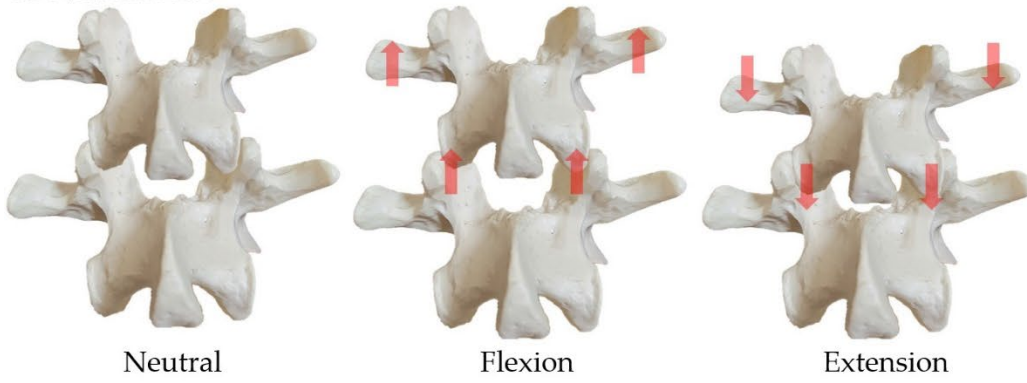
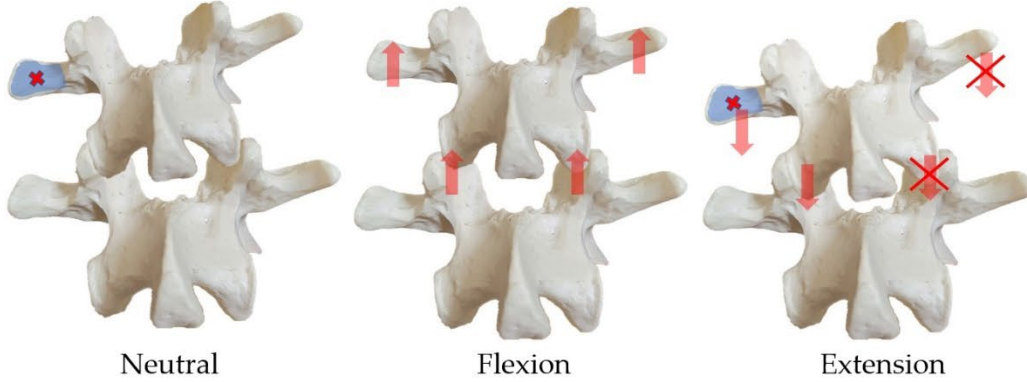


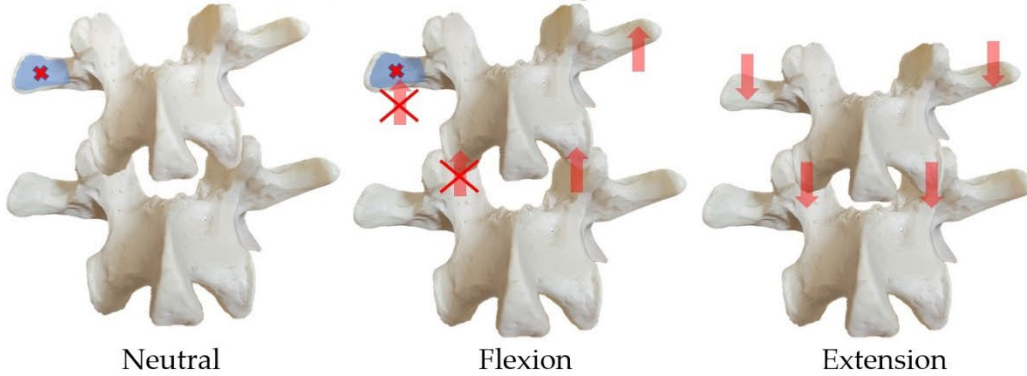
A. Normal state



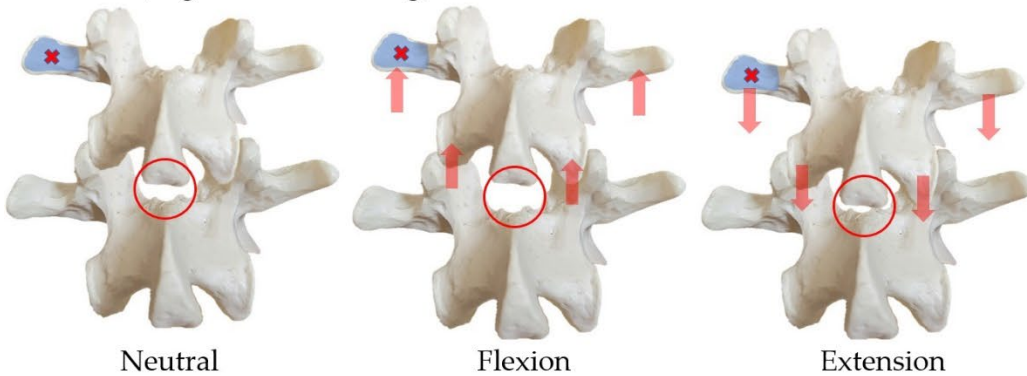
B. Flexion, left rotation, left lateral bending



C. Extension, left rotation, left lateral bending



D. Neutral, right lateral bending, left rotation



**Figure S1.** A detailed description of the malposition diagnosis through the manual method with the transverse process palpated on the left<sup>†</sup>. A, normal; B, FRS<sub>L</sub>; C, ERS<sub>L</sub>; D, NRrSL.

<sup>†</sup>If the transverse process is palpated on the right, the figure above should be considered in reverse.

Cross marks on the transverse process, relatively more palpable transverse processes with limited movement; F, flexion; E, extension; S, side bending (lateral bending); R, right side; L, left side.

**Table S1.** Number of diagnoses by detailed elements in listhesis diagnosis

Level	Item*	Var†	MD group			XE group			XN group			AI group		
			MD1	MD2	MD3	XE1	XE2	XE3	XN1	XN2	XN3	AI1	AI2	AI3
L1	Lis‡	Yes (n)	0	5	4	0	0	0	0	2	0	0	0	0
		No (n)	100	95	96	100	100	100	100	98	100	100	100	100
	Cor§	Lt. (n)	0	4	0	0	0	0	0	0	0	0	0	0
		Rt. (n)	0	1	0	0	0	0	0	0	0	0	0	0
		N (n)	100	95	100	100	100	100	100	100	100	100	100	100
	Sag	Ant. (n)	0	0	2	0	0	0	0	0	0	0	0	0
		Ret. (n)	0	0	2	0	0	0	0	2	0	0	0	0
		N (n)	100	100	96	100	100	100	100	98	100	100	100	100
L2	Lis‡	Yes (n)	1	11	16	2	2	2	7	12	0	0	2	1
		No (n)	99	89	84	98	98	98	93	88	100	100	98	99
	Cor§	Lt. (n)	0	6	1	0	0	1	1	1	0	0	0	0
		Rt. (n)	1	3	1	0	0	0	1	0	0	0	0	0
		N (n)	99	91	98	100	100	99	98	99	100	100	100	100
	Sag	Ant. (n)	0	1	5	0	0	0	0	0	0	0	0	0
		Ret. (n)	0	2	10	2	2	2	6	12	0	0	2	1
		N (n)	100	97	85	98	98	98	94	88	100	100	98	99
L3	Lis‡	Yes (n)	1	14	9	0	1	0	16	10	0	1	0	1
		No (n)	99	86	91	100	99	100	84	90	100	99	100	99
	Cor§	Lt. (n)	0	5	1	0	0	0	1	1	0	0	0	1
		Rt. (n)	0	1	0	0	0	0	1	0	0	1	0	0
		N (n)	100	94	99	100	100	100	98	99	100	99	100	99
	Sag	Ant. (n)	1	7	4	0	0	0	1	0	0	0	0	0
		Ret. (n)	0	1	4	0	1	0	13	9	0	0	0	0
		N (n)	99	92	92	100	99	100	86	91	100	100	100	100
L4	Lis‡	Yes (n)	0	2	7	1	2	2	15	12	0	2	3	3
		No (n)	100	98	93	99	98	98	85	88	100	98	97	97
	Cor§	Lt. (n)	0	1	0	1	1	1	1	3	0	1	1	1
		Rt. (n)	0	0	0	0	0	0	0	0	0	0	0	0
		N (n)	100	99	100	99	99	99	99	97	100	99	99	99
	Sag	Ant. (n)	0	0	3	0	0	0	2	0	0	0	0	0
		Ret. (n)	0	1	4	0	1	1	11	10	0	1	2	2
		N (n)	100	99	93	100	99	99	87	90	100	99	98	98
L5	Lis‡	Yes (n)	0	0	4	2	1	0	1	2	0	2	2	3
		No (n)	100	100	96	98	99	100	99	98	100	98	98	97
	Cor§	Lt. (n)	0	0	0	0	0	0	0	0	0	0	0	0
		Rt. (n)	0	0	0	0	0	0	0	0	0	0	0	0
		N (n)	100	100	100	100	100	100	100	100	100	100	100	100
	Sag	Ant. (n)	0	0	0	0	1	0	0	1	0	0	0	0
		Ret. (n)	0	0	4	2	0	0	1	1	0	2	2	3
		N (n)	100	100	96	98	99	100	99	98	100	98	98	97

\*Element: All investigators determined the presence of listhesis‡; subsequently, they evaluated listhesis of the coronal§ (right and left laterolisthesis, neutral) and sagittal planes|| (anterolisthesis, retrolisthesis, neutral).

†Var: (variables) The number of diagnoses made by each investigator is indicated.

AI, X-ray based diagnosis using artificial intelligence program by non-experts; Ant., anterolisthesis; Cor, coronal plane; Lis, presence of listhesis, Lt., left; N, neutral; Ret., retrolisthesis; Rt., right; Sag, sagittal plane; MD, manual diagnosis by experts; XE; X-ray-based diagnosis by experts; XN; X-ray-based diagnosis by non-experts.

**Table S2.** Number of diagnoses by detailed elements in malposition diagnosis

			MD group			XE group			XN group			AI group		
Level	Item*	Var†	MD1	MD2	MD3	XE1	XE2	XE3	XN1	XN2	XN3	AI1	AI2	AI3
L1	Mal‡	Yes (n)	47	11	60	63	74	51	64	80	41	82	70	77
		No (n)	53	89	40	37	26	49	36	20	59	18	30	23
	Sag§	Flex. (n)	11	4	33	37	51	22	17	52	5	52	37	31
		Ext. (n)	12	4	14	3	0	2	15	0	0	5	1	0
		N (n)	77	92	53	60	49	76	68	48	95	43	62	69
	Axi	Rt. (n)	25	4	20	21	24	16	22	27	16	20	25	24
		Lt. (n)	22	4	35	21	21	23	22	19	14	23	24	25
		N (n)	53	92	45	58	55	61	56	54	70	57	51	51
	Cor**	Rt. (n)	21	5	29	20	17	19	29	23	15	33	21	34
		Lt. (n)	26	2	26	16	17	11	20	14	7	22	14	18
		N (n)	53	93	45	64	66	70	51	63	78	45	65	48
L2	Mal‡	Yes (n)	67	31	66	63	59	60	64	65	43	74	67	78
		No (n)	33	69	34	37	41	40	36	35	57	26	33	22
	Sag§	Flex. (n)	16	11	34	15	12	14	8	13	3	19	13	10
		Ext. (n)	27	11	8	4	2	3	21	3	1	6	2	2
		N (n)	57	78	58	81	86	83	71	84	96	75	85	88
	Axi	Rt. (n)	30	13	17	22	26	19	22	30	17	20	28	25
		Lt. (n)	36	12	45	23	21	22	23	23	16	24	24	23
		N (n)	34	75	38	55	53	59	55	47	67	56	48	52
	Cor**	Rt. (n)	26	16	35	30	19	27	33	29	18	36	31	35
		Lt. (n)	40	7	27	21	21	20	17	21	8	29	22	28
		N (n)	34	77	38	49	60	53	50	50	74	35	47	37
L3	Mal‡	Yes (n)	48	34	72	52	51	48	65	63	44	64	57	72
		No (n)	52	66	28	48	49	52	35	37	56	36	43	28
	Sag§	Flex. (n)	13	15	34	5	5	7	7	2	3	11	3	3
		Ext. (n)	16	12	9	3	5	3	19	8	0	0	5	6
		N (n)	71	73	57	92	90	90	74	90	97	89	92	91
	Axi	Rt. (n)	24	9	14	20	23	18	20	31	18	16	20	20
		Lt. (n)	23	17	53	19	17	19	21	22	16	16	22	19
		N (n)	53	74	33	61	60	63	59	47	66	68	58	61
	Cor**	Rt. (n)	24	14	39	23	14	18	32	26	14	28	24	27
		Lt. (n)	23	12	28	11	12	10	16	16	2	20	13	20
		N (n)	53	74	33	66	74	72	52	58	84	52	63	53
L4	Mal‡	Yes (n)	57	40	66	46	43	42	45	53	35	52	49	68
		No (n)	43	60	34	54	57	58	55	47	65	48	51	32
	Sag§	Flex. (n)	13	16	28	9	8	11	4	5	1	12	7	6
		Ext. (n)	43	15	13	8	8	5	16	9	2	1	9	11
		N (n)	44	69	59	83	84	84	80	86	97	87	84	83
	Axi	Rt. (n)	30	15	11	12	12	11	12	23	13	8	19	20
		Lt. (n)	23	15	49	13	13	16	15	15	13	8	14	18
		N (n)	47	67	40	75	75	73	73	62	74	84	67	62
	Cor**	Rt. (n)	32	19	34	15	13	10	13	17	10	19	16	17
		Lt. (n)	21	13	26	16	13	16	24	18	7	24	18	26
		N (n)	47	68	40	69	74	74	63	65	83	57	66	57
L5	Mal‡	Yes (n)	80	41	38	40	38	24	9	54	20	58	48	53

No (n)		20	59	62	60	62	76	91	46	80	42	52	47
Sag <sup>§</sup>	Flex. (n)	39	14	13	11	11	4	1	14	0	22	9	15
	Ext. (n)	40	25	16	7	10	3	1	8	1	1	9	6
	N (n)	21	61	71	82	79	93	98	78	99	77	82	79
Axi <sup>  </sup>	Rt. (n)	60	12	1	4	6	4	0	21	8	1	16	19
	Lt. (n)	19	7	34	9	9	8	3	10	7	5	14	14
	N (n)	21	81	65	87	85	88	97	69	85	94	70	67
Cor <sup>**</sup>	Rt. (n)	62	11	10	10	5	5	2	8	2	17	8	11
	Lt. (n)	18	7	25	17	16	12	4	22	4	26	21	17
	N (n)	20	82	65	73	79	83	94	70	94	57	71	72

<sup>§</sup>Element: All investigators assessed the presence of malposition<sup>‡</sup>; subsequently, they evaluated malposition of the sagittal<sup>§</sup>(flexion, extension, neutral), axial<sup>||</sup>(right and left rotation, neutral), and coronal planes<sup>\*\*</sup>(right and left lateral bending).

<sup>||</sup>Var: (variables) The number of diagnoses performed by each investigator is indicated.

AI, X-ray-based diagnosis using artificial intelligence program by non-experts; Axi, axial plane; Cor, coronal plane; Lt., left; Mal, presence of malposition; MD, manual diagnosis by experts; N, neutral; Rt., right; Sag, sagittal plane; XE, X-ray-based diagnosis by experts; XN, X-ray-based diagnosis by non-experts