Evaluation Test Methods for Gtr 7

Verification for the difference in the waveform configuration on the 095G dummy

JASIC/JAPAN

Verification Tests

In the calibration test without headrest（GTR7-06-06） conducted in the last year, the waveform configurations（phase shift） of 095G dummy were different from those of 102G dummy and 115G dummy. The cause of these differences were then investigated.

Verification method and test condition

095G dummy and 102G dummy were used, and verification test which exchanged jackets was performed. Calibration test without headrest using light probe was implemented in the last year, therefore, this verification test was also performed using only light probe.

1) 095G dummy (Spine＋102GJacket)←Original 095G dummy (Spine + Jacket)
2) 102G dummy (Spine＋095GJacket)←Original 102G dummy (Spine + Jacket)

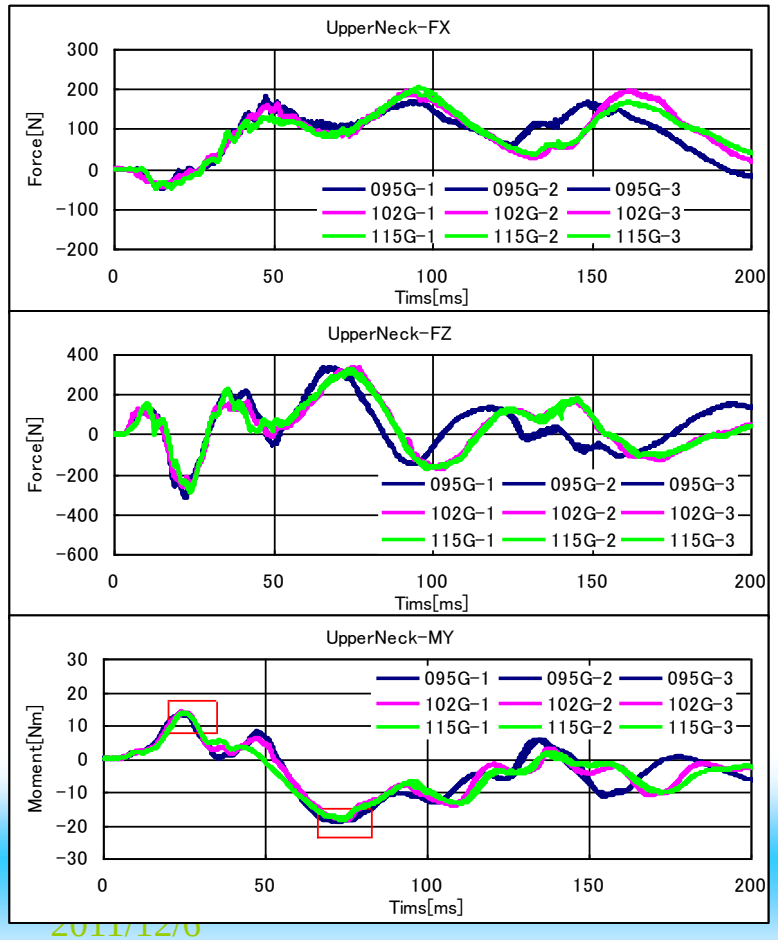
Calibration test with headrest was also performed according to the above conditions. And the factors analyzed are the difference in the waveform configuration, etc.

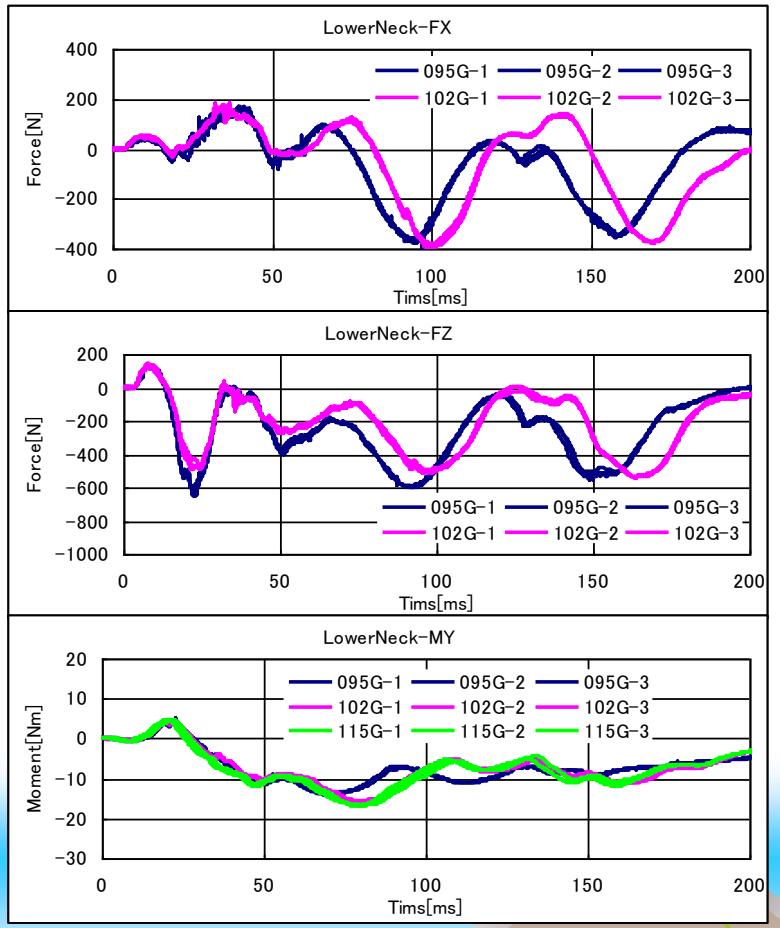
Results（without headrest, UpperNeck-FX･FZ･MY）

Calibration test without headrest（GTR7-06-06）

It was shown that the waveform configurations（phase shift）of 095G dummy were different from those of 102G dummy and 115G dummy.

GTR7-06-06：Calibration test without headrest and with a light prove weight



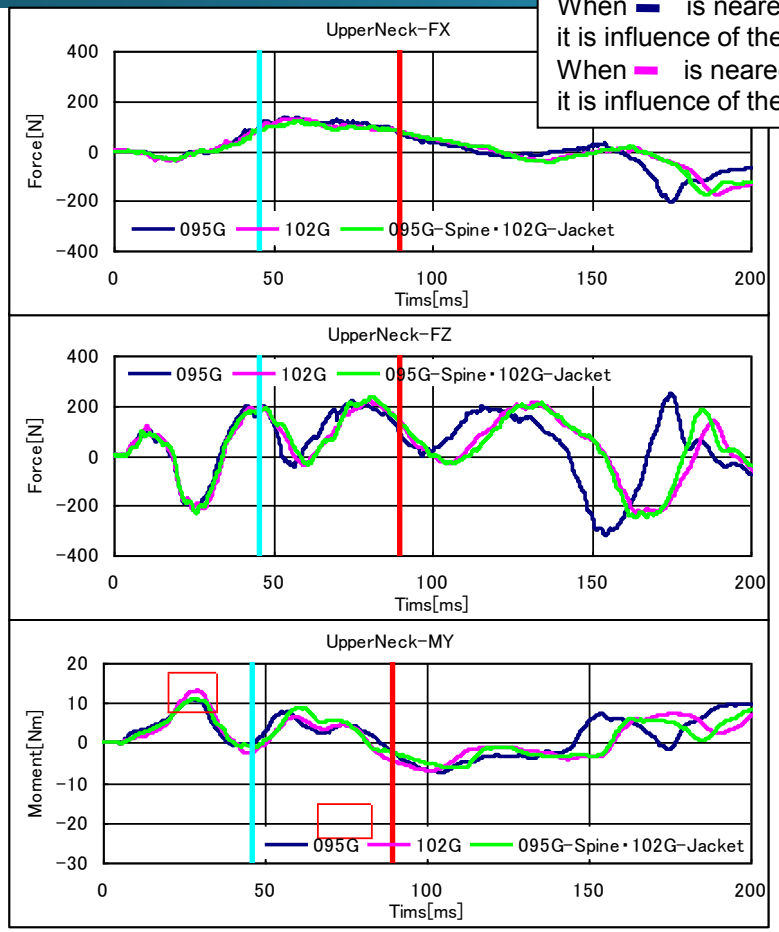


Results（with headrest, UpperNeck-FX・FZ・MY）

GTR-08-13

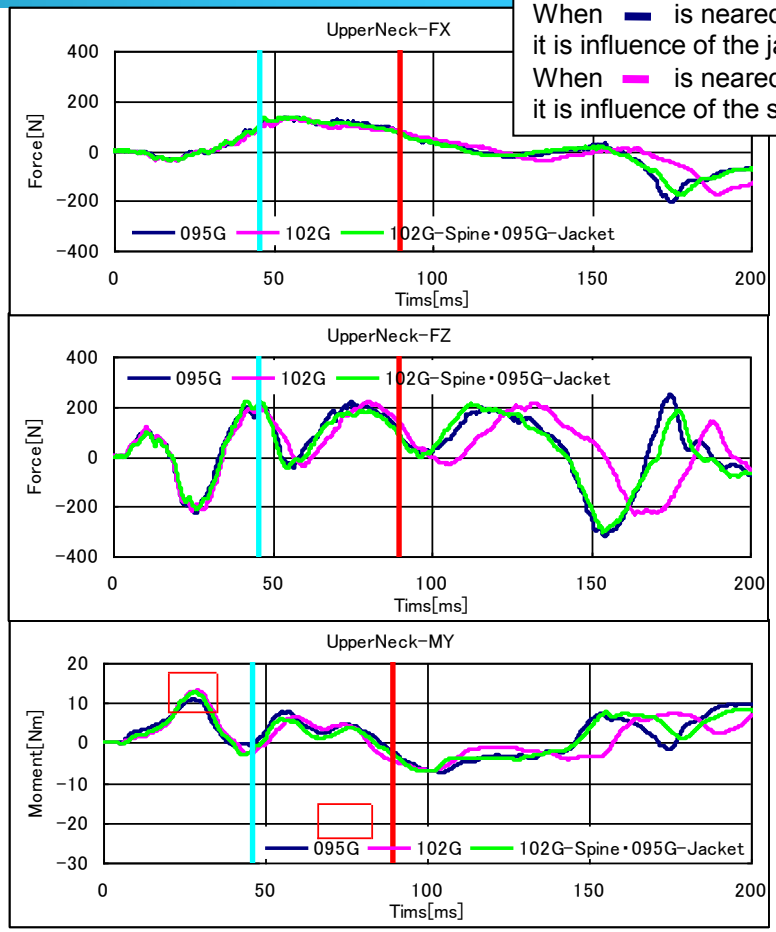
1) 095G Spine + 102G Jacket

When ■ is neared, it is influence of the spine.
When ■ is neared, it is influence of the jacket.



2) 102G Spine + 095G Jacke

When ■ is neared, it is influence of the jacket.
When ■ is neared, it is influence of the spine.



For the HRCT time range from 0 to end

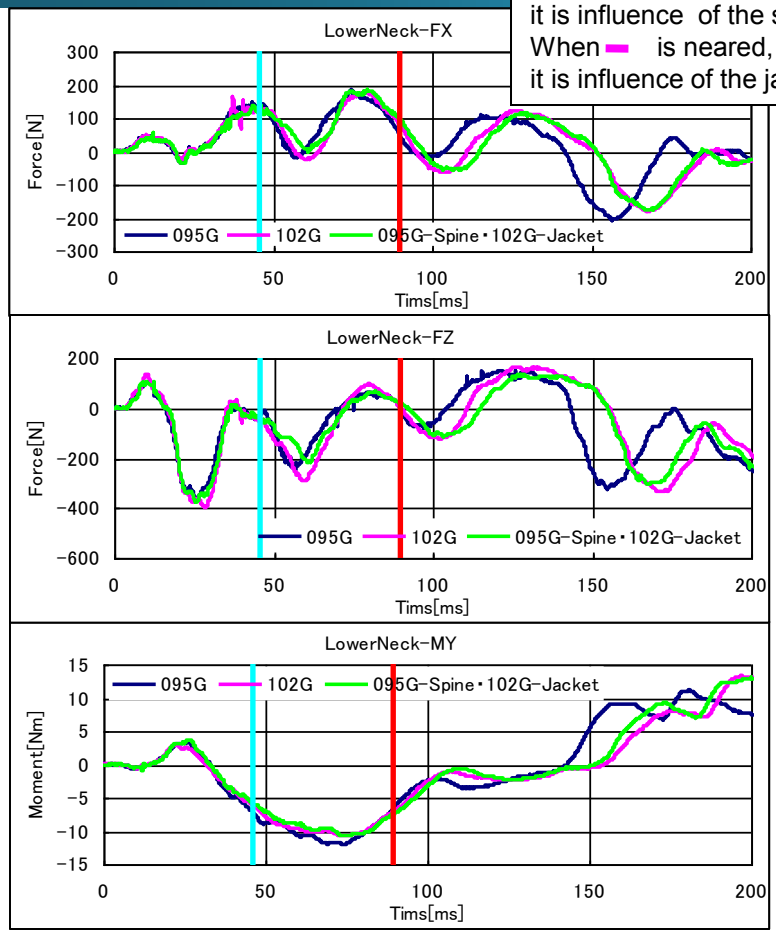
- For the FX, almost no difference.
- For the FZ, the influence of a jacket occurred and difference was not shown in the dummy equipped on the same jacket.
- For the MY, it was influenced (phase shift) by the jacket.

Results（with headrest, LowerNeck-FX･FZ･MY）

GTR-08-13

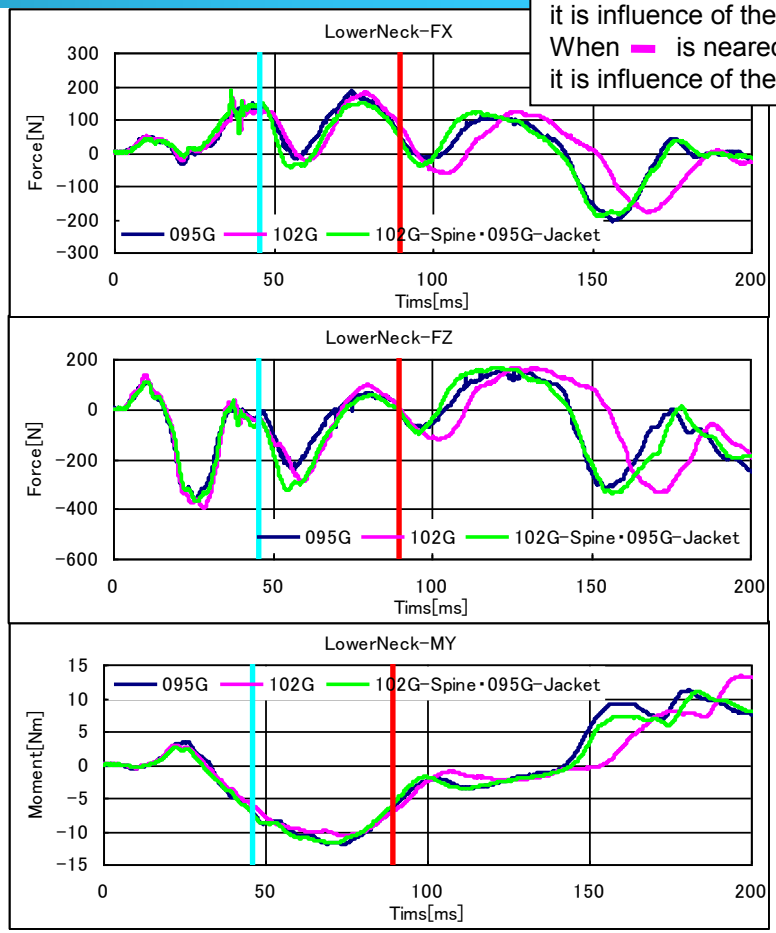
1) 095G Spine + 102G Jacket

When → is neared,
it is influence of the spine.
When → is neared,
it is influence of the jacket.



2) 102G Spine + 095G Jacket

When → is neared,
it is influence of the jacket.
When → is neared,
it is influence of the spine.



For the HRCT time range from 0 to end

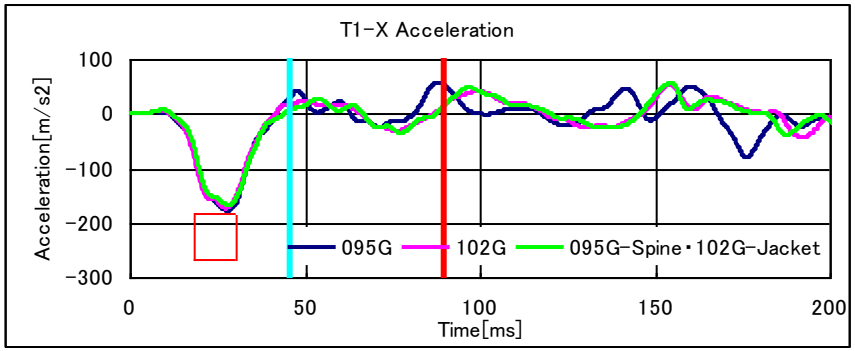
- About FX and FZ, no influence until HRCT-Start. But, it was influenced (phase shift) by the jacket while the head made contact with the headrest.
- For the MY, the influence of jacket occurred, the difference was not shown in the dummy equipped with the same jacket..

Results（with headrest, T1 Acceleration）

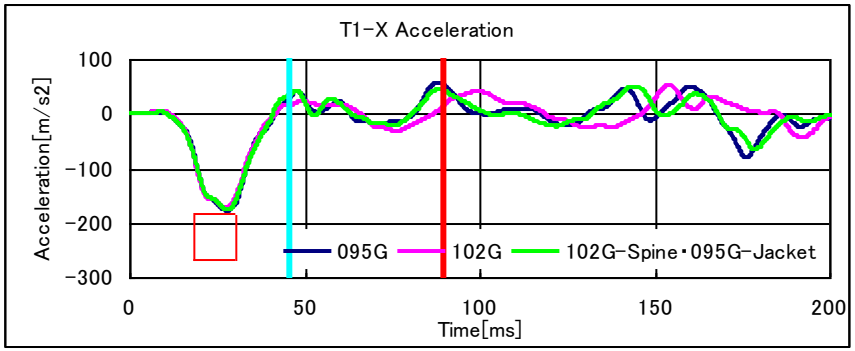
1) 095G Spine + 102G Jacket

2) 102G Spine + 095G Jacket

When → is neared, it is influence of the spine.
When → is neared, it is influence of the jacket.



When → is neared, it is influence of the jacket.
When → is neared, it is influence of the spine.



By having exchanged jacket, differences were shown on the dummy's neck force and moment. It was thought that it also had influence on T1 acceleration.

T1 Acceleration

There was no influence which exchanged the jacket until HRCT-Start. But, influences (phase shift) were found by changing the jacket while head made contact with the headrest.

Summary of verification test results（with headrest）

1) 095G Spine + 102G Jacket　2) 102G Spine + 095G Jacket

UpperNeck and LowerNeck Force・Moment ・ T1 Acceleration

→ By having exchanged jackets, the difference had occurred in the phase shift of the waveform.

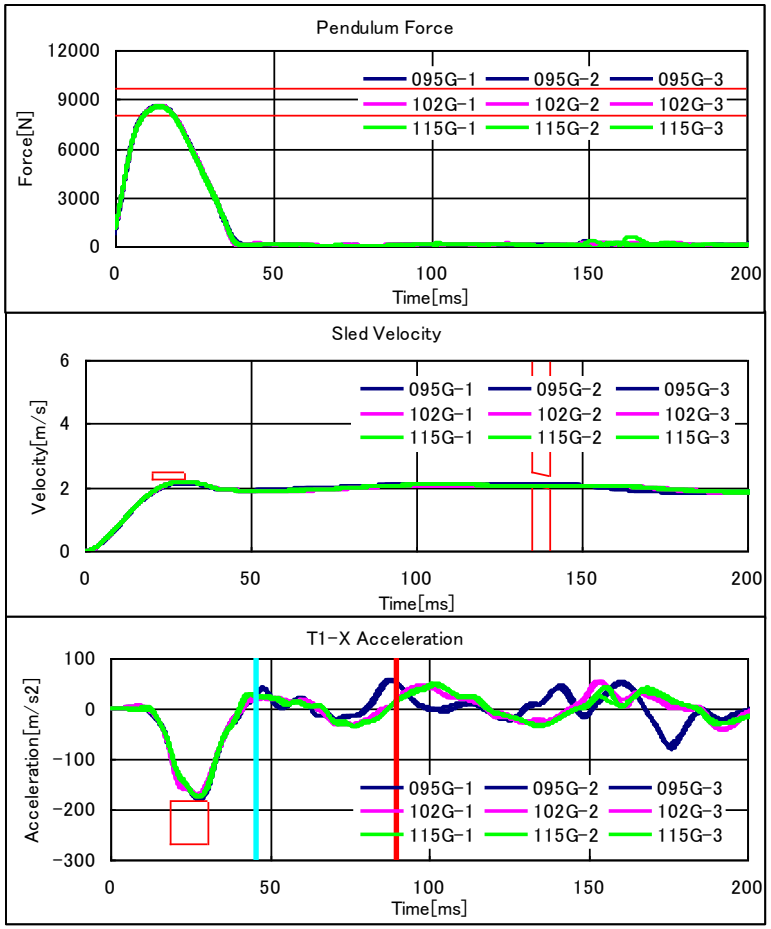
In the Light probe test, it was pointed out that the characteristic of the jacket has influence on the dummy's injury value（phase shift of the waveform）.

In the Heavy probe test, it will not pay so much attention for the phase shift of the waveform due to the bottoming-out (to reach the max. deformation) of the BioRID II dummy's fresh.　However, in order to keep more stable test results, It is necessary to unify the specification of fresh characteristics among the dummies.

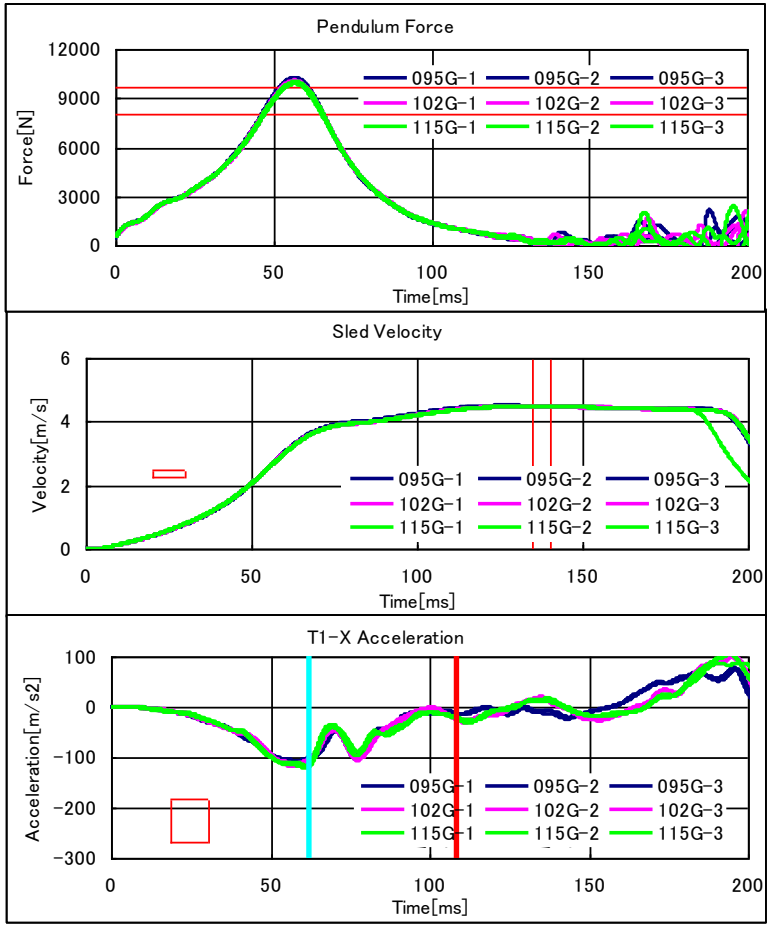
Reference (1) : Results

HRCT-Start
HRCT-End

a) Light Probe



b) Heavy Probe

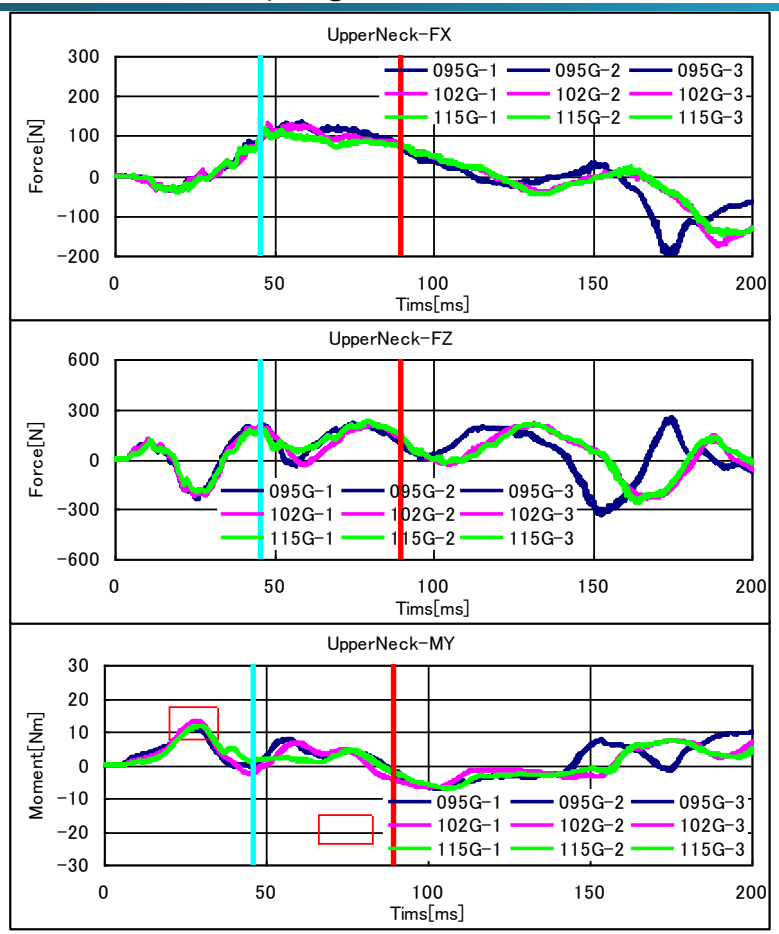


- The repeatability of impact force for each test were good.
- Peak value of sled velocity for b) was around twice that of a).
- For the waveform of T1 acceleration between HRCT-Start and -End, the phase shift of waveform occurred in a), but did not occur in b).

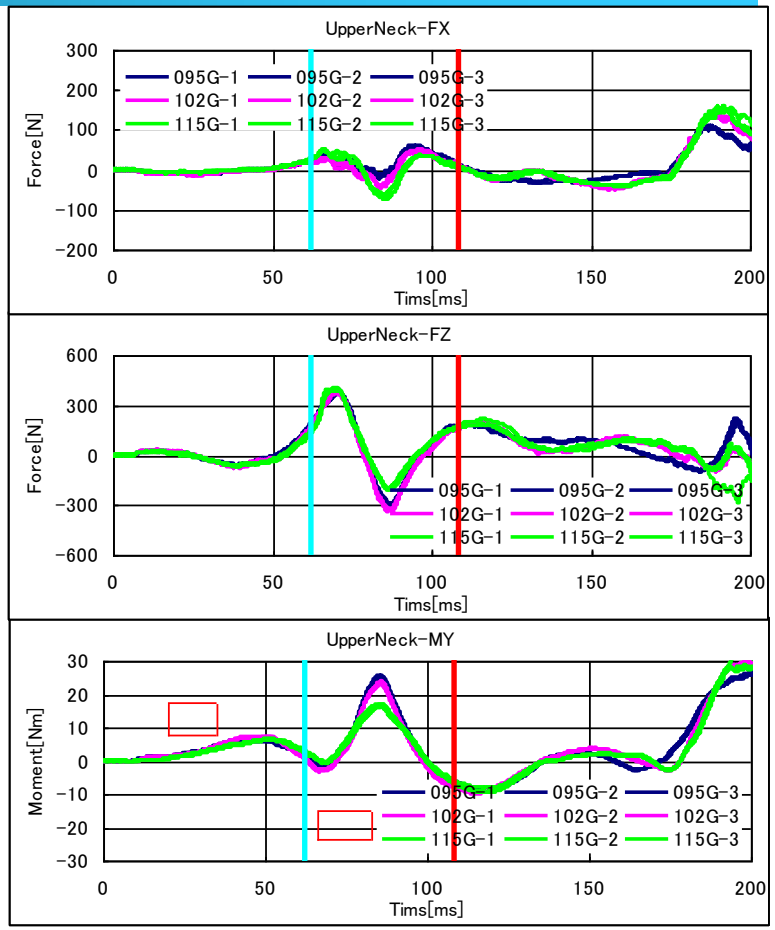
Reference (2) :Results（UpperNeck-FX･FZ･MY）

GTR-08-13 HRCT-Start HRCT-End

a) Light Probe



b) Heavy Probe



For the range from HRCT-Start to HRCT-End,

- For the time range of HRCT, a)（46～90ms：44ms）and b)（62～108ms：46ms）were almost similar.
- The peak value in the case of b)(C.V.：1.8～9.3%）were slightly larger than the case of a)（C.V.：1.8～4.2%）. Except for FX, the peak value of FZ･MY of b) was higher than 1).

17/6/2011

Influence of the characteristic of jacket（Hardness of rubber flesh）

・The hardness of the jacket of 095G dummy is "hardness of 6“.
・The hardness of the jacket of 102G dummy and 115G dummy are "hardness of 3“.
⇒ The jacket of 095G dummy is harder than the other jackets.

When the jacket becomes hard, phase shift of waveform will become early. When the jacket becomes soft, phase shift of waveform will become late. Therefore, the difference in the hardness of the jacket can cause change of the phase shift of the waveform.

＜Reference 1＞
The error range of the product when manufacturing a dummy jacket is between "hardness of 3 to 6“. When the error range of a product is seen, it conforms to the regulation. But in order to improve the repeatability of the jacket, there is the need to make the variation of product as small as possible.

＜Reference 2＞
Hardness of rubber flesh：The volume of relative displacement of the resistance when forcing the surface for the needle which is not sharp. There are JIS K 6253 and ISO 7619. **Notice: Human‘s skin have a hardness of about 10.**

Acknowledgments

The JASIC/JAPAN would like to acknowledge the Japan branch office of Humanetics for supporting the implementation of Verification Tests on BioRID-II characteristics with using a light probe impactor.

We would like also to thank the staffs of the Japan branch office of Humanetics for the technical support.

Suggestions for further studies of PDB and OSRP

At first, many thanks for great contributions with respect to the clarification of the BioRID II dummy's characteristics by PDB and OSRP.

However, the following issues will be suggested in order to further clarify the characteristics of BioRID II dummy itself.

- To use the latest version of BioRID II dummy (it may be temporary freezed the modification of the current dummy, and should investigate (analyze) the output in details based on a fundamental tests.
- To clarify a sitting procedure of the BioRID II dummy for the tests.
- To clarify an influence of the interaction between Ricaro seat and the dummy. In order to clarify the phenomenon, to adopt a flat rigid seat instead of the Ricoro seat.