Japan Research Activities in the GTR-7 Phase 2 amendment
Bio RID II seating proposal #5

JASIC/Japan

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Feb. 10-11.2009

1. Seating Condition Proposal

2. Seating Procedure Proposal based on variation study

3. Comparison between design torso angle and 25 degree fixed angle

4. Seating Procedure Proposal for smaller torso angle seat.

① Background of Design Torso Angle Proposal

Range of design torso angles used in different vehicle types

Note: data presented in HR-4-13
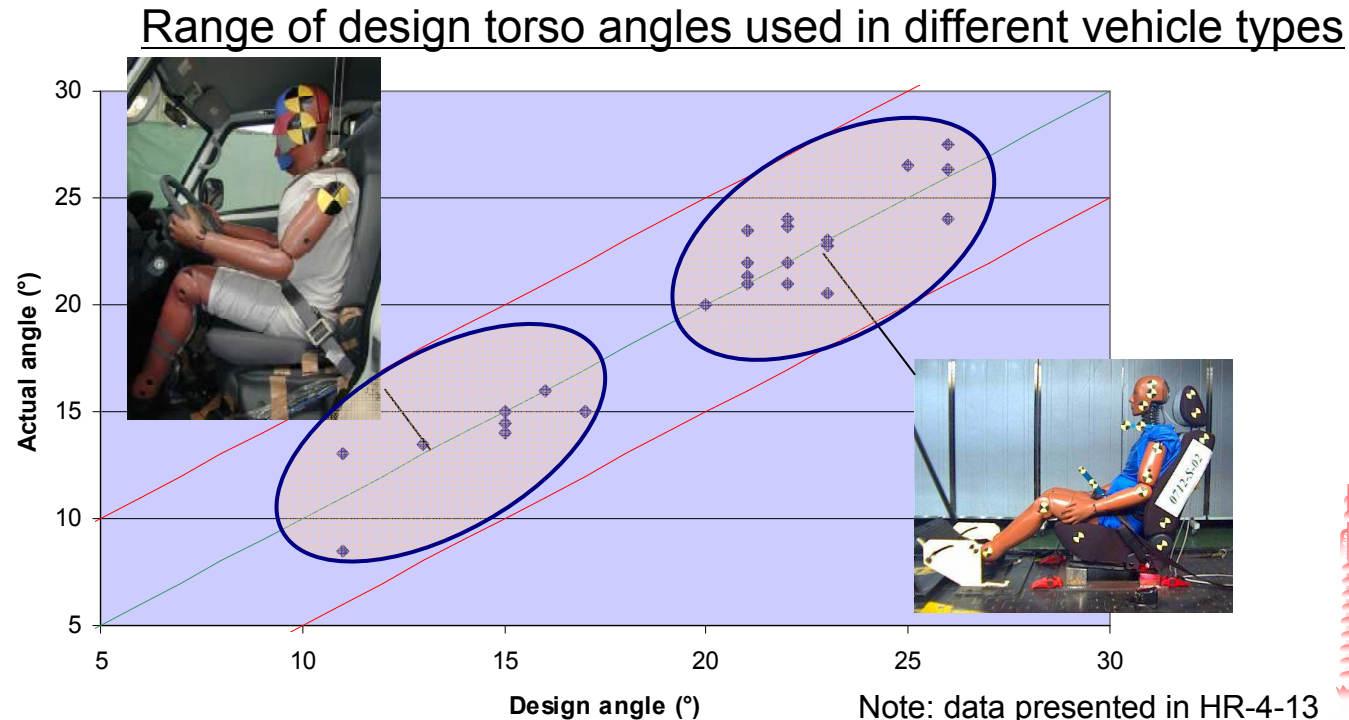
- Design torso angle is specified by typical driving posture for each type of vehicle and seating height. It is varied from 10° to 30°.
  - For certain seat designs, 25° bears no relation to the real world seating position and in some cases may not even be physically achievable
  - Advise the use of the procedure specified in ECE17 Annex 3
- All other safety tests, including vehicle crash tests, are conducted with the design torso angle.

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1. Seating Condition Proposal

The dummy seating procedure should be modified from the IIWPG procedure as follows, as the actual seating angle is closer to the design torso angle. In addition, the dummy outputs are very sensitive to the static backset according to the simulation and test results.

① Seat torso angle:
　　 Design torso angle ⇒ 25 degrees

② Backset tolerance:
　　　　 +/-2 mm ⇒ +/- 5 mm.

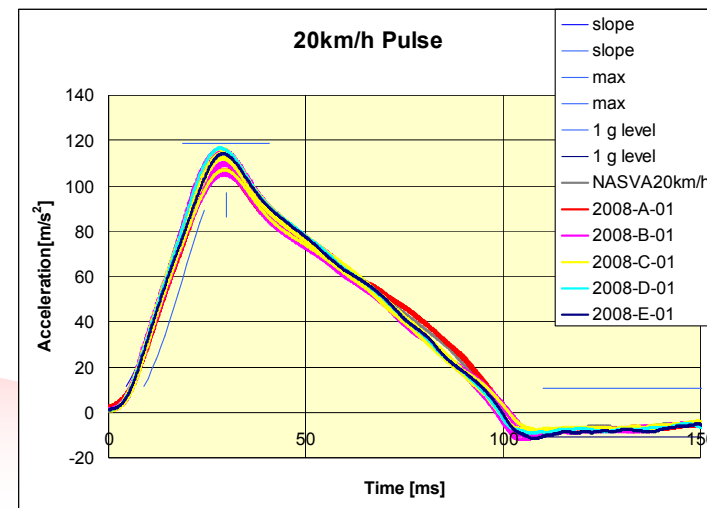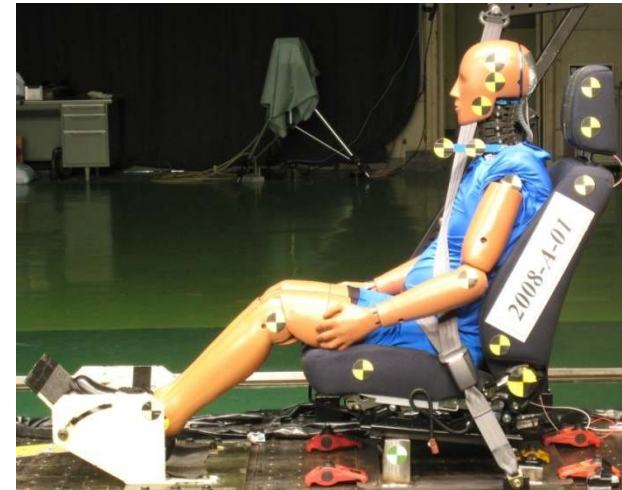③ Special adjustment in the case of smaller torso angle seat

2．Seating procedure variation effect study

JARI has conducted the following tests to confirm the effects of seating variation.

・Back set ： ＋5mm ＋10mm

・H-point ＋5mm ＋10mm

・Pelvis angle： ＋2.5° −2.5°

Crash Pulse : Delta V 20km/h
Seat : Passive-type seat

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Seating procedure variation effect study

Variation effect summary

Test No.	HRCT	Hx Acc.	T1 Acc.	Upper FX	Upper FZ	Upper MY-Flx.	Upper MY-Ext.	Lower FX	Lower FZ	Lower MY-Flx.	Lower MY-Ext.	NIC	OC-T1
2008-B-01～05（ (Ave.)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2008-B-06（BS +5mm）	103.1	107.7	98.7	123.5	111.9	104.7	100.0	111.9	121.9	124.6	114.4	118.2	104.7
2008-B-07（BS +10mm）	105.8	114.8	97.6	146.7	123.0	109.2	100.0	123.5	143.2	147.0	128.4	135.5	109.8
2008-B-08（HP +5mm）	100.9	101.9	96.0	111.6	99.2	104.2	100.0	101.4	102.1	105.7	105.0	103.4	99.8
2008-B-09（HP +10mm）	101.9	103.8	92.3	123.3	98.8	108.2	100.0	103.0	104.2	109.7	110.0	107.6	99.5
2008-B-10（PA +2.5°）	97.7	100.2	89.8	106.5	101.7	103.3	100.0	102.7	105.4	103.2	102.8	89.6	96.3
2008-B-11（PA -2.5°）	103.7	102.7	110.7	100.7	100.4	95.6	100.0	98.2	97.2	107.2	102.3	117.7	106.9

Unit : % | ±5 | ±10 | ±20 | ±21～ |

Conclusion
- Back set variation produces the greatest effect on all indicators.
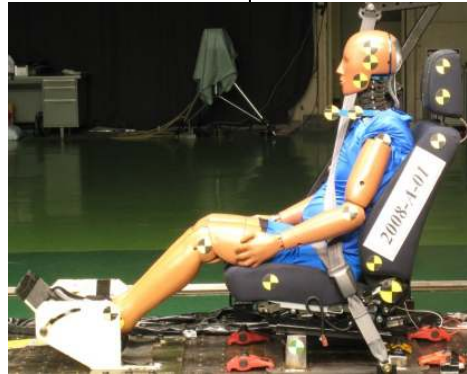- H-point variation is the second effect on all indicators.

Evaluation Method

Compare with the same seat evaluationǀ indicator variation between JNCAP test with design torso angle and IIHS test with 25 degree fixed torso angle.
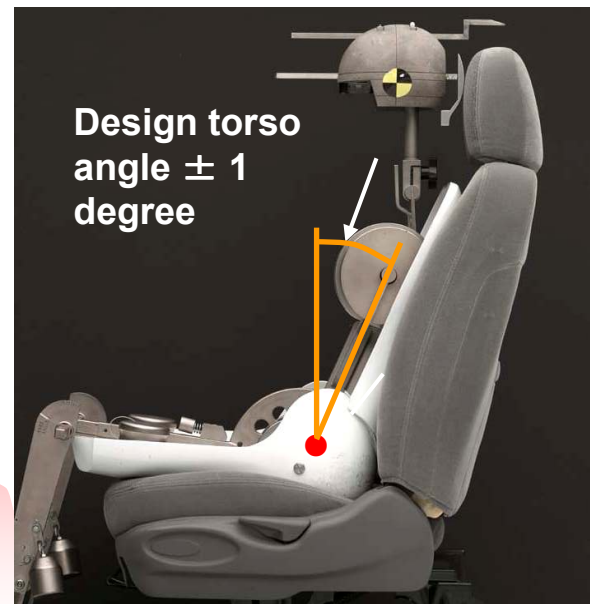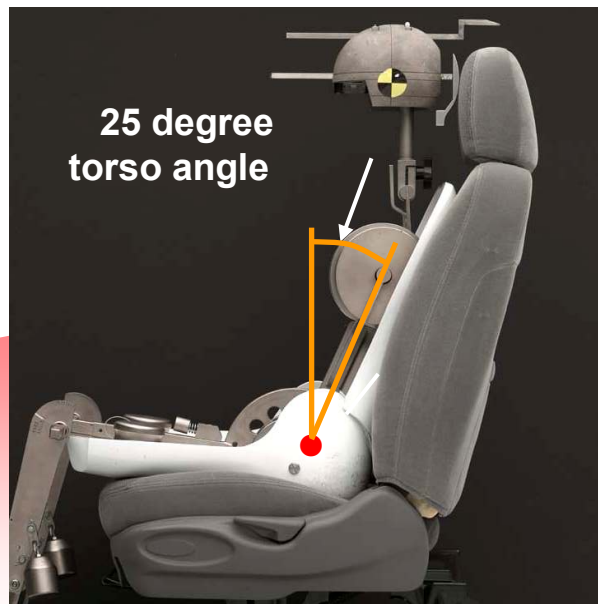

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Sled pulse Delta-V: 16 [km/h]

JNCAP Japan New Car Assessment Program
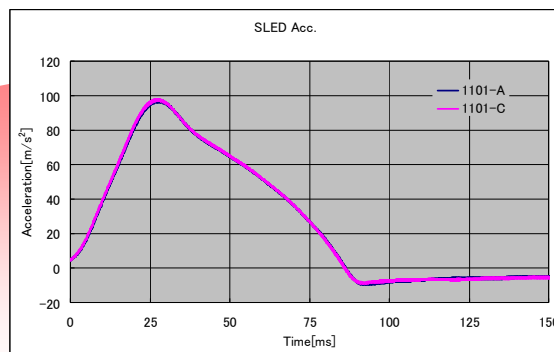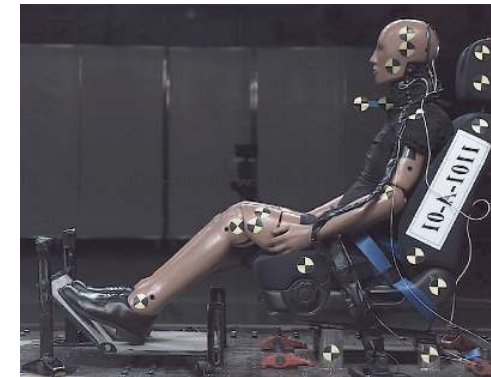
Sled pulse Delta-V: 17.6 [km/h]

25 degree torso angle

Design torso angle ± 1 degree

Indicator	target value
NIC	22
Upper Fx	620
Upper Fz	950
Upper My(Flx.)	32
Upper My(Ext.)	32
Lower Fx	620
Lower Fz	1075
Lower My(Flx.)	32
Lower My(Ext.)	32

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3. Comparison between design torso angle and 25 degree fixed angle

Additional Sled Test

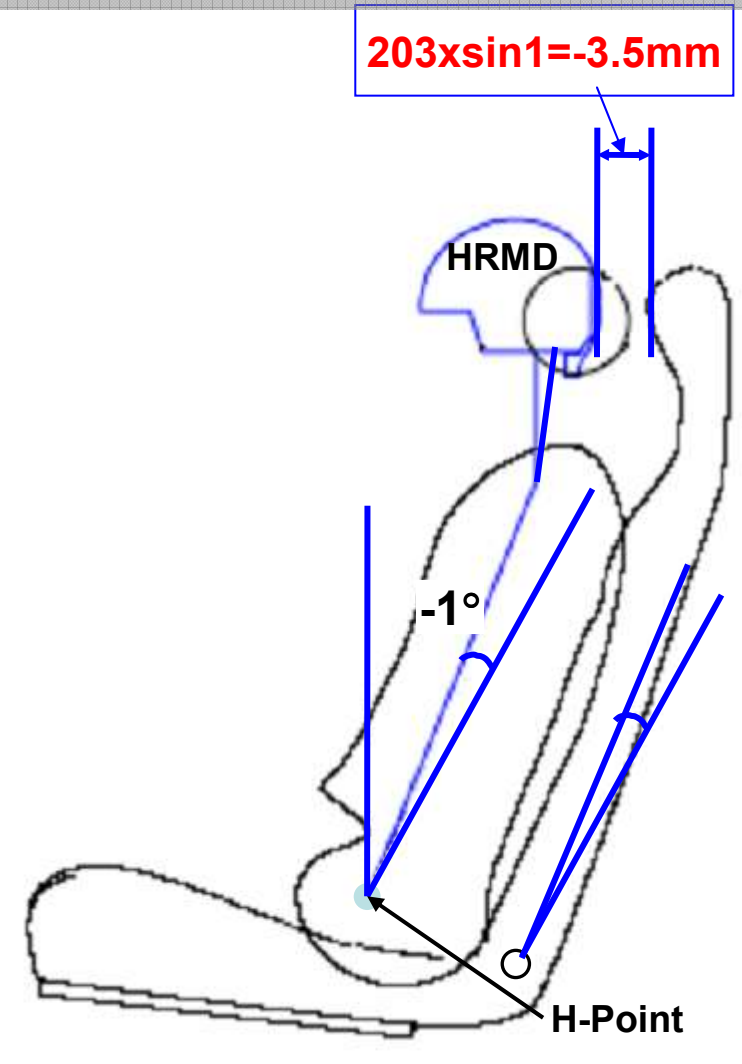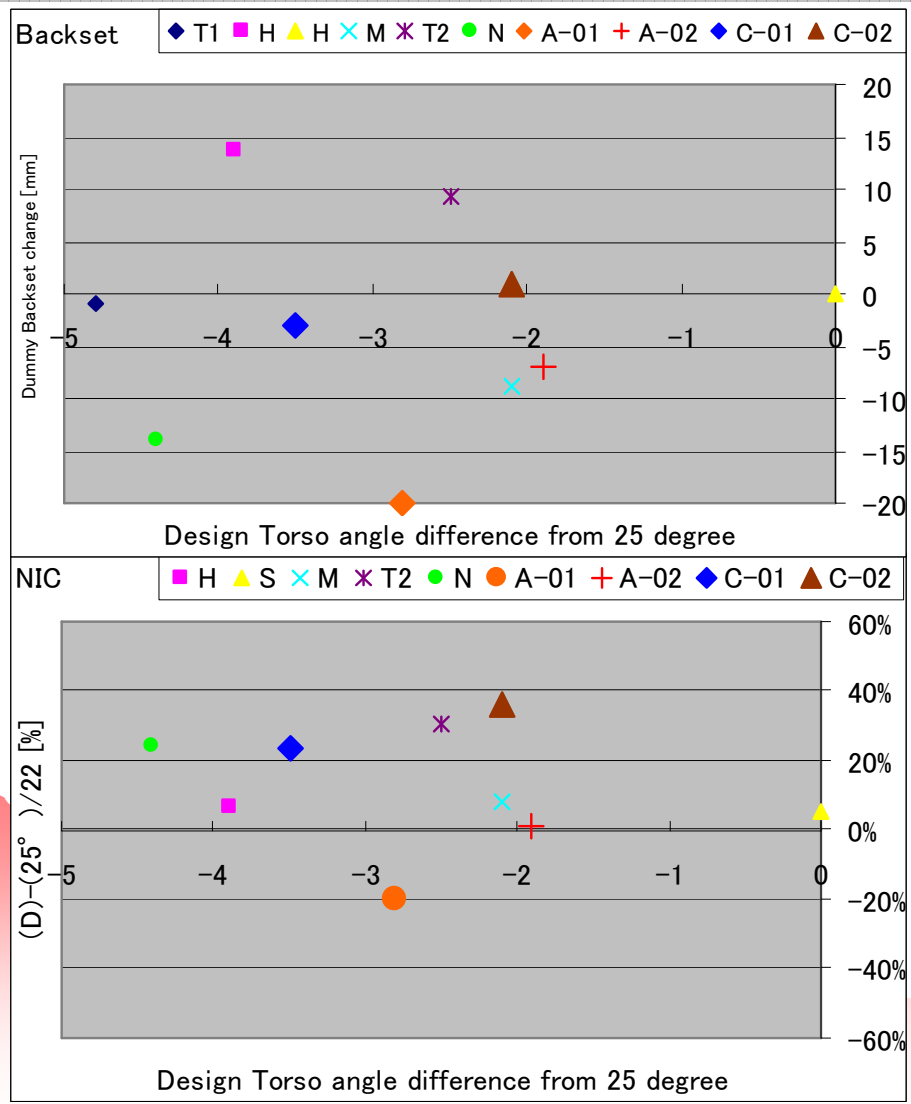**Comparison of three different torso angles for two different seats.**

Seat type	Torso angle（degree）	Backset (mm)
A-01	21.3	73
A-02	22.2	86
A-03	24.1	94
C-01	19.5	82
C-02	20.9	85
C-03	23.0	84

Sled pulse
Delta-V: 16 [km/h]

No clear tendency was seen in evaluation indicators between 25° fixed angle and standard torso angle in seats with a design torso angle of 20° or more .

Backset | ◆ T1 ■ H ▲ H ✕ M ✳ T2 ● N ◆ A-01 ＋ A-02 ◆ C-01 ▲ C-02

Dummy Backset change [mm]

Design Torso angle difference from 25 degree

NIC | ■ H ▲ S ✕ M ✳ T2 ● N ● A-01 ＋ A-02 ◆ C-01 ▲ C-02

(D)-(25°)/22 [%]

Design Torso angle difference from 25 degree

**203xsin1=-3.5mm**

HRMD

-1°

H-Point

3. Comparison between design torso angle and 25 degree fixed angle

No clear tendency was seen in evaluation indicators between 25° fixed angle and standard torso angle in seats with a design torso angle of 20° or more .

3. Comparison between design torso angle and 25 degree fixed angle
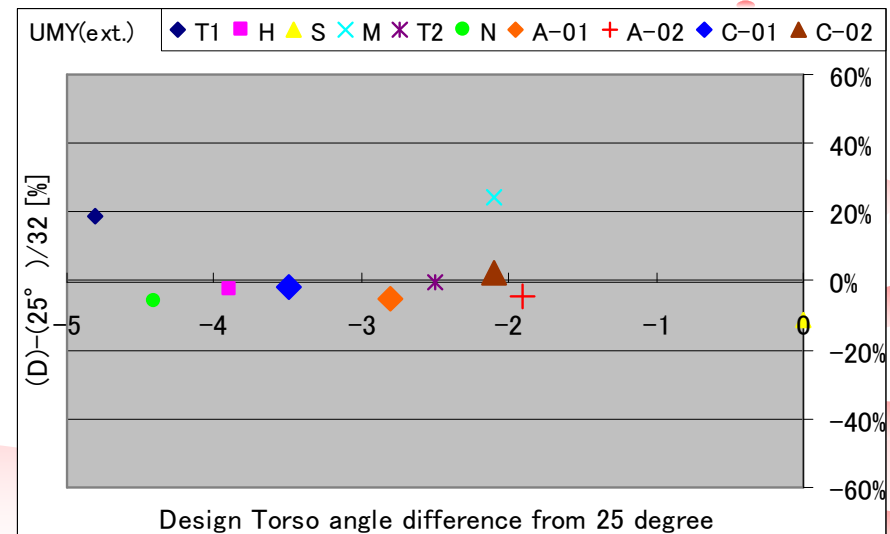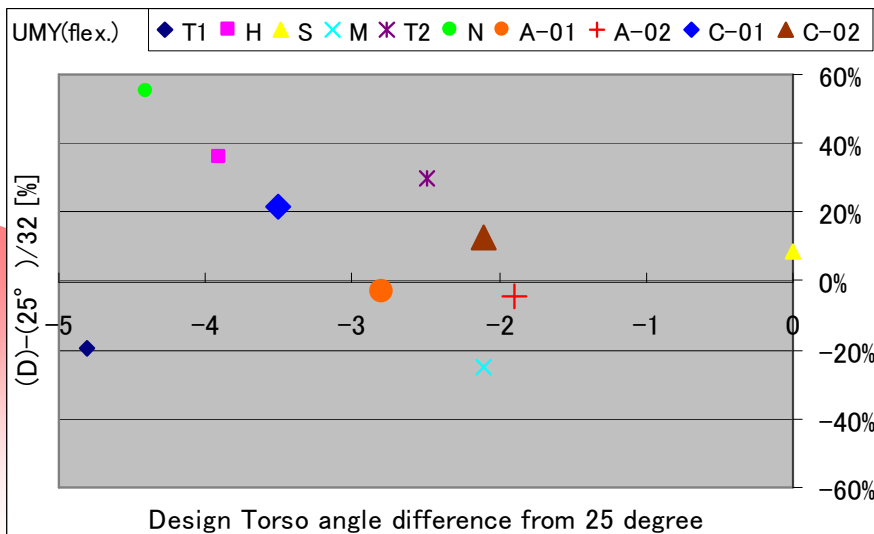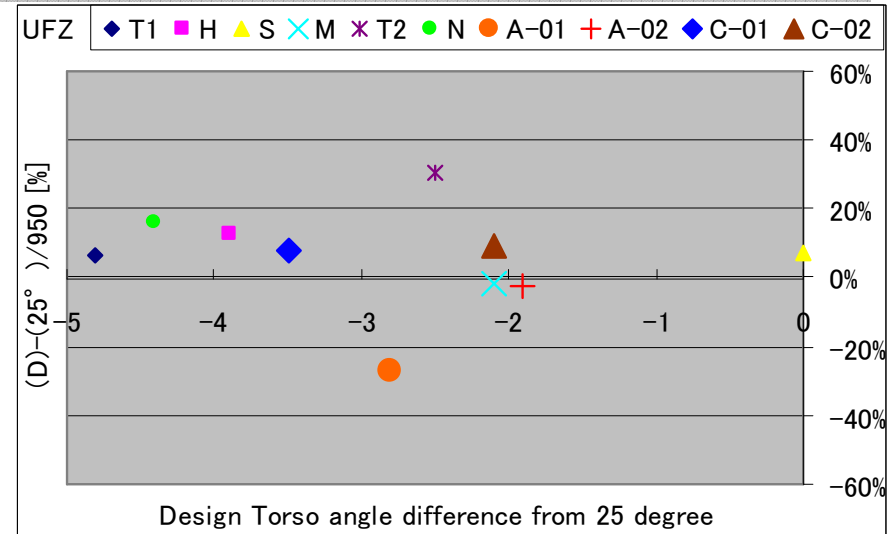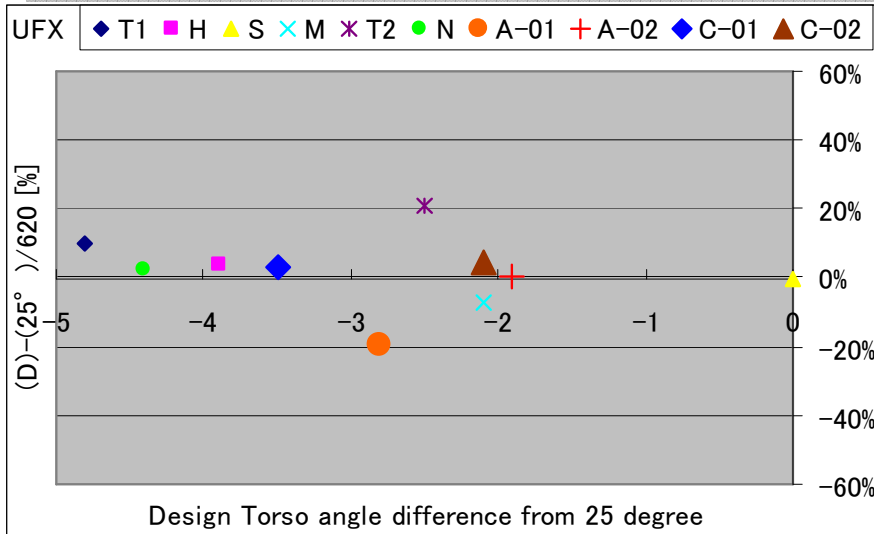
No clear tendency was seen in evaluation indicators between 25° fixed angle and standard torso angle in seats with a design torso angle of 20° or more .
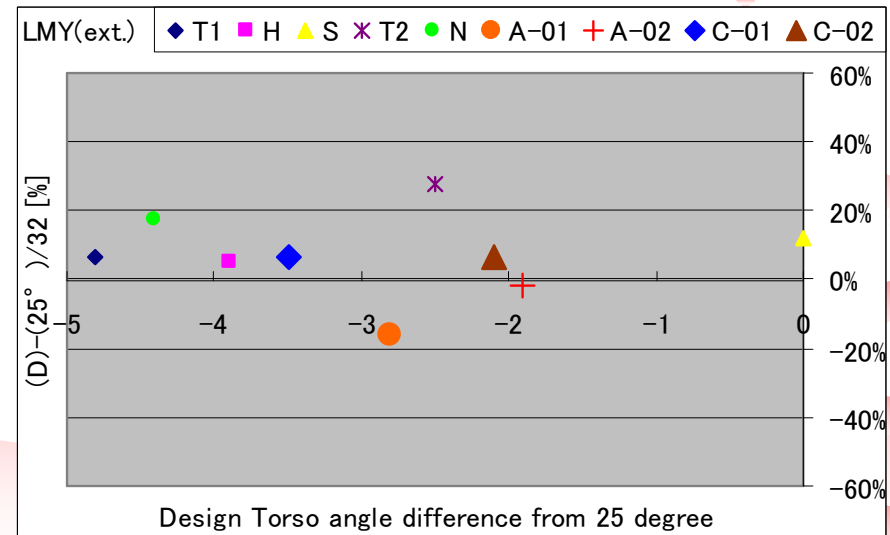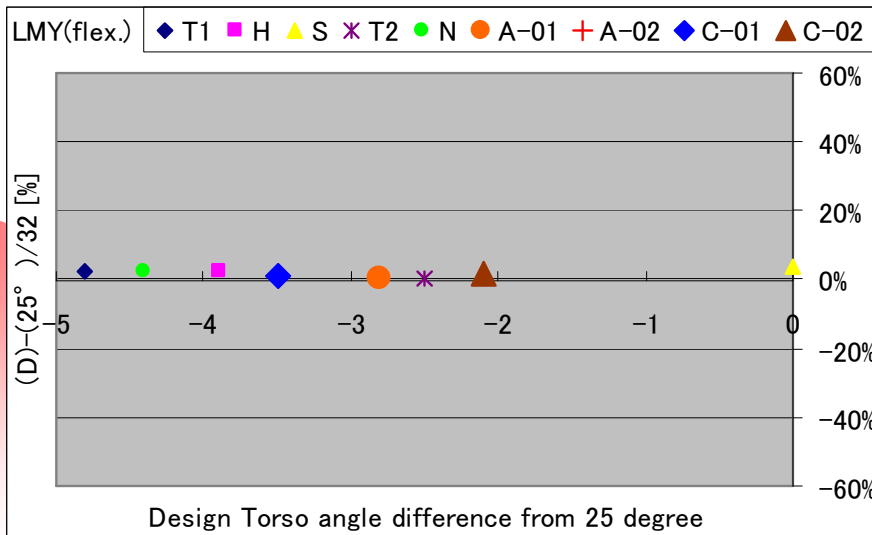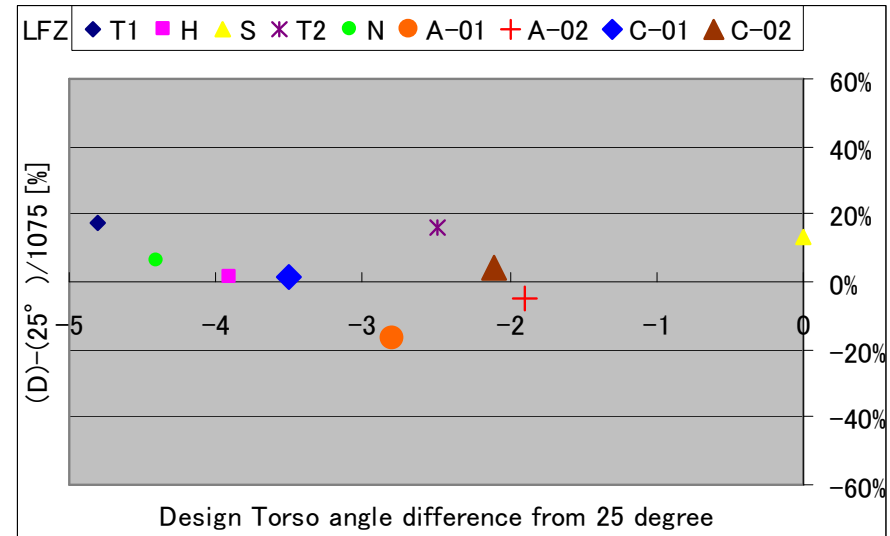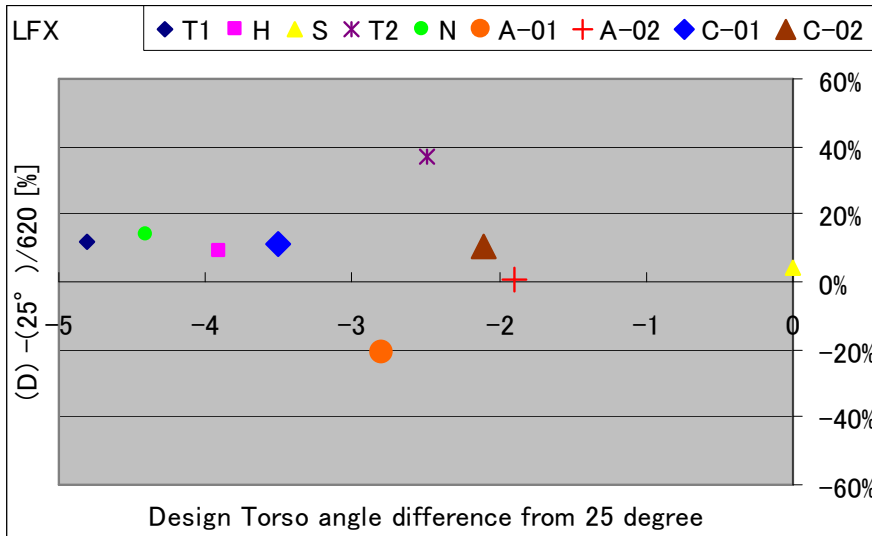
◆**To evaluate dummy seating in the actual driving position as well as in the same position as in other crash forms, the standard design torso angle should be used.**

◆**No clear different was seen in the effect on the dynamic evaluation between standard design torso angle (20° or more) and 25° fixed angle.**

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# 4. Smaller Design Torso Angle seat seating trial

Upright torso seat Fleet ratio

The front seat torso angle is upright (less than 20°) in 45% of vehicles on the market. Therefore, it is difficult to appropriately evaluate all the seats by dynamic testing unless the upright dummy is established.
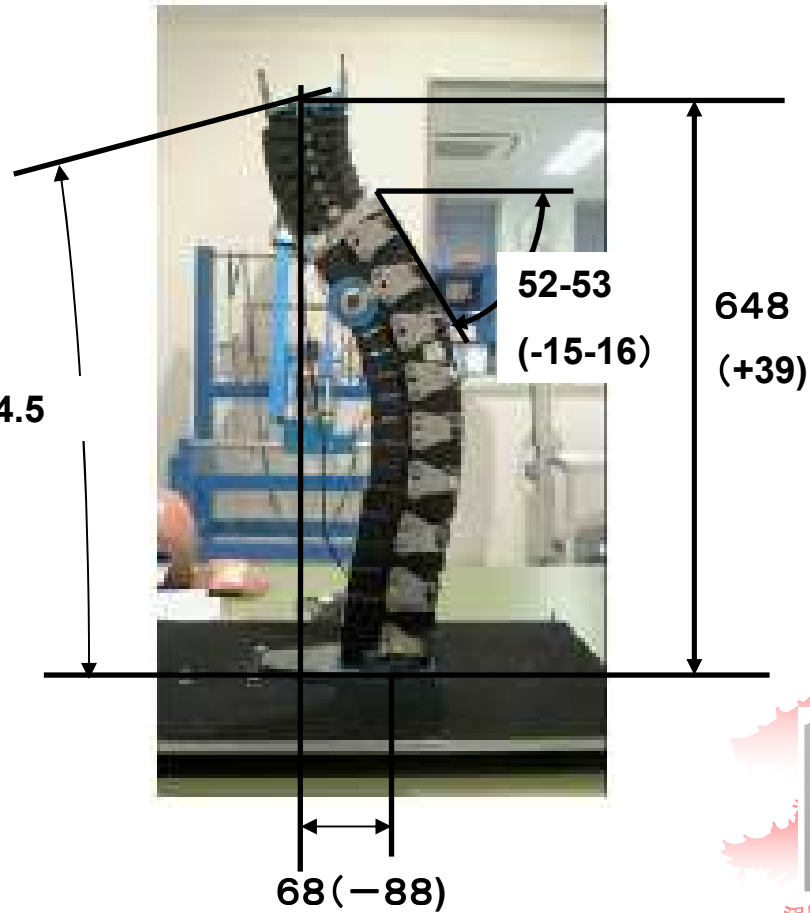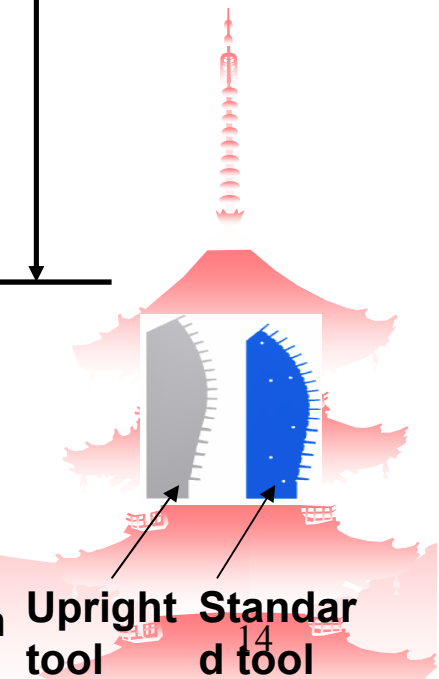
Upright
torso angle

Standard
torso angle

N1
10%
0.1%
M2

M1

45%

35%
M1

48%

55%

M2
N1

7%
0.1%
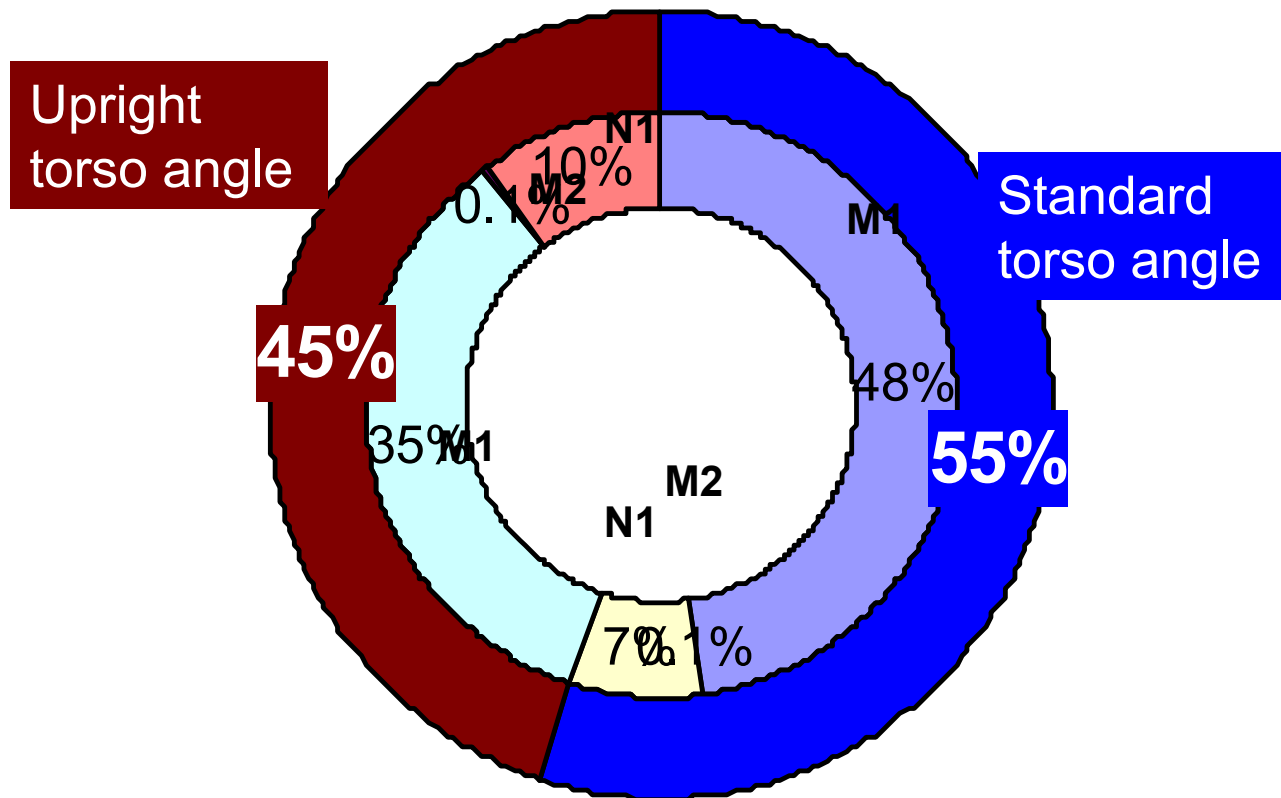
4. Smaller Design Torso Angle seat seating trial

Standard tool
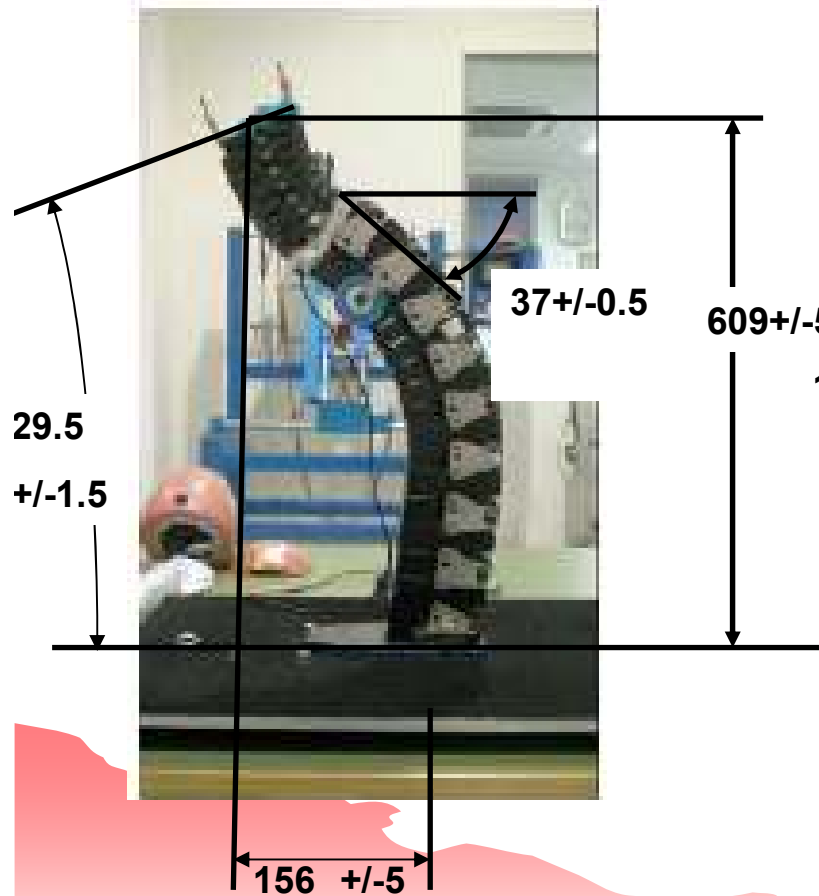
Upright tool

37+/-0.5

609+/-5

14.5

29.5
+/-1.5

156 +/-5

52-53

(-15-16)

648

(+39)

68（-88）

T2 angle of Upright tool is about 15 degree greater than standard tool

Upright tool   Standard tool

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Spine Pin and Point Measurement Result

Without Jacket

標準治具+低トルソ治具

Standard tool

Upright tool

- 1回目
- 2回目

With Jacket

標準治具+低トルソ治具（Jacket有）

Standard tool

Upright tool

Large forward inclination

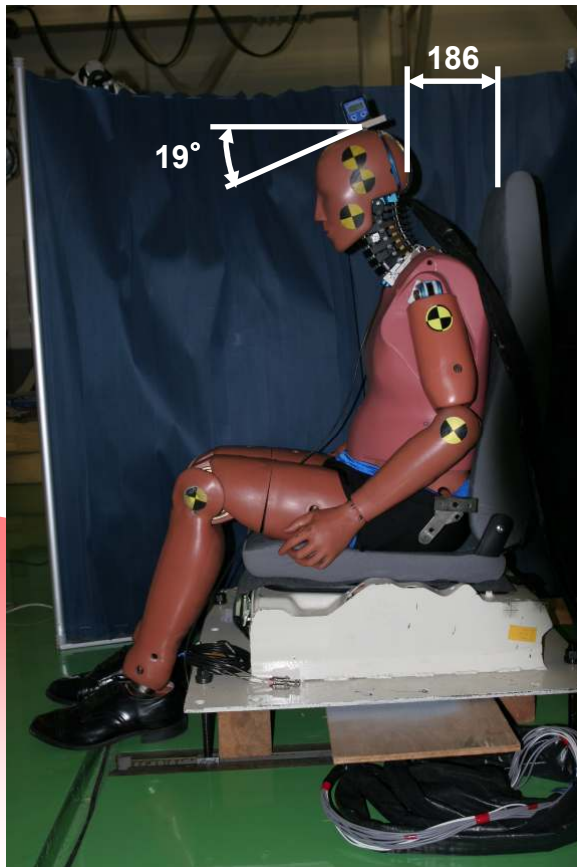- 6回目（ジャケット有）
- 8回目（ジャケット有）
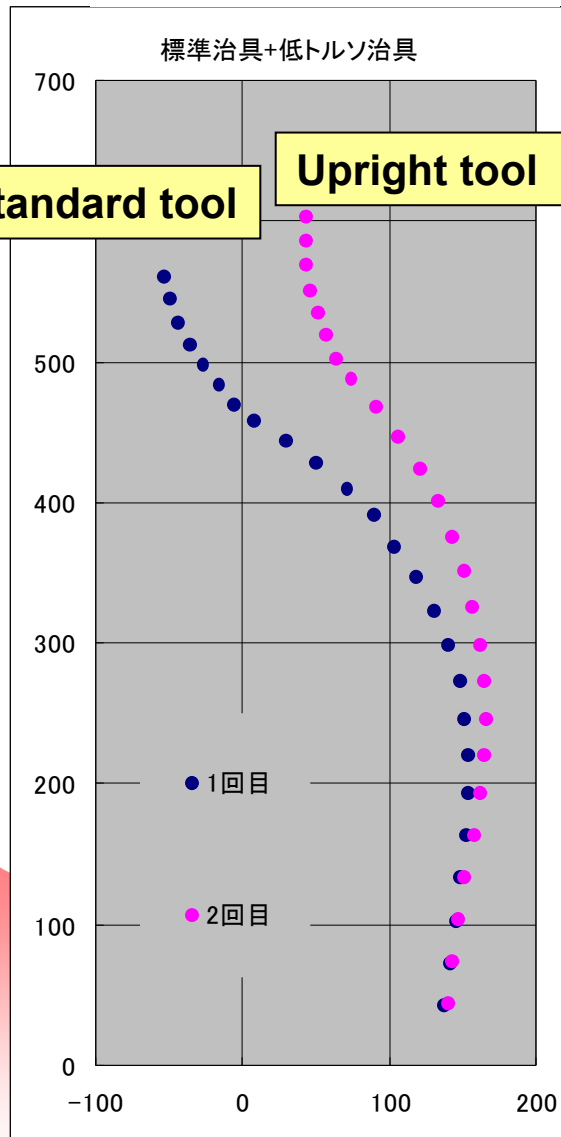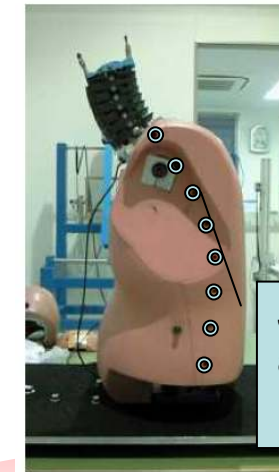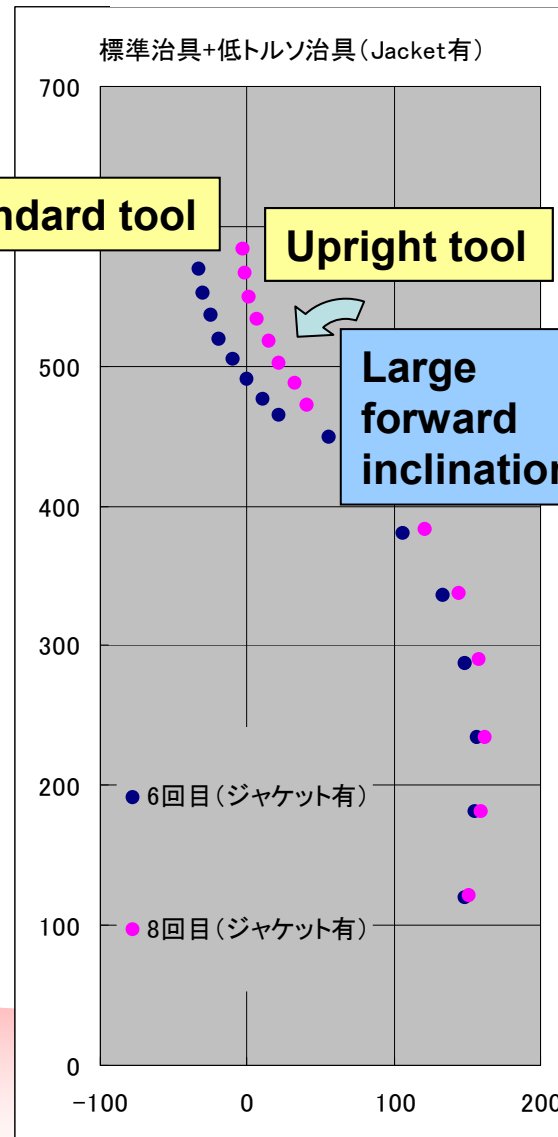
Jacket attachment bolts restriction

Seating Trial Result

•Dummy head angle and backset are improved with upright tool.
•In the case of about 14 degree torso angle, head can maintain laterally level, however, backset is little bit smaller than target, 112mm.
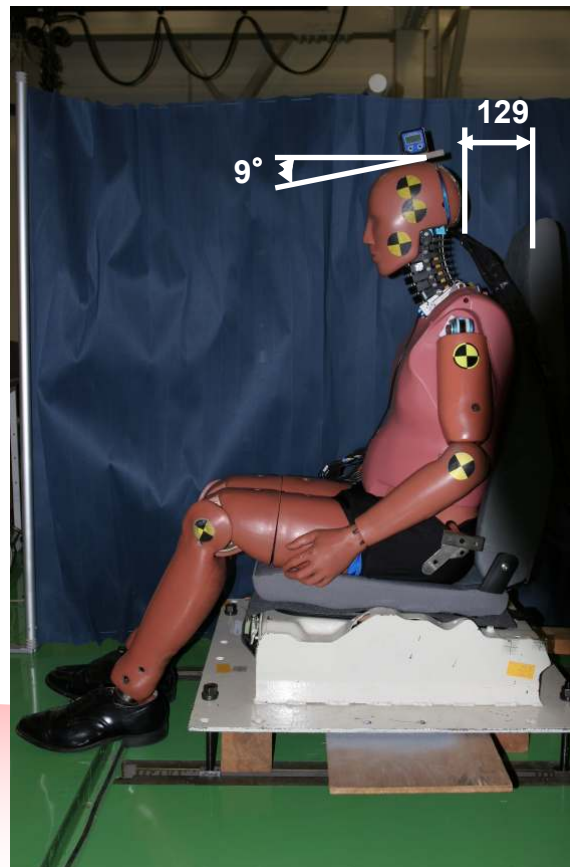
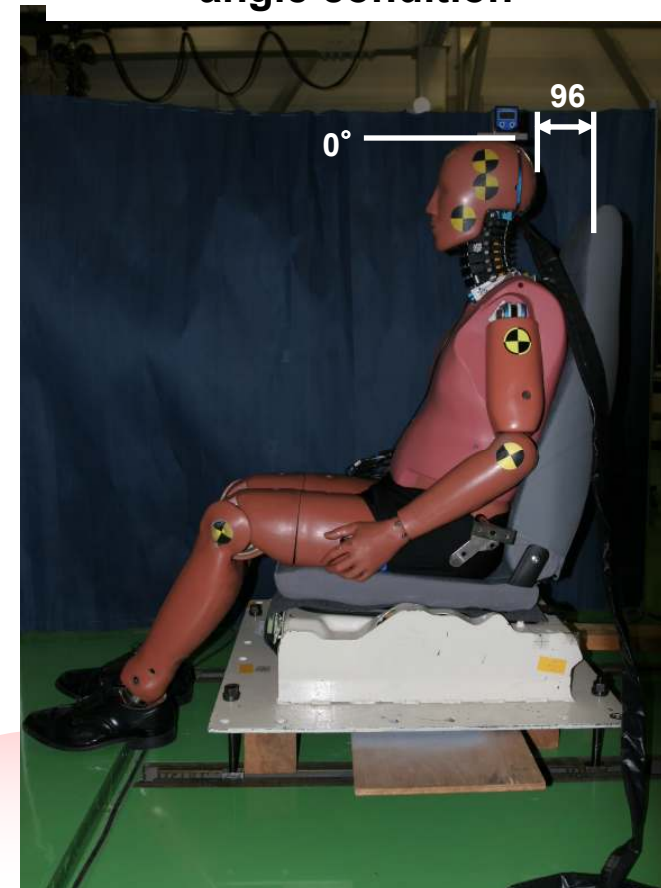| Standard tool	Upright tool	Upright tool
with 10 degree torso angle	with 10 degree torso angle	with about 14 degree torso angle condition

◆The spine and jacket are able to install without any conflict.

◆T2 angle of Upright tool is about 15 degree greater than standard tool

◆Large forward inclination is occurred due to the jacket attachment bolts restriction

◆Dummy head angle and backset is improved for 10 degree torso angle seat with upright tool, However, head angle is

◆**Dummy head angle and backset is improved for 10 degree torso angle seat with upright tool, However, head angle is still tilted due to jacket restriction. Therefore, this tool introduction was proposed.**

◆**In Japan, the standard design torso angle is upright (less than 20°) in about half (45%) of vehicles on the market; it is difficult to evaluate them only by dynamic testing, and the static backset option is necessary.**

Thank you for your attention ！