



The T1G of Hybrid-III for Whiplash Injury Evaluation

JAPAN/ MLIT
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Neck Injury Evaluation Criteria

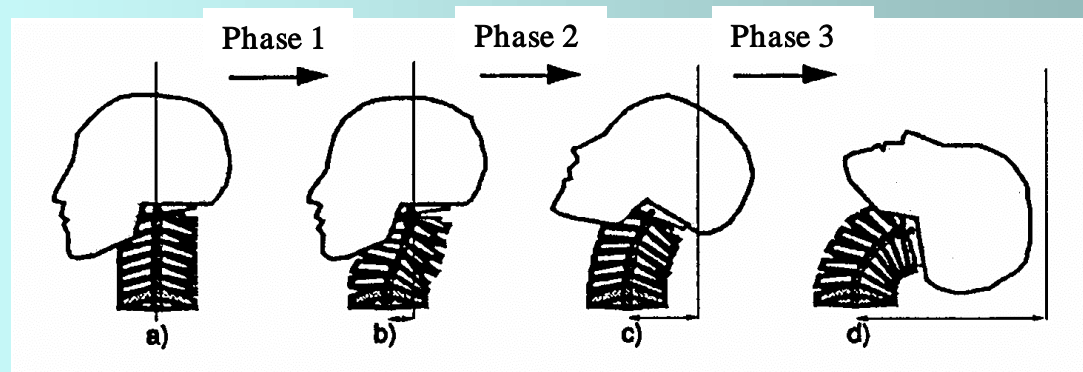
HR-6-5



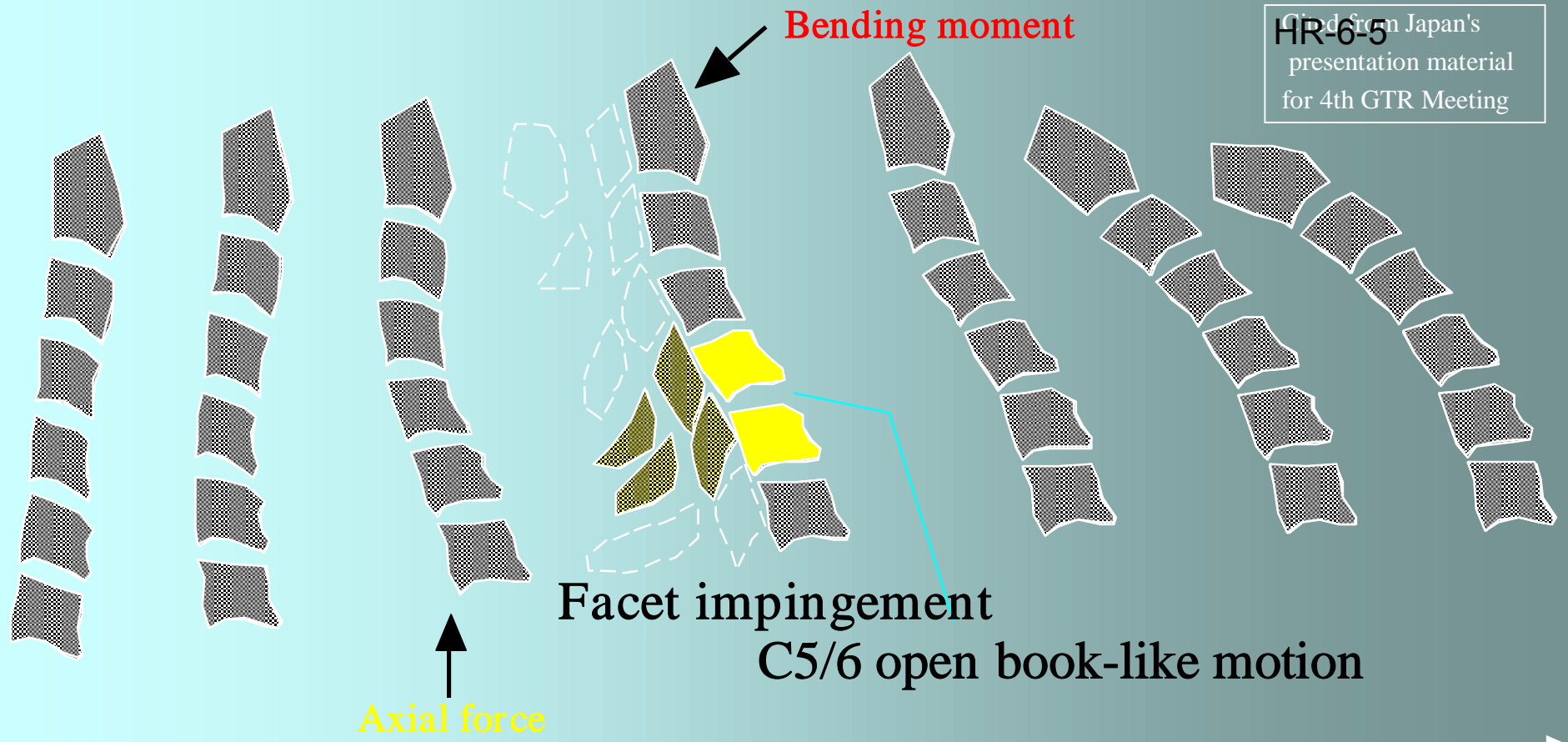
Cited from Japan's
presentation material
for 4th GTR Meeting

- For neck injury evaluation, the S-shape curving of the neck must be considered.

⇔ Conventional view



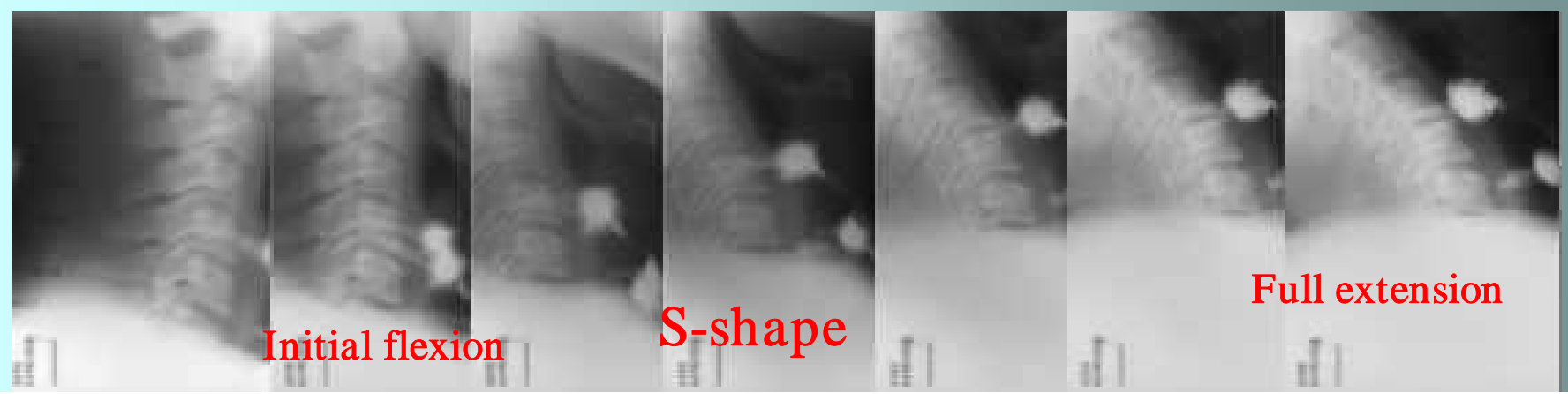
Bostrom et al, A New Neck Injury Criterion Candidate Based on Injury Findings in the Cervical Spinal Ganglia After Experimental Neck Exteseion Trauma,1996 IRCOBI Conference



initial flexion

S-shape curvature

full extension

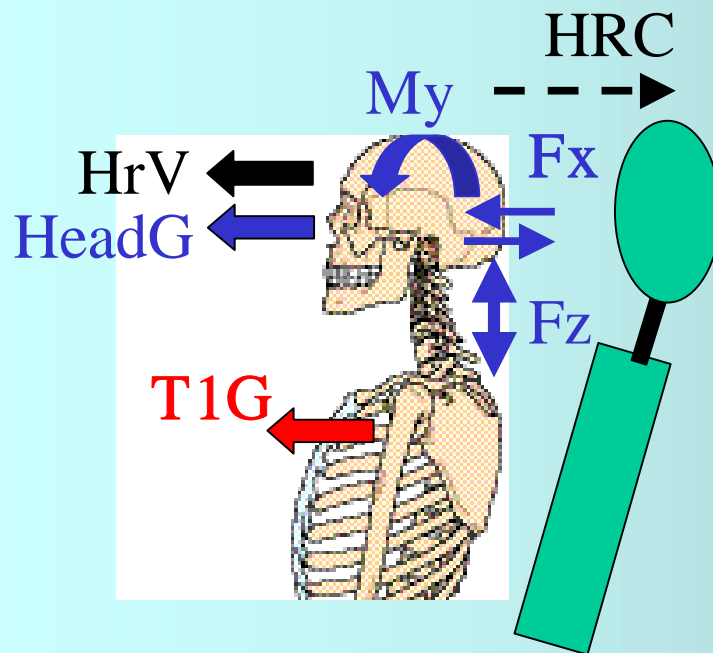


Existing Neck Injury Evaluation Methods^{HR-6-5}



All the methods using **upper** and **lower** neck criteria

- IIWPG – **T1G**, HRC, **F_x**, **F_z**
- EuroNCAP – **NIC**, Nkm, Head rebound V,
(draft) **F_x**, **F_z**, **T1G**, HRC



NIC: Calculated from acceleration/
velocity of the **head** and **T1**

Nkm: Calculated from neck moment
and neck shear force



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To verify different biomechanical responses of HY-III and BioRID II



HY-III



BioRID II

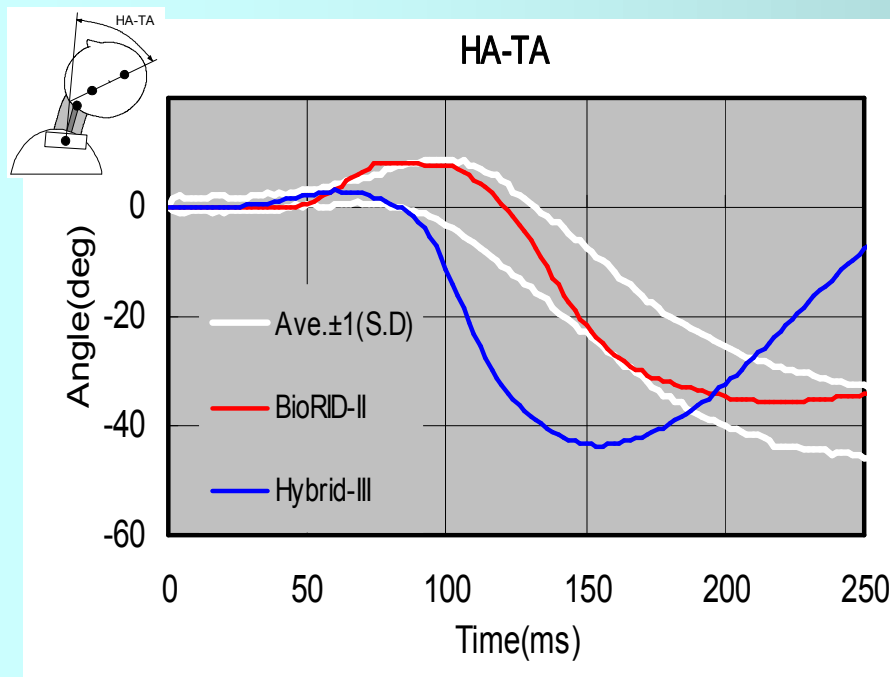
Kinematics

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HR-6-5
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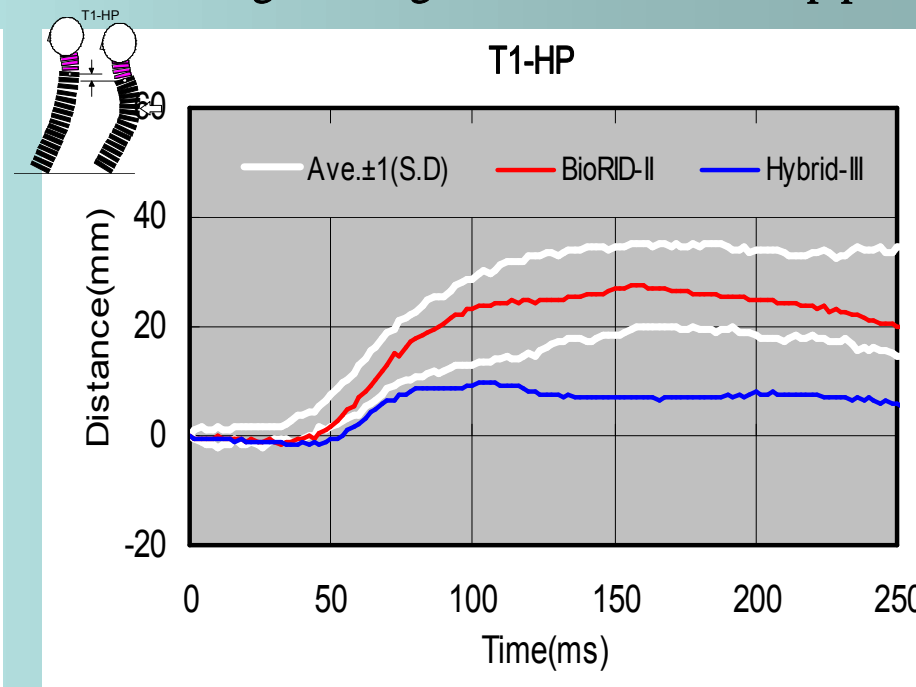


- BioRID II is closer in terms of S-shape deformation pattern of the neck and the head/neck angle relative to T1 of human volunteer than HY-III.

HA: Head Angle, TA: Torso Angle



T1-HP: Length change between T1 and Hip point



HY-IIIの挙動は人体と異なるが、ピークレベルは近い

HY-IIIの挙動、ピークレベル共に人体と異なる

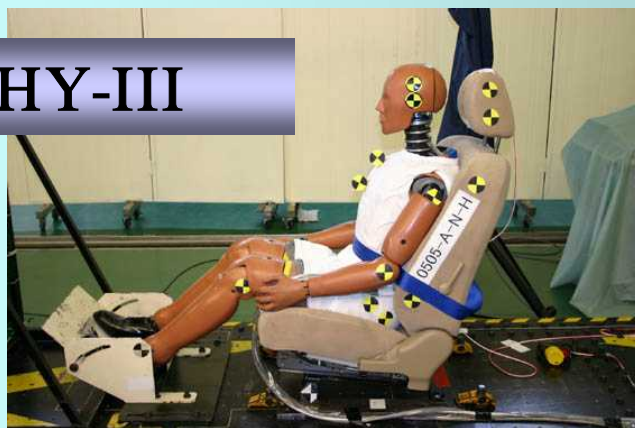


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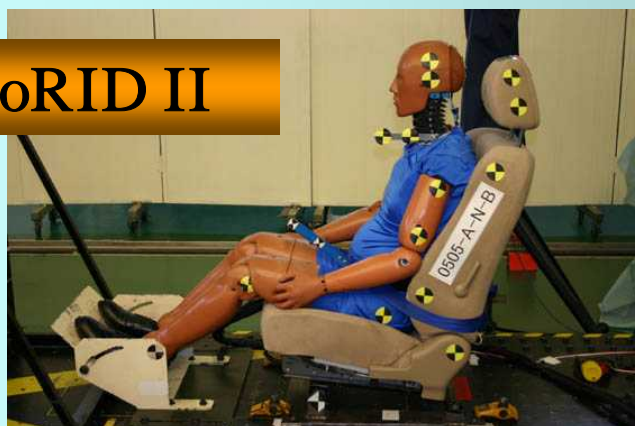
Hyge Sled Test

To verify the different biomechanical responses of HY-III and BioRID II due to different seat characteristics.

HY-III



BioRID II



Types of Tests

Seat A : Normal Head Rest

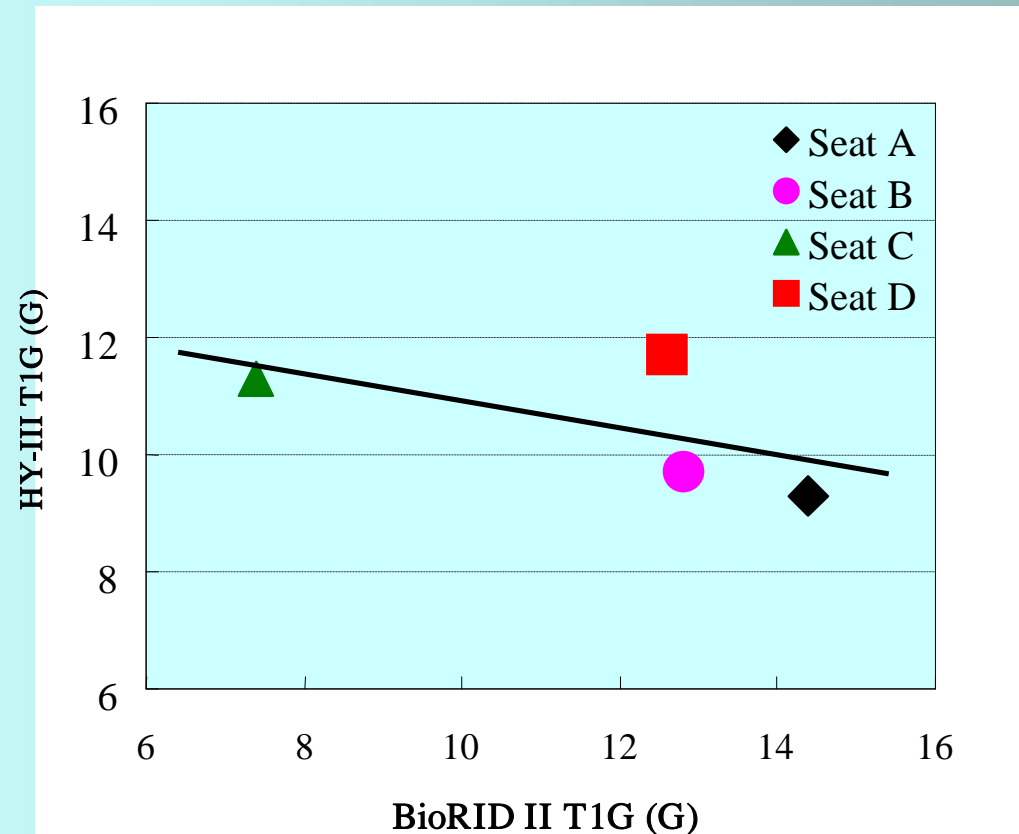
Seat B : Active Head Rest

Seat C : Normal Head Rest

Seat D : Active Head Rest



T1G Comparison between Hybrid-III and BioRID II



Because the T1G values of Hybrid-III and the more biofidelic BioRID II correlate inversely, the T1G of Hybrid-III is inappropriate as a neck injury evaluation criterion.

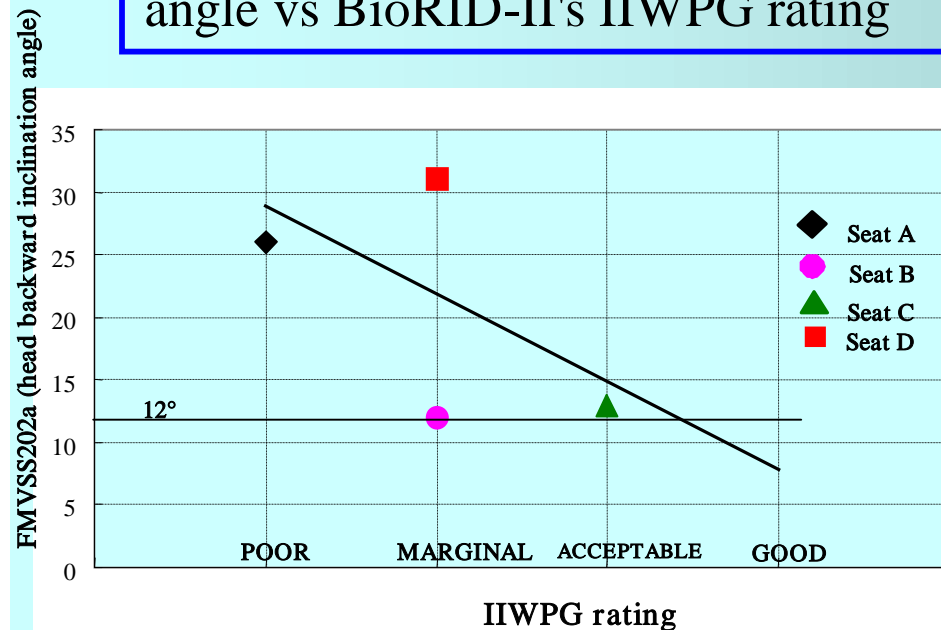


Hybrid-III's Head Backward Inclination/T1G

vs BioRID-II's IIWPG Rating

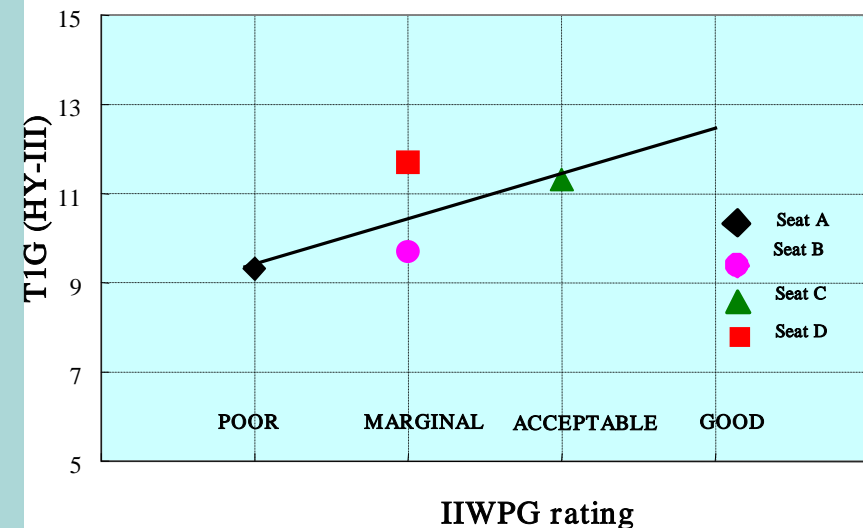
Hybrid-III の場合、T1G加速度よりも頭部後傾角の方が生体忠実性のより良いBioRID IIの評価指標と相関がある。

Hybrid-III's head backward inclination angle vs BioRID-II's IIWPG rating



Roughly Fair correlation

Hybrid-III's T1G vs BioRID-II's IIWPG rating



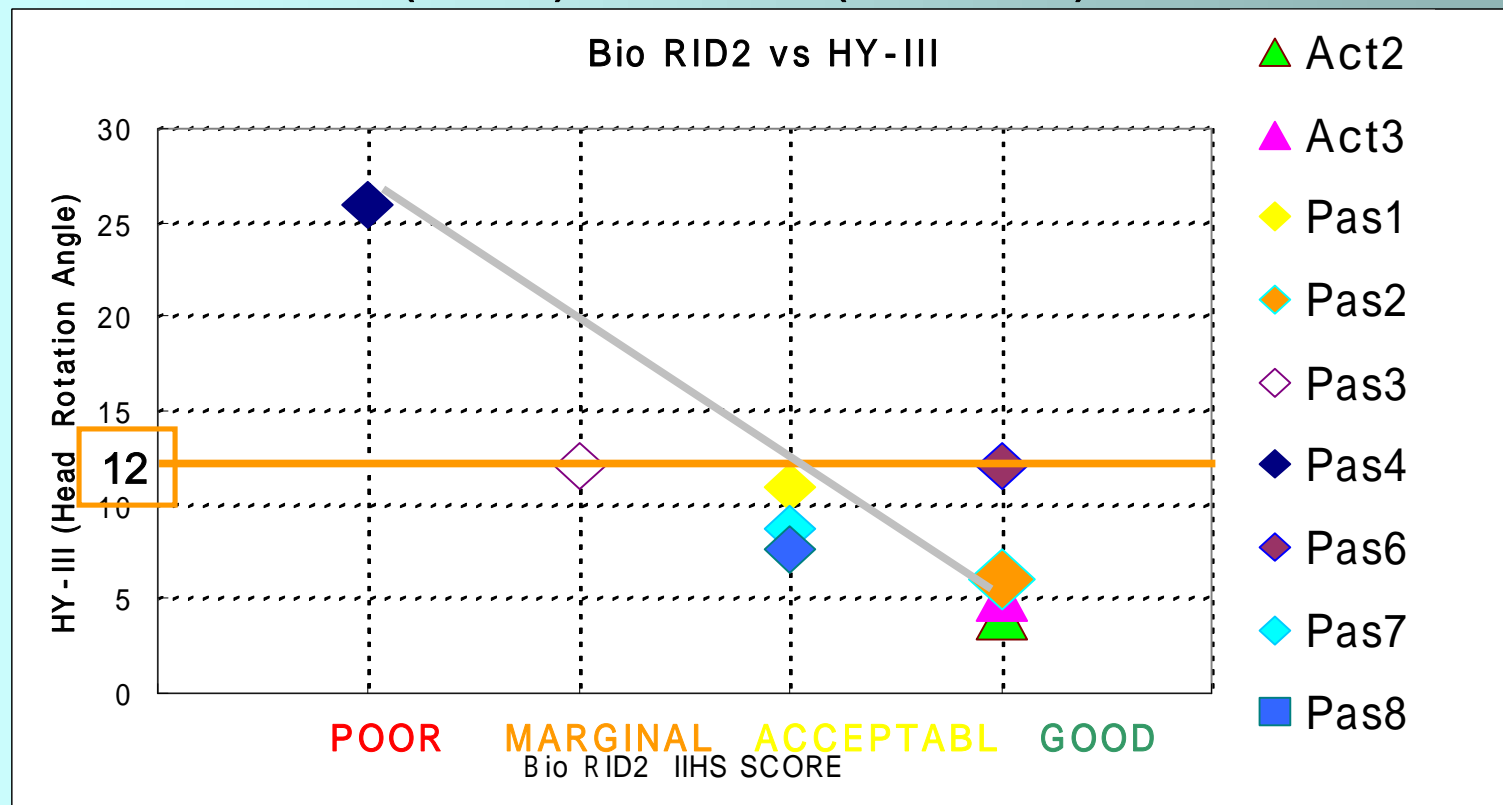
Inverse correlation



HY-III頭部後傾角要件の妥当性検証

頭部後傾角の要件は生体忠実性の低さから傷害低減効果を示す根拠が不十分であり、技術的実現性から決めるのが妥当と考えるが、現提案[頭部後傾角 12°]はIIHSアセスメント実力との相関性検証結果から厳しすぎると考えられる。

FMVSS 202a (HY-III) vs IIWPG (BioRID-II) Evaluations





Conclusions

- S-shape curving of the neck is important.
Desirable to measure both upper/lower neck criteria.
- Hybrid-III's T1G is an inappropriate criterion for the following reasons:
 - 生体忠実性が低い
 - Inversely correlates with biofidelic BioRID-II's T1G.
 - Inversely correlates with IIWPG rating.
- If Hybrid-III is to be used, head backward inclination angle is more reliable a neck injury evaluation criterion than T1G.
しかしながら、現要件 案[12°以下]の妥当性はさらに検証要と考える。



Conclusions

- 将来的には、ダミーだけでなくスレッド波形も含めて、より市場の事故実態と相関性のある、(オプションではない)本来のダイナミック要件とすることが必要であり、その旨がプレアンブルにフェーズ2で検討すべき事項と記載することが望まれる。