

### Errata<sup>1</sup>

Due to circumstances beyond the control of the authors, the following corrections must be made in addition to minor errors in spelling:

- 1) Addition of Tables 1-4.
- 2) Page 2, 2nd column, line 3: are somewhat more elastic [15, 16] than other spinal tissue.
- 3) Page 4, 1st column, line 17: 6V placed across the gage.
- 4) Page 4, 1st column, line 60: . . . to applied loading using a pulley arrangement . . .
- 5) Page 4, 1st column, last line: significantly. This fact and uncertainties . . .
- 6) Page 4, 2nd column, line 23: an extrapolation of the effects to higher loads is possible. In
- 7) Page 4, 2nd column, line 38: lation 1 ms after initial contact, with rotation commencing
- 8) Page 4, Fig. 5: Times relative to impact: Upper left,  $t < 0$ ; upper right,  $t = 140$  ms; lower left,  $t = 300$  ms; lower right,  $t = 380$  ms.

9) Page 5, Fig. 6: The run number designations on the figure and in the caption should read:

- (a) Run 9FBA-4.2; Run 7RHS-1.0; Run 12SBA-4.0
- (b) Run 14FHA-8.1; Run 6RHA-4.0; Run 13SHA-2.1

10) Page 5, 2nd column, line 36: the levels considered injurious [25-27] as to . . .

11) Page 5, 2nd column, line 58: capitis, as shown in Fig. 7(a), which was expected.

12) Page 5, 2nd column, line 68: more than extended. However, the longus capitis experienced strains up to 45

13) Page 6, 1st column, Fig. 6: Run number captions are interchanged.

- (a) should read: Run 15FHS-1.5
- (b) should read: Run 6RHA-4.0

14) Page 7, 1st column, line 37: several centimeters apart. This was the only muscle with two displacement gages, one along the lateral and one along the medial end. The left longus capitis reached a maximum strain of 25 percent for base impact and 12 percent for the small direct blow; the former occurred at the 3/4 cycle point.

15) Page 7, 2nd column, line 28: enclosure. Their configurations are similar to those shown in

- 16) Ref. 17: Replace 1969 by 1968.
- 17) Ref. 26: Add date: 1970.

<sup>1</sup>“Response of an Advanced Head-Neck Model to Transient Loading” by J. M. Winters and W. Goldsmith, published in the February 1983 issue of the JOURNAL OF BIOMECHANICAL ENGINEERING, Vol. 105, No. 1, pp. 63-70.

**Table 1 Head displacement, velocity and acceleration, film results and accelerometer data**

Run number	Peak displacement			Rebound displacement			Impact time ms	Trans-lation time ms	Linear high speed				Accelerometer		Angular high-speed			
	Linear cm	$\theta$ deg	$t^*$ ms	Linear cm	$\theta$ deg	$t^*$ ms			$v$ , m/s	$t^*$ ms	$a$ , g	$t^*$ ms	$a$ , g	$t^*$ ms	$\dot{\theta}$ rad/s	$t^*$ ms	$\ddot{\theta}$ rad/s <sup>2</sup>	$t^*$ ms
1FHA-2.1	-23.2	37	190	-5.0	8	590	10	10	0.9	15.0	13.5	14.0	7.5	14.0	11.7	30.0	340	30.0
2FHA-2.5	-31.7	41	165	-6.5	10	520	5	5	1.1	6.9	25.6	5.9	8.0	8.0	10.7	69.0	460	28.0
3FHS-1.1	-11.2	16	129	-5.1	5	440	3	4	0.7	9.8	16.1	5.0	-	-	3.6	79.0	125	12.0
5RHA-2.0	39.3	-37	224	16.1	-12	680	11	20	1.3	14.0	41.2	6.0	40.0	6.0	30.4	39.0	2560	35.0
6RHA-4.0	47.9	-39	187	20.5	-18	540	8	16	1.6	20.0	32.0	6.0	39.0	6.0	29.3	50.0	2920	45.0
7RHS-1.0	22.1	-17	148	8.2	-7	495	4	13	0.8	18.0	26.3	4.0	20.0	4.0	5.3	30.0	590	95.0
8RBA-4.5	-22.0	18	140	-5.2	-6	470	-	-	0.4	14.0	2.1	15.0	-	-	12.4	35.0	1070	40.0
9FBA-4.2	25.5	11	140	8.0	5	460	-	-	0.9	49.0	4.1	25.0	-	-	12.0	70.0	1200	99.0
11FBA-4.2	26.0	15	200	8.5	4	620	-	-	0.4	220.0	0.7	170.0	3.0	90.0	0.3	60.0	2	80.0
12SBA-4.0	-30.0	29	180	-15.0	13	450	-	-	0.6	180.0	1.5	120.0	-	-	1.0	140.0	7	200.0
13SHA-2.1	-65.3	35	157	-19.8	11	640	7	9	1.0	10.0	31.7	9.0	-	-	10.6	40.0	630	20.0
14FHA-8.1	-155.0	56	147	-91.0	31	470	6	9	1.3	4.0	49.9	4.0	40.0	5.0	16.1	40.0	920	20.0

Times  $t^*$  shown are those for attainment of the maximum value of the corresponding kinematic parameter

**Table 2 Muscle displacement summary<sup>(a)</sup>**

Run number	L Long Cap		L SCM		R SCM (1)		R SCM (2)		L Scal Post		L Spl Cerv		L Spl Cap		L S-Sp Cap	
	$\mathcal{E}$ (%)	$t$ (ms)	$\mathcal{E}$ (%)	$t$ (ms)	$\mathcal{E}$ (%)	$t$ (ms)	$\mathcal{E}$ (%)	$t$ (ms)	$\mathcal{E}$ (%)	$t$ (ms)	$\mathcal{E}$ (%)	$t$ (ms)	$\mathcal{E}$ (%)	$t$ (ms)	$\mathcal{E}$ (%)	$t$ (ms)
2FHA-2.1	23	140	22	160	6	160	20	140	6	160	11	360	11	550	5	500
3FHS-1.1	10	140	5	140	2	40	7	40	0	-	3	400	4	450	2	450
4RHA-1.6	13	20	3	550	2	40	1	40	1	50	26	140	13	150	18	170
5RHA-2.0	25	30	5	45	5	40	4	40	-8	110	25	180	21	220	34	240
6RHA-4.0	32	30	18	45	7	40	4	40	-10	100	34	190	24	180	40	190
7RHS-1.0	14	30	8	45	-4	150	-1	120	3	70	9	150	16	140	25	150
8RBA-4.5	19	80	17	25	3	130	10	120	-6	120	5	100	-1	120	-1	120
9FBA-4.2	16	20	-13	120	-5	150	-10	120	6	200	9	190	18	180	22	190
10FBA-4.2	7	490	8	160	7	140	7	140	5	80	14	150	19	130	29	150
11RBA-4.2	10	90	20	90	17	130	20	130	3	450	2	400	2	450	6	120
12SBA-4.0	26	470	25	320	11	160	33	50	1	500	5	450	12	470	1	470
13SHA-2.1	12	30	-1	60	3	150	41	150	9	180	5	180	10	180	0	-
14FHA-8.1	45	160	18	140	13	150	23	130	15	140	5	90	2	230	-7	150
15FHS-1.5	30	120	15	130	8	130	18	130	2	20	4	120	-1	130	-1	130

<sup>(a)</sup>Peak values and their time of occurrence

**Table 3 Disk pressure summary<sup>(a)</sup>**

Run number	T3/T2		T2/T1		T1/C7		C7/C6		C6/C5		C5/C4		C4/C3	
	(kPa)	(ms)	(kPa)	(ms)	(kPa)	(ms)	(kPa)	(ms)	(kPa)	(ms)	(kPa)	(ms)	(kPa)	(ms)
2FHA-2.5	3	140	105	140	-27	440	10	150	6	150	4	150	2	170
3FHS-1.1	3	140	33	120	30	120	9	140	3	200	16	50	3	180
4RHA-1.6	0		-14	60	-5	60	-		-15	240	-17	240	0	
5RHA-2.0	3	120	-17	120	-		-38	150	-10	130	-25	60	-5	70
6RHA-4.0	-6	120	-37	120	-		-16	110	-16	120	-40	130	-7	110
7RHS-1.0	2	140	-7	110	-		-28	140	-3	120	-23	120	-2	140
9FBA-4.2	-		-40	5	-10	130	-26	130	-13	130	-25	40	-30	40
10FBF-4.2	0		-30	130	-		-10	180	-36	180	-28	100	0	
11RBF-4.2	-4	250	-3	400	-		-		-18	120	-19	140	-11	180
12SBF-4.0	-12	200	15	400	-		35	300	25	320	25	350	-20	250
13SHA-2.1	0		-		6	150	10	110	-3	130	-18	150	-11	110
14FHA-8.1	-15	140	40	70	-		4	140	5	120	36	70	2	120
15FHS-1.5	-2	110	-		-		20	100	8	5	30	80	1	120

<sup>(a)</sup>The numerical values represent the peak pressure and the corresponding time of this pressure, respectively, for each disk for each test

**Table 4 Peak intracranial pressure summary (absolute values)<sup>(d)</sup>**

Run number	Anterior <sup>(a)</sup>		Posterior <sup>(a)</sup>		Center <sup>(a)</sup>		Center <sub>L</sub> <sup>c</sup>		Left <sup>(b)</sup>		Right <sup>(b)</sup>	
	(MPa)	(ms)	(MPa)	(ms)	(MPa)	(ms)	(MPa)	(ms)	(MPa)	(ms)	(MPa)	(ms)
5RHA-2.0	0.5	20	2.1	20	2.0	30	0.7	15	2.8	18	1.8	12
6RHA-4.0	0.3	15	3.0	20	0.8	15	0.8	8	3.8	20	4.6	25
7RHS-1.0	0.2	13	0.5	15	-		-		3.5	8	1.4	14
8RBA-4.5	0.8	5	2.0	6	-		-		4.5	3	3.5	25
9FBA-4.2	0.9	8	3.0	10	2.0	10	1.2	12	7.0	10	1.4	28
10FBA-4.2	0.6	130	0.9	130	2.5	45	0.8	35	5.0	20	2.5	80
11RBA-4.2	0.6	200	0.7	200	1.5	180	0.7	160	4.5	105	1.8	110
12SBA-4.0	0.5	78	0.9	75	0.8	70	0.2	140	2.5	75	0.6	120
13SHA-2.1	0.2	14	0.3	12	1.0	4	0.4	9	1.5	12	0.7	4
14FHA-8.1	0.9	6	1.5	5	0.8	12	0.5	12	4.0	4	3.0	5
15FHS-1.5	0.5	5	0.7	4	0.6	4	0.2	5	2.0	4	1.0	3
FHA-1.8	0.007	4	0.025	4	0.020	2						
RHA-18	0.023	6	0.019	5	0.061	6						
FHS-1.2	0.010	2	0.004	2	0.010	2						
RHS-1.1	0.017	1	0.013	1	0.031	1						

The time span is the period for attainment of the peak strain after beginning of contact.

<sup>(a)</sup>On the line of the intersection of the transverse and the sagittal plane

<sup>(b)</sup>On line orthogonal to above

<sup>(c)</sup>Center<sub>L</sub> is 1.5 cm posterior and 1.5 cm inferior to the center

<sup>(d)</sup>The data presented in the last four rows are from reference [10]. For comparative purposes, the run number displayed in this previous work has been converted into the notation used in the present study.