade was 0.476 (95% CI, 0.206–0.700), alongside the linearly weighted estimate of 0.560 (95% CI, 0.286–0.762) reported in Table 3 of the main manuscript. All three readers assigned the same grade in 11 wrists and grades within one category in 20; one wrist spanned the full range.

Supplementary Table 5. Exploratory reader descriptors recorded for the 80 positive round-1 evaluations

Descriptor	n (%) of 80
Motion sequence in which instability was most evident	
Radioulnar deviation	38 (48)
Both sequences similarly	29 (36)
Flexion–extension	13 (16)
Motion phase in which instability was most evident	
Multiple phases	33 (41)
Radial deviation	28 (35)
Extension	9 (11)
Ulnar deviation	7 (9)
Flexion	3 (4)

Dominant anatomical level	
Proximal carpal row	59 (74)
Midcarpal joint	11 (14)
Both/combined	10 (13)
Dynamic signs selected (multiple selection permitted)	
Loss of synchronous scaphoid–lunate motion	50 (63)
Dynamic scapholunate opening/closing	42 (53)
Abnormal or delayed lunate rotation	33 (41)
Transient subluxation	28 (35)
Catch-up/abrupt catching motion	27 (34)
Abnormal translation	24 (30)
Abnormal midcarpal motion	17 (21)
Other	2 (3)
Abnormal anatomical relationships selected (multiple selection permitted)	
Scapholunate	61 (76)
Lunocapitate	34 (43)
Scaphocapitate	16 (20)
Lunotriquetral	14 (18)
Other/indeterminate	6 (8)
Dominant kinematic movement quality	
Combined motion	22 (28)
Rotation	20 (25)
Widening/opening	15 (19)
Translation	8 (10)
Catch-up/abrupt catching	6 (8)
Indeterminate	5 (6)
Subluxation	4 (5)
Temporal behavior	
Transient/phasic	41 (51)
Persistent/continuous	31 (39)
Cannot determine	8 (10)
Severity grade	
Moderate	33 (41)
Marked	27 (34)
Mild	20 (25)
Associated second pattern present	15 (19)
Lunotriquetral	7 (9)
Midcarpal	5 (6)
Scapholunate	3 (4)
The motion-sequence item was structurally determined for the 42 of 80 evaluations that were positive on only one axis; only the 38 positive on both axes contributed a free choice. At least one anatomical relationship and at least one dynamic sign were selected in every one of the 80 evaluations. Percentages are rounded and may not total 100.	

Supplementary Table 6. Exploratory clinical correlation
Round-1 three-reader majority judgment vs. the composite clinical classification (n = 50 wrists)

	Composite classification positive	Composite classification negative	Total
Majority judged instability present	15	11	26
Majority judged instability absent	2	22	24
Total	17	33	50
Overall concordance 37 of 50 wrists. Fisher exact test, $P < 0.001$. Odds ratio 14.1 (95% CI, 2.6–149.1; conditional			

maximum-likelihood estimate with exact interval). CI, confidence interval.
Seven of the 11 majority-positive wrists classified as negative never underwent arthroscopy and therefore could not have been classified positive. Because verification was selective, and because the composite classification could become positive only after operative assessment, these counts do not support estimation of sensitivity, specificity, predictive values or area under the receiver operating characteristic curve. No such measure was calculated.