#### รายการล้างลิง

#### ภาษาไทย

- เจน รัตนไพศาล. **ทันตวัสดุศาสตร์**. พิมพ์ครั้งที่ 2. กรุงเทพ: บริษัทโรงพิมพ์ไทยวัฒนาพานิช จำกัด, 2533.
- ทนง ฉัตรอุทัย **โลหะ (เจือ) ในทางทันตกรรม.** เชียงใหม่: คณะทันตแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่. 2528.

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สถาบันวิทยบริการ จุฬาลงกรณ์มหาวิทยาลัย

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	14 44 44 54 44 44 54 44 44 44 44 44 44	4 44 50 46 44 51 64 60 60 66 46 46 44 44 54 64 66 6	14 64 64 66 64 64 64 64 64 64 66 6	e ac 44 tc ac cc ac ac ac	*** ** ** ** ** ** ** ** ** ** ** ** **
	TENSILE				
	never cast bet	fore 6 11	3057.9298 2	2504.815	1022.586
	cast 2 times (	1/2) 5 8	3881.0068	5446.635	2435.809
	** ** ** ** ** ** ** ** ** **	4 04 64 65 65 66 54 04 64 64 65 65 66 54 54 65 64 64 64	H 66 64 66 66 66 68 68 68 68 68 68 68	• •• •• •• •• •• •• ••	***************************************
	Mean Differen	nce = 29176.9230			
	Levene's Test	for Equality of Varia	nces: F= 4.39	1 P= .060	3
	t-test for Equa	lity of Means			
	Variances t-va	alue df 2-Tail Sig	SE of Diff	99%	Cl for Diff
	** ** ** ** ** ** ** ** ** **			6 <b>66 64 66 66 66 66</b> 66 66	*************************************
	Equal 11	000. 9	2472.345	(21140	.39, 37213.46)
	Unequal 11	1.04 5.40 .000	2641.751	(18524	.96, 39828.88)
	Variable	Number of Cases	Mean	SD SE	of Mean
	VariableELONGATE	Number of Cases	Mean	SD SE	of Mean
			14 44 44 44 44 44 44 44 44 44 44 44 44 4	SD SE	of Mean
	ELONGATE	fore 6	3.2972	.788	· · · · · · · · · · · · · · · · · · ·
<u>a</u>	ELONGATE never cast bef	fore 6 1/2) 5	3.2972	.788	.322
व	ELONGATE never cast befores (	fore 6 1/2) 5	3.2972 3364	.788 .394	.322
٦	ELONGATE never cast befores (	fore 6 1/2) 5	3.2972 3364	.788 .394	.322
<u>a</u>	ELONGATE never cast before cast 2 times (  Mean Different Levene's Test	fore 6  1/2) 5  Ice = 2.9608  for Equality of Variantity of Means	3.2972 3364	.788 .394 	.322
ন্	ELONGATE never cast before cast 2 times (  Mean Different Levene's Test t-test for Equa	fore 6  1/2) 5  Ice = 2.9608  for Equality of Variantity of Means	3.2972 .3364 	.788 .394 	.322
a a a a a a a a a a a a a a a a a a a	ELONGATE never cast before cast 2 times (  Mean Different Levene's Test t-test for Equal Variances t-variances	fore 6  1/2) 5  Ice = 2.9608  for Equality of Variantity of Means	3.2972 .3364 	.788 .394 	.322

		i 46 <del>54</del> 54 <del>4</del> 6 56 46 46	44 44 44 44 44 44	• • • • • • • • • • • •			
STRAIN	** ** ** ** ** ** **						44 64 64
never cas	t hefore	6		.0006	.000	.000	
cast 2 tim		5		.0003	.000	.000	
********	*******		<b>66 64 66 64 64 66 6</b>	.0000	.000	,000	<b>64 66 6</b> 1
Mean Diff	erence =	0004					
			f Variano	es: F= .95	3 P-	355	
t-test for i			Variant	,00. 1 = .00		000	
			ail Sig	SE of Diff	99%	CL for Diff	
	*********					******	<b>44 44 4</b> (
Equal	3.10	9	.013	.000	(.00	00, .001)	
•							
Unequal	3.17	8.99	.011	.000	{.	.000, .001)	
Unequal	3.17	8.99	.011	.000	(.	.000, .001)	
Unequal  Variable		8.99		.000  Mean	(. SD	000, .001) SE of Mean	
·						······································	14 66 64
·	Num					······································	14 66 64
Variable	Num		ases i			······································	14 66 14
Variable	Num SS t before	nber of Co	ases i	Viean	SD	SE of Mean	14 66 64
Variable  HARDNE  never case	Num SS t before	nber of Co	ases i	Mean	SD 3.010	SE of Mean	64 66 64
Variable  HARDNE  never case	Num	ober of Co	ases i	Mean	SD 3.010	SE of Mean	56 66 6i
Variable  HARDNE  never cast  cast 2 tim  Mean Diff	Num SSS t before les (1/2) erence =	6 5 3.9633	ases 1	Mean	3.010 2.661	SE of Mean 1.229 1.190	14 64 64
Variable  HARDNE  never cast  cast 2 tim  Mean Diff	Num SSS t before les (1/2) erence = Test for E	6 5 3.9633	ases 1	Mean 5,4833 1,5200	3.010 2.661	SE of Mean 1.229 1.190	
Variable  HARDNE  never cast  cast 2 tim  Mean Diff  Levene's  t-test for E	Num SSS t before les (1/2) erence = Test for E Equality of	6 5 3.9633 equality of	ases f	Mean 5.4833 1.5200 	3.010 2.661 7 P= .	SE of Mean 1.229 1.190	14 44 44
Variable  HARDNE  never cast  cast 2 tim  Mean Diff  Levene's  t-test for E	Num ESS t before les (1/2) erence = Test for E Equality of t-value	6 5 3.9633 iquality of f Means	ases 6	Mean 5.4833 1.5200 	3.010 2.661 7 P= .:	SE of Mean  1.229  1.190	14 64 64
Variable  HARDNE  never cast  cast 2 tim  Mean Diff  Levene's  t-test for E  Variances	Num ESS t before les (1/2) erence = Test for E Equality of t-value	6 5 3.9633 iquality of f Means	ases 6	Mean 5.4833 1.5200 	3.010 2.661 7 P=	SE of Mean  1.229  1.190  898	16 66 64

Variable	Number of Cas	es Mean	SD	SE of Mean
<b>46 44 14 46 46 16 46 44 44 16 4</b>	84 84 86 84 86 86 86 86 86 86 86 86 86 86 86 86 86		44 44 44 44 44 44 44 44	86 86 86 86 86 86 86 86 86 84 86 86 84 84 84 84 84
TENSILE				
never cast be	fore 6	113057.9298	2504.815	1022.586
cast 3 times (	(1/3) 5	68288.8470	4966.893	2221.262
66 64 64 66 64 66 64 64 64 64	66 66 <del>66 66 66 66</del> 66 66 66 66 66 66 66 66	E 44 <del>44</del> 16 <del>48</del> 86 <del>54</del> 86 <del>41</del> 16 48 46 46 46	** ** ** ** ** ** **	** \$4 64 64 64 64 64 64 64 64 64 64 64 64 64
Mean Differer	nce = 44769.082	8		
Levene's Test	t for Equality of \	Variances: F= 1.05	52 P= .332	2
t-test for Equa	ality of Means			
Variances t-v	alue df 2-Tai	Sig SE of Diff	f 99%	CI for Diff
			**********	**************
Equal 19	.45 9 .0	2301.816	37286	.87, 52251.30)
Unequal 18	.31 5.67 .0	000 2445.340	(35700	.73, 53837.44)
				<del></del>
Variable	Number of Ca	ses Mean	SD SE	of Mean
Variable	Number of Ca	ses Mean	SD SE	of Mean
Variable	Number of Ca	ses Mean	SD SE	of Mean
	56 56 56 56 56 56 56 56 56 56 56 56 56 5	ses Mean	SD SE	of Mean
ELONGATE	fore 6		14 60 64 60 60 61 64 64 64	66 66 66 66 66 66 66 66 66 66 66 66 66
ELONGATE never cast be	fore 6	3.2972	.788	.322
ELONGATE never cast be	fore 6 (1/3) 5	3.2972	.788	.322
ELONGATE never cast be cast 3 times (	fore 6 (1/3) 5	3.2972	.788 .595	.322
ELONGATE never cast be cast 3 times (	fore 6 (1/3) 5 (1/3) 5 (1/3) 5 (1/3) 5 (1/3) 5 (1/3) 7	3.2972 .5884	.788 .595	.322
ELONGATE never cast be cast 3 times (	fore 6 (1/3) 5 moe = 2.7088 t for Equality of N	3.2972 .5884	.788 .595	.322
ELONGATE never cast be cast 3 times ( Mean Different Levene's Test t-test for Equal Variances t-val	fore 6 (1/3) 5 moe = 2.7088 t for Equality of N	3.2972 .5884 /ariances: F= .152	.788 .595	.322
ELONGATE never cast be cast 3 times (  Mean Different Levene's Test t-test for Equal Variances t-variances	fore 6 (1/3) 5 makes = 2.7088 t for Equality of Neans alue df 2-Tail	3.2972 .5884 /ariances: F= .152	.788 .595	.322 .266 

	Numbe	er of Cases	Mean	SD	SE of Mean	
46 46 44 66 66 86 44 66	5 66 84 66 66 66 66 66 66 66 66	66 84 64 64 66 66 66 66 66 66 66 66	es 44 es 66 es 66 es 66 es	66 88 66 88 66 86 <b>8</b>	9 44 64 54 64 64 64 64 64 64 64 64 64 64 64 64 64	1 44 44 44
STRAIN						
never cas	t before	6	.0006	.000	.000	
cast 3 tim	nes (1/3)	5	.0004	.000	.000	
***********	1 64 64 64 64 65 65 66 66 66 66	44 44 44 44 64 64 64 64 64 64	***********	14 44 14 44 14 44 4	1 86 66 86 86 86 88 88 86 86 86 86 86 86	*****
Mean Dif	ference = .00	002				
Levene's	Test for Equ	ality of Varian	nces; F= .04	19 P=	.831	
t-test for	Equality of M	1eans				
Variances	t-value df	2-Tail Sig	SE of Dif	f 99°	% Cl for Diff	*
*********	66 46 <del>66 66 66</del> 60 66 66 66 66	*** ** ** ** ** ** ** ** **				
Equal	1,59	.145	.000	(.	000, .001)	
Unequal	1.58	3.17 .15	3 .000	)	(.000, .001)	
·						
Variable	Numbe	r of Cases	Mean	SD	SE of Mean	44 64 88 64
HARDNE	ESS					
			- 1000	0.040	1.229	
never cas	t before	6 6	5.4833	3.010	1.225	
never cas			5.4833 0.4600	2.485	1.111	
						*****
cast 3 tim		5 6				<del>66</del> 64 66 66
cast 3 tim	nes (1/3) 	5 6 	0.4600	2.485	1.111	· 64 64 64 64
cast 3 tim  Mean Diff Levene's	nes (1/3) ference = 5.0 Test for Equa	5 6	0.4600	2.485	1.111	*** ** ** **
cast 3 tim  Mean Diff Levene's	nes (1/3) ference = 5.0 Test for Equality of M	5 6  D233  ality of Varian  leans	0.4600 	2.485 7 P=	1.111 872	*******
cast 3 tim  Mean Diff  Levene's  t-test for i	nes (1/3) ference = 5.0 Test for Equality of M	5 6	0.4600 	2.485 7 P=	1.111 872	
Mean Diff Levene's t-test for i	nes (1/3) ference = 5.0 Test for Equality of M t-value df	5 6  2233  ality of Varian  deans  2-Tail Sig	0.4600 ces: F= .02 SE of Dif	2.485 7 P= f 99%	1.111 872	******
cast 3 tim  Mean Diff  Levene's  t-test for i	nes (1/3) ference = 5.0 Test for Equality of M t-value df	5 6  2233  ality of Varian  leans  2-Tail Sig	0.4600 	2.485 7 P= f 99% (46	1.111 872	

Variable Number of Cases	Mean SI	SE of Mean
	**************	
TENSILE		•
never cast before 6	113057.9298 2504	.815 1022.586
cast 1 time (2/1) 5	94197.8644 1196	5.597 535.134
	e so es os es os es os es os es	*** ** ** ** ** ** ** ** ** ** ** ** **
Mean Difference = 18860.0654		
Levene's Test for Equality of Va	riances: F= 1.066 F	°= .329
t-test for Equality of Means		
Variances t-value df 2-Tail S	sig SE of Diff	99% CI for Diff
***************************************		
Equal 15.34 9 .000	1229.388	14863.85, 22856.28)
Unequal 16.34 7.42 .000	1154,145	14820.15, 22899.99)
<u> </u>		
Variable Number of Cases	Mean SD	SE of Mean
Variable Number of Cases	Mean SD	SE of Mean
Variable Number of Cases	Mean SD	SE of Mean
***************************************	Mean SD	
ELONGATE		.322
ELONGATE never cast before 6	3.2972 .788	.322
ELONGATE  never cast before 6  cast 1 time (2/1) 5	3.2972 .788	.322
ELONGATE  never cast before 6  cast 1 time (2/1) 5	3.2972 .788 .8868 .817	.322
ELONGATE  never cast before 6  cast 1 time (2/1) 5  Mean Difference = 2.4104	3.2972 .788 .8868 .817	.322
ELONGATE  never cast before 6  cast 1 time (2/1) 5  Mean Difference = 2.4104  Levene's Test for Equality of Va	3.2972 .788 .8868 .817	.322 .366
ELONGATE  never cast before 6  cast 1 time (2/1) 5  Mean Difference = 2.4104  Levene's Test for Equality of Value t-test for Equality of Means	3.2972 .788 .8868 .817 	.322 .366 
ELONGATE  never cast before 6  cast 1 time (2/1) 5  Mean Difference = 2.4104  Levene's Test for Equality of Value of Value of Value of Variances t-value of 2-Tail S	3.2972 .788 .8868 .817 	.322 .366 

Variable	Number	of Cases	Mean	SD	SE of Mean	
66 86 66 66 66 66 66 66 64 86 64 66	• •• •• •• •• •• •• •	4 44 44 44 44 44 44 44 44			4 44 44 44 44 44 44 44 44 44 44	** ** ** ** ** **
STRAIN		•				
never cast bef	fore	6	.0006	.000	.000	
cast 1 time (2)	/1)	5	.0002	.000	.000	
** ** ** ** ** ** ** ** ** ** **	• •• •• •• •• •• •• ••	• • • • • • • • • • • • •	**********	**********	6 44 64 46 46 46 46 46 46 66 46 46	56 6 <del>6</del> 56 6 <del>6</del> 66 <b>8</b> 4 66
Mean Differen	ce = .000	95				
Levene's Test	for Equal	ity of Variar	nces: F= 4.	299 P=	.068	
t-test for Equa	lity of Me	ans				
Variances t-va	alue df	2-Tail Sig	SE of Di	ff 99	% Cl for Diff	
***********	• •• •• •• •• •• •	• • • • • • • • • • • • •	********	1 44 44 44 44 46 44 4	• • • • • • • • • • • • • • • • • • • •	
Equal 4.	50 9	.001	.000	(	.000, .001)	
Unequal 4.5	80 7.2	28 .00	2 .00	0	(.000, .001)	
 					4 -	
Variable	Number	of Cases	Mean	SD	SE of Mean	
			**********	**********		16 44 66 66 66 66 66
HARDNESS					·	
never cast bef	ore	6 (	65.4833	3.010	1.229	
cast 1 time (2/	/1)	5 (	62.8600	2.387	1.068	
** ** ** ** ** ** ** ** ** **	. 44 44 44 44 44 44 44	1 44 44 46 86 84 44 84 84 84 <b>8</b> 4	***********	** ** ** ** ** *	6 44 46 44 46 46 46 46 46 46 46 46 46	*********
Mean Differen	ce = 2.62	33				
Levene's Test	for Equali	ity of Varian	ces: F= .13	72 P=	.688	
t-test for Equal	lity of Me	ans				
Variances t-va	lue df	2-Tail Sig	SE of Dit	ff 99%	6 Cl for Diff	
				66 46 66 66 66 66 <b>6</b>	: 44 <del>65 66 64 64 64 64 64 64 64 6</del>	****
Equal 1.5	57 9	.150	1.666	(-2	.791, 8.038)	
Unequal 1.6	61 8.9	9 .142	1.628	(-2	.668, 7.915)	
44 64 66 64 64 64 64 64 64 64 64 64	********	64 54 62 66 54 64 54 65 64	11 41 44 14 14 14 14 14	44 44 44 45 <b>4</b> 4 54 41	64 66 66 65 65 64 66 66 66 66 66 6	*******

Variable .	Number of Ca	ases Mean	SD	SE of Mean
**************	64 64 64 64 64 64 66 66 66 66 66 66 66 6	1 04 14 65 64 64 66 64 64 64 64 64 64 64	4 66 66 66 66 66 66 66 66 66	56 <del>64</del> 64 <del>64</del> <del>64</del> <del>64</del> <del>64</del> 66 66 66 66 66 66
TENSILE			•	
never cast be	fore 6	113057.9298	3 2504.815	1022.586
cast 2 times (	(2/2) 5	84184.7076	4543.929	2032.107
****************		• • • • • • • • • • • • • • • • • • • •	<del>i 44 to 44</del> 44 54 <del>64</del> 64 64 66	14 66 41 64 16 66 66 66 66 46 66 66 66 66 66 66
Mean Differer	nce = 28873.22	22		
Levene's Test	t for Equality of	Variances: F= 2	734 P= .133	1
t-test for Equa	ality of Means			
Variances t-v	alue df 2-	Tail Sig SE of	Diff 99%	CI for Diff
66 84 64 64 64 64 64 64 64 64	**************	1 54 54 64 54 54 54 54 54 54 54 54 54 64 64	4 44 44 44 44 44 44 44 44	14 64 66 66 66 66 66 66 66 66 66 66 66 66
Equal 13	.40 9	.000 2154.	716 (21869	).17, 35877.28)
Unequal 12	.69 5.98	.000 2274.	893 (20436	3.96, 37309.49)
			***************************************	·
Variable	Number of Ca	ises Mean	SD SE	of Mean
************	06 10 <del>61</del> 00 40 64 11 64 06 64 64 44 46		f 44 44 44 44 44 46 46 46 46 46 46 46 46	4 64 64 65 65 54 66 54 66 66 66 66 66 66
ELONGATE		·		
never cast be	fore 6	3.2972	.788	322
cast 2 times (	2/2) 5	1.6880	.627	280
66 64 66 66 64 66 66 66 66 66 66 66 66	16 46 64 <del>1</del> 6 44 64 56 46 66 66 44 46 66	44 44 66 44 46 46 46 46 46 46 46 46 46 4	• • • • • • • • • • • • • • • • • • • •	***************************************
Mean Differer	nce = 1.6092			
Levene's Test	for Equality of	Variances: F= .1	25 P= .731	
t-test for Equa	ality of Means			
Variances t-va	alue df 2-Ta	il Sig SE of Dif	f 99% Cl f	or Diff
************		36 44 66 <del>44</del> 66 <del>44</del> 64 44 44 66 <del>66</del> 66 <del>4</del> 6	• • • • • • • • • • • • • • • • • • • •	\$ 86 86 86 86 86 86 86 86 86 86 88 88 88
Equal 3.	69 9 .0	005 .436	(.190, 3	.028)
Unequal 3.	77 8.99 .0	.427	(.222, 2	.996)

Variable	Numb	per of Cases	Mean	SD S	SE of Mean	
STRAIN	4 14 46 44 16 42 66 48 48 66 66			<b>*******</b> *****************************	10	••
never cas	st before	6	.0006	.000	.000	
cast 2 tin	nes (2/2)	5	.0009	.001	.000	
*********	6 84 <del>64</del> 64 66 64 86 <del>6</del> 5 64 86	*******	54 54 64 54 64 54 <del>54</del> 54 44 54	44 66 44 66 64 64 66 66		44
Mean Dif	ference = -	.0003				
Levene's	Test for Ed	uality of Var	iances: F= 4.	324 P= .0	67	
t-test for	Equality of	Means				
Variances	t-value o	of 2-Tail Si	ig SE of Di	ff 99%	CI for Diff	
44 54 44 54 54 54 54 5	1 41 44 <mark>41 44 44 44 44 44 44</mark>	64 64 64 64 64 64 64 64 64	86 66 66 86 66 86 64 66 64 66 6	64 to 44 to 44 64 64 64 6	12 16 44 16 42 16 42 16 44 16 44 16 46 46 46 46 46	14
Equal	<mark>6</mark> 1	9 .559	.000	(00	2, .001)	
Unequal	5 <mark>5</mark>	4.28 .608	.001	(00	3, .002)	
Variable	Numb	per of Cases	Mean	SD :	SE of Mean	
Variable	Numb	per of Cases	Mean	SD S	SE of Mean	84
Variable """""" HARDNI		per of Cases	Mean	SD 5	SE of Mean	•
*********	::::::::::::::::::::::::::::::::::::::	per of Cases	Mean ####################################	SD :	SE of Mean	<b>14</b>
HARDNI	ESS et before	**************	***************		***************************************	<b>56</b>
HARDNI	ESS et before	<b>6</b>	65.4833	3.010 2.483	1.229	s6 14
HARDNI never cas cast 2 tin	ESS et before	6 5	65.4833	3.010 2.483	1.229 1.110	56 14
HARDNI never cas cast 2 tin	ESS  at before  hes (2/2)  ference = 4	6 5 .7833	65.4833	3.010 2.483	1.229	s4 44
HARDNI never cas cast 2 tin Mean Dif Levene's	ESS  at before  hes (2/2)  ference = 4	6 5 .7833 uality of Vari	65.4833 60.7000	3.010 2.483	1.229	14
HARDNI never cas cast 2 tin	ESS  at before  thes (2/2)  ference = 4  Test for Equality of	6 5 .7833 uality of Vari	65.4833 60.7000	3.010 2.483 	1.229	14
HARDNI never cas cast 2 tin	ESS  at before  thes (2/2)  ference = 4  Test for Equality of	6 5 .7833 uality of Vari	65.4833 60.7000 ances: F= .09	3.010 2.483 	1.229 1.110	14 14
HARDNI never cas cast 2 tin	ESS  at before  thes (2/2)  ference = 4  Test for Equality of	6 5 .7833 uality of Vari	65.4833 60.7000 ances: F= .09	3.010 2.483 	1.229 1.110	16 16

Variable	Number of Cases	Mean	SD	SE of Mean
***********	*** *** ** ** ** ** ** ** ** ** ** ** *	• • • • • • • • • • • • • • •	** ** ** ** ** ** ** **	
TENSILE	•			
never cast be	efore 6 11	3057.9298	2504.815	1022.586
cast 3 times	(2/3) 6 6	7084.1785	9940.854	4058.337
			10 44 00 40 64 64 64 64 64 64 64 64 64 64 64 64 64	
Mean Differe	nce = 45973.7513			
Levene's Tes	t for Equality of Varie	ances: F= 30	.013 P= .00	· · · · · · · · · · · · · · · · · · ·
t-test for Equ	ality of Means			
Variances t-v	alue df 2-Tail Sig	SE of Di	ff 99%	CI for Diff
41 44 44 44 44 44 44 44 44 44			**********	11 44 64 44 64 64 64 64 64 64 64 64 64 64
Equal 10	0.98 10 .000	4185.18	36 (32706	5.86, 59240.64)
Unequal 10	5.63 .000	4185.18	36 (30453	3.32, 61494.18)
Variable	Number of Cases	Mean	SD SE	of Mean
variable	Nulliber of Cases	IVICALI	30 36	Of Mean
11 11 01 11 11 11 11 11 11 11 11 11			66 46 86 86 86 86 86 86 86 46 46	
ELONGATE				
never cast be	fore 6	3.2972	.788	.322
cast 3 times	(2/3) 6	1.5585	1,352	.552
66 56 66 66 66 66 66 66 66 66 66	44 42 44 44 46 44 44 44 44 44 44 46 46 46 46		** ** ** ** ** ** ** **	16 44 54 45 46 56 56 56 56 56 56 56 56 56 56 56 56 56
Mean Differe	nce = 1.7387			
Levene's Tes	t for Equality of Varie	ances: F= 7.2	261 P= .02	3
t-test for Equ	ality of Means			
Manianana atau	alia at ortalion	. OF -4 D	. 000 C	1 f D)##

2-Tail Sig

.022

8.04 .026

Equal

Unequal

2.72

2.72

10

SE of Diff

.639

.639

99% CI for Diff

(-.286, 3.764)

(-.405, 3.883)

****	Num	ber of	Cases	Mean 	SD	SE of Mean	4 64 44
STRAIN							
never cast	before	6		.0006	.000	.000	
cast 3 time	es (2/3)	4		.0003	.000	.000	
	1 44 44 44 44 44 44 44			** ** ** ** ** ** ** **	56 66 66 64 66 <b>6</b> 6	04 06 06 04 02 46 04 06 06 04 06 06 06 04 04	4 66 46
Mean Diffe	rence =	.0004					
Levene's T	est for E	quality	of Varia	nces: F= .07	76 P=	.790	
t-test for E	quality of	Mean	S				
Variances	t-value	df 2	-Tail Sig	SE of Diff	99	9% CI for Diff	
	41 <del>11</del> 11 11 11 11 11 11 11		*****	16 46 46 46 46 46 46 46 46			1 44 44
Equal	2.51	8	.036	.000		(.000, .001)	
Unequal	2.51	6.59	.042	.000		(.000, .001)	
						<del></del>	
Variable	Num	ber of	Cases	Mean	SD	SE of Mean	
***************************************	46 44 46 46 46 46 46		** ** ** ** ** **	16 44 44 14 14 14 14 14 14 14	** ** ** ** ** *	*******************	1 44 44
HARDNES	SS			.,,,,,		<u> </u>	
HARDNES		6		65,4833	3.010	1.229	
	before	6		65.4833 64.5500	3.010 2.611	1.229 1.066	
never cast	before						i <b>66 64</b>
never cast cast 3 time	before es (2/3)	6					i <b>66 6</b> 4
never cast cast 3 time	before es (2/3) erence = .	6 			2.611		1 44 64
never cast cast 3 time	before es (2/3) erence = est for Ec	6 	of Varia	64.5500	2.611	1.066	. 44 44
never cast cast 3 time	before es (2/3) erence = est for Ecquality of	6	of Varia	64.5500	2.611 20 P=	1.066	1 44 64
never cast cast 3 time	before es (2/3) erence = est for Ecquality of	6	of Varia	64.5500 	2.611 20 P=	1.066	04444
never cast cast 3 time	before es (2/3) erence = est for Ecquality of	6	of Varia	64.5500 	2.611 20 P=	1.066	0 44 44

Variable Number of Cases Mean SD SE of Mean	
***************************************	
TENSILE	
never cast before 6 113057,9298 2504.815 1022.586	
cast 1 time (3/1) 6 96183.0272 4633.460 1891.602	
Mean Difference = 16874.9027	
Levene's Test for Equality of Variances: F= .714 P= .418	
t-test for Equality of Means	
Variances t-value df 2-Tail Sig SE of Diff 99% Cl for Diff	
Equal 7.85 10 .000 2150.312 (10058.49, 23691.32)	
Unequal 7.85 7.69 .000 2150.312 (9658.069, 24091.74)	
Variable Number of Cases Mean SD SE of Mean	
Variable Number of Cases Mean SD SE of Mean	
Variable Number of Cases Mean SD SE of Mean  ELONGATE	
ELONGATE	
ELONGATE  never cast before 6 3.2972 .788 .322	
ELONGATE  never cast before 6 3.2972 .788 .322  cast 1 time (3/1) 6 1.1752 .505 .206	
ELONGATE  never cast before 6 3.2972 .788 .322  cast 1 time (3/1) 6 1.1752 .505 .206	
ELONGATE  never cast before 6 3.2972 .788 .322  cast 1 time (3/1) 6 1.1752 .505 .206  Mean Difference = 2.1220	
ELONGATE  never cast before 6 3.2972 .788 .322  cast 1 time (3/1) 6 1.1752 .505 .206  Mean Difference = 2.1220  Levene's Test for Equality of Variances: F= .157 P= .701	
ELONGATE  never cast before 6 3.2972 .788 .322  cast 1 time (3/1) 6 1.1752 .505 .206  Mean Difference = 2.1220  Levene's Test for Equality of Variances: F= .157 P= .701  t-test for Equality of Means	
ELONGATE  never cast before 6 3.2972 .788 .322  cast 1 time (3/1) 6 1.1752 .505 .206  Mean Difference = 2.1220  Levene's Test for Equality of Variances: F= .157 P= .701  t-test for Equality of Means  Variances t-value df 2-Tail Sig SE of Diff 99% CI for Diff	

	f 64 <del>66</del> 64 64 <del>64</del> 64 6	94 84 <del>84</del> 84 <del>84</del> 64 84 84 84 84		1 44 46 44 66 44 66 4		<del></del>
STRAIN		•				
never cast bef	ore	6	.0006	.000	.000	
cast 1 time (3,	/1)	6	.0007	.001	.000	
	1 44 44 44 44 44 44 44	14 <b>44 44 14 44 14 44 4</b> 6 48 44	i 66 44 66 44 66 66 46 66 46	1 66 66 66 66 66 66 6	** ** ** ** ** ** ** ** ** ** ** ** **	46 46 46 84 44 84
Mean Differen	ce =00	01				
Levene's Test	for Equal	ity of Variar	nces: F= 10	0.402 P=	.009	
t-test for Equa	lity of Me	ans				
Variances t-va	lue df	2-Tail Sig	SE of Dif	f 99%	CI for Diff	
						** ** ** ** **
Equal	34 10	.741	.000	(0	01, .001)	
Unequal	34 6.	59 .744	.000	(00	01, .001)	
Variable	Number	of Cases	Mean	SD	SE of Mean	
Variable	Number	of Cases	Mean	SD	ŞE of Mean	14 64 64 64 64
Variable  ***********************************	Number	of Cases	Mean	SD	SE of Mean	56 56 64 56 <del>66</del> 56
	4 4 4 4 4 4 4 4 4 4	4 66 66 68 80 68 60 64 64 64	Mean	SD	SE of Mean	16 66 66 66 66
HARDNESS	ore	6 6	ec 44 44 44 44 44 44 44 44			11 14 14 14 14 14
HARDNESS never cast bef	ore	6 6	55.4833	3,010	1.229	
HARDNESS never cast bef cast 1 time (3)	ore (1)	6 6	55.4833	3,010	1.229	16 44 44 44 44
HARDNESS never cast bef cast 1 time (3)	ore (1) ce = 8.18	6 6	55.4833 57.3000	3.010 2.991	1.229	56 56 56 56 56 56 66 56 56 56 56
HARDNESS never cast bef cast 1 time (3/	ore (1) ce = 8.18 for Equal	6 6 6 5 33 ity of Varian	55.4833 57.3000	3.010 2.991	1.229	16 64 64 64 64 64 14 64 64 64 64 62
HARDNESS never cast bef cast 1 time (3/ Mean Differen Levene's Test t-test for Equal	ore (1) ce = 8.18 for Equal	6 6 6 5 33 ity of Varian	65.4833 67.3000 doces: F= .00	3,010 2,991 200 P=	1.229	
HARDNESS never cast bef cast 1 time (3/	ore (1) ce = 8.18 for Equal	6 6 6 5 33 ity of Varian	65.4833 67,3000 foces: F= .00	3.010 2.991 	1.229 1.221 	
HARDNESS never cast bef cast 1 time (3/ Mean Differen Levene's Test t-test for Equal Variances t-va	ore (1) ce = 8.18 for Equali lity of Me	6 6 6 5 33 ity of Varian	65.4833 67.3000 doces: F= .00	3.010 2.991 	1.229 1.221 	
HARDNESS never cast bef cast 1 time (3/ Mean Differen Levene's Test t-test for Equal	ore (1) ce = 8.18 for Equali lity of Me	6 6 6 5 33 ity of Varian	65.4833 67,3000 foces: F= .00	3.010 2.991 00 P=	1.229 1.221 	8

Variable					
Variable	Number of	Cases Mea	an SD	SE of Mean	
44 44 44 44 54 54 44 45 56 56 46 46 56	66 56 66 66 66 66 66 66 66 66		4 44 44 46 44 46 46 84 48 46 46 46 46		
TENSILE					
never cast befo	ore 6	113057	.9298 2504.81	5 1022.586	
cast 2 times (3	3/2) 5	86134	. <mark>8172 5191.10</mark>	1 2321.531	
** ** ** ** ** ** ** ** ** ** **	** ** ** ** ** ** ** ** **		• • • • • • • • • • • • • • • • • • • •		
Mean Difference	ce = 26923.	1126			
Levene's Test	for Equality	of Variances:	F= 1.960 P= .	195	
t-test for Equal	ity of Mean	s			
Variances t-val	lue df 2	-Tail Sig SE	of Diff 99	% CI for Diff	
*************			1 64 64 64 64 64 64 64 64 64 64 64 64 64	• 44 64 64 64 64 64 64 64 64 64 64 64 64	
Equal 11.	.31 9	.000 2	381.072 (191	83.27, 34662.96)	
Unequal 10.	.61 5.54	.000 2	:536.767 (175	15.71, 36330.52)	
Variable	Number of	Cases Mea	an SD	SE of Mean	
************	16 66 66 66 56 64 66 66 68 58	66 66 64 64 64 66 66 66 66 66	66 64 64 64 66 66 66 66 66 66 66 66 66	• • • • • • • • • • • • • • • • • • • •	
FLONIOATE					
ELONGATE					
never cast before	ore 6	3,297	72 .788	.322	
		3.297		.322	
never cast befo		1.150	02 .915		
never cast befo	/2) 5 	1.150	02 .915	.409	
never cast before cast 2 times (3,	/2) 5 	1.150	915	.409	
never cast before cast 2 times (3,	/2) 5 :e = 2.1470 for Equality	1.150	915	.409	
never cast before cast 2 times (3,	/2) 5 :e = 2.1470 for Equality ty of Means	1.150	02 .915 	.409 	
never cast before cast 2 times (3).  Mean Difference Levene's Test for Equality.	/2) 5 :e = 2.1470 for Equality ty of Means	1.150	915	.409 	
never cast before cast 2 times (3).  Mean Difference Levene's Test for Equality.	/2) 5	1.150	02 .915 F= .568 P= .4 of Diff 99%	.409 	

Variable	Number	of Cases	Mean	SD SE	of Mean
14 44 46 14 46 44 44 44 44 44 44	1 86 48 86 48 64 86 48 66 <b>8</b>	4 44 56 55 66 56 65 56 65 66	16 66 66 64 66 66 66 66 66	1 16 16 16 16 16 16 16 16 16	00 00 00 00 00 00 00 00 00 00 00 00 00
STRAIN					
never cast be	efore	6	.0006	.000	.000
cast 2 times	(3/2)	5	.0003	.000	.000
86 66 66 68 66 64 64 64 84 86 66	i 44 44 66 46 66 46 46 46 4	4 66 46 44 44 44 44 46 44 46	14 64 54 64 56 66 66 66 66	44 44 44 44 44 44 44	26 64 64 62 64 64 64 64 64 64 64 64 64 64 64 64
Mean Differe	nce = .000	4			
Levene's Tes	t for Equal	ity of Varian	ces: F= 1.0	12 P= .34	<b>1</b> 1
t-test for Equ	ality of Me	ans			
Variances t-v	alue df	2-Tail Sig	SE of Diff	99% C	il for Diff
	1 44 44 44 44 44 44 44 44				
Equal 2	2.94 9	.017	.000	(.000	, .001)
Unequal 3	8.03 8.8	36 .014	.000	(.000	, .001)
	***************************************				
Variable	Number	of Cases	Mean	SD S	E of Mean
61 66 66 64 64 66 66 64 64 64 64			04 04 04 04 04 04 04 04 04 04	***********	*** *** ** ** ** ** ** ** ** ** ** ** *
HARDNESS					
never cast be	fore	6 6	55.4833	3.010	1.229
cast 2 times	(3/2)	5 5	55.3200	2.924	1.307
66 64 66 66 64 66 65 64 66 68 68	46 66 66 46 66 66 66 4	5 <b>06 06 06 06 06 06 06 06 0</b>			M 11 41 11 41 11 41 41 41 41 41 41 41 41
Mean Differer	nce = 10.1	633			
Levene's Tes	t for Equal	ty of Varian	ces: F= .008	B P= .92	9
t-test for Equa	ality of Me	ans			
Variances t-v	alue df	2-Tail Sig	SE of Diff	99% (	CI for Diff
41 44 64 64 64 64 64 64 64 64 64	** ** ** ** ** ** ** **		***********		34 <del>54 54 54 54 54 54 54 54 54 54 54</del> 54
Equal 5	.65 9	.000	1.800	(4.31	3, 16.013)
Unequal 5	.66 8.7	4 .000	1.794	(4.33	1, 15.996)
04 04 04 04 04 05 05 10 12 14 14	** ** ** ** ** ** **	H +1 44 64 64 64 64 64 64 64 64	• •• •• •• •• •• •• ••	** ** ** ** ** ** **	-4 16 44 54 84 84 88 86 86 86 86 86 86 86 86 86 86 86 86

Variable	Num	ber of Cases	s Mean	SD	SE of Mean
66 66 66 66 66 66 66 66		64 86 <del>84</del> 66 <del>84</del> 66 <del>84</del> 66 64 66	66 66 56 66 66 64 66 66 66 64 66 66	. 44 45 46 44 44 44 66 6	of out to 6 out and
TENSILE					
never cast	before	6	113057.9298	2504.81	5 1022.586
cast 3 time	s (3/3)	6	78793.9705	7485.64	8 3056.003
46 44 66 46 46 66 46 46 66	44444444	46 44 56 <del>44 56 66 66 64 66 56</del>	44 54 54 64 64 64 64 64 64 64 64 64 64 64 64 64		0 64 50 64 64 64 64 54 64 64 66 66 65 65 65 65 66 66 66
Mean Diffe	rence =	34263.9593			
Levene's T	est for E	quality of Va	riances: F= 20.	.396 P= .0	001
t-test for E	quality o	f Means			
Variances	t-value	df 2-Tail S	Sig SE of Dif	f 999	% Cl for Diff
** ** ** ** ** ** ** **	<mark></mark>				***************************************
Equal	10.63	10 .000	3222.55	1 (2404	8.58, 44479.33)
Unequal	10.63	6.11 .000	3222.55	1 (2231	3.38, 46214.54)
Variable	Num	hber of Cases	s Mean	SD S	E of Mean
Variable	Num	aber of Cases	s Mean	SD S	E of Mean
Variable	** ** ** ** ** **	nber of Cases	s Mean	SD S	E of Mean
	 TE	nber of Cases	3.2972	SD S	E of Mean
ELONGA	TE before		3,2972		4 84 84 84 84 84 88 88 88 88 86 86 86 84 84 84 84 84 84
ELONGAT	TE before	6	3,2972	.788	.322
ELONGAT	before	6	3,2972	.788	.322
ELONGAT never cast cast 3 time	before s (3/3) rence =	6 6 	3,2972	.788 1.174	.322
ELONGAT never cast cast 3 time Mean Diffe Levene's To	before s (3/3) rence = est for E	6 6 1.2385 quality of Va	3.2972 2.0587	.788 1.174	.322
ELONGAT never cast cast 3 time	before s (3/3) rence = est for E	6 6 1.2385 quality of Va	3,2972 2,0587 2,0587	.788 1.174 43 P= .2	.322 .479
ELONGAT never cast cast 3 time  Mean Diffe Levene's Tot-test for Edvariances	before s (3/3) rence = est for E quality of	6 6 1.2385 quality of Va	3.2972 2.0587 riances: F= 1.4	.788 1.174 43 P= .2	.322 .479
ELONGAT never cast cast 3 time  Mean Diffe Levene's Tot-test for Edvariances	before s (3/3) rence = est for E quality of	6 6 1.2385 quality of Va Means df 2-Tail S	3.2972 2.0587 riances: F= 1.4	.788 1.174 43 P= .24 99% CI	.322 .479

Variable	Nur	mber of	Cases	Mean	SD	SE of Mean	
14 44 14 24 44 54 44 44	64 64 64 64 64 64 64 64	16 44 64 64 64 64 6	1 11 41 41 41 41 41	i <del>at</del> a <b>s a</b> s as as as as as as as	44 44 44 44 44 44	14 24 46 46 46 48 48 48 48 48 48 48 48 48 48 48 48	id 44 46 64
STRAIN							
never cas	t before	6		.0006	.000	.000	
cast 3 tim	ies (3/3)	6		.0032	.004	.002	
84 64 86 66 66 86 88 64	86 46 46 86 88 64 64 46	16 66 66 66 66 66 6	1 64 11 64 14 64 <del>6</del> 4	i a4 44 84 64 84 86 86 86 62 86 62	44 44 44 44 44 4	** ** ** ** ** ** ** ** ** ** ** ** **	14 64 64 64
Mean Diff	erence =	0026					
Levene's	Test for	Equality	of Varia	ances: F= 4.5	523 P=	.059	
t-test for I	Equality o	of Mean	s				
Variances	t-value	df 2	-Tail Siç	SE of Diff	99%	CI for Diff	
**********		14 64 44 46 64 66 61		44 44 44 44 44 44 44 44 44	********	4 14 16 41 44 44 44 44 44 44 44 44 44 44 44	14 44 44 44
Equal	-1. <mark>6</mark> 7	10	.125	.002	(00	07, .002)	
Unequal	-1.67	5.04	.155	.002	(00	09, .004)	
 			ha.c		,	····	
Variable	Nür	nber of	Cases	Mean	SD	SE of Mean	
44 44 44 44 44 44 44 44	14 44 64 46 44 46 44 6	4 44 44 44 44 44	*********	86 86 86 86 86 86 86 86 86		• •• •• •• •• •• •• •• •• •• •• •• •• •	44444
HARDNE	SS						
never cast	: before	6		65.4833	3.010	1.229	
				001.1000	0.010		
cast 3 tim	es (3/3)	6		63.6500	3.626	1.480	
cast 3 time	es (3/3)	6	86 86 66 66 66 66	63.6500	3.626		i 44 <b>6</b> 6 84
cast 3 time		• • • • • • • •		63.6500	3.626	1.480	• •• ••
Mean Diffe	erence =	1.8333	of Varia	63.6500	3.626	1.480	6 44 54 64
Mean Diffe	erence =	1.8333 Equality		63.6500	3.626	1.480	• • • • • • • • • • • • • • • • • • • •
Mean Diffe Levene's T	erence = Test for E	1.8333 Equality		63.6500 	3.626 35 P=	1.480	• •• • • •
Mean Diffe Levene's T t-test for E Variances	erence = Test for E	1.8333 Equality of Means	s -Tail Sig	63.6500	3.626 35 P=	1.480	*****
Mean Diffe Levene's T t-test for E Variances	erence = Test for E Equality of t-value	1.8333 Equality of Means	s -Tail Sig	63.6500 	3.626 35 P= f 99%	1.480	******
Mean Diffe Levene's T t-test for E Variances	erence = Test for E Equality of t-value	1.8333 Equality of Means of 2.	s -Tail Sig	63.6500 	3.626 35 P= f 99% (-4.	1.480 	

Variable	Number of Cases	Mean S	SD SE of Mean
****************	• = • • • • • • • • • • • • • • • • • •	54 44 20 54 50 04 54 48 54 44 64 44	***************************************
TENSILE			
never cast bef	ore 6 11	3057.9298 2	504.815 1022.586
cast 1 time (4,	/1) 6 11	9150.4150 4	329.762 1767.618
66 66 66 66 66 66 66 66 66 66 66		54 54 44 64 64 64 64 64 64 64 64	14 <del>14</del> 14 14 14 14 14 14 14 14 14 14 14 14 14
Mean Differen	ce = -6092.4852		
Levene's Test	for Equality of Varia	nces: F= .747	P= .408
t-test for Equa	lity of Means		
Variances t-va	alue df 2-Tail Sig	SE of Diff	99% Cl for Diff
44 44 44 44 44 44 44 44 44 44			64 44 44 44 44 45 14 44 44 44 44 44 44 14 44 14 44 14 44 14 44 14 44 14 44 14 1
Equal -2.	98 10 .014	2042.096	(-12565.9, 380.888)
Unequal -2.	98 8.01 .017	2042.096	(-12946.1, 761.156)
			***************************************
Variable	Number of Cases	Mean S	SD SE of Mean
Variable	Number of Cases	Mean S	SD SE of Mean
Variable  ***********************************	Number of Cases	Mean S	SD SE of Mean
		id ad ad ad ad ad ad ad ad ag ag ag	SD SE of Mean
ELONGATE	ore 6	3.2972 .7	***************************************
ELONGATE never cast bef	ore 6	3.2972 .7	788 .322
ELONGATE never cast bef	ore 6	3.2972 .7	788 .322
ELONGATE never cast bef cast 1 time (4/	ore 6	3.2972 2.7998	788 .322
ELONGATE never cast bef cast 1 time (4/	ore 6 /1) 6	3.2972 2.7998	788 .322 592 .242
ELONGATE never cast bef cast 1 time (4/	ore 6  1) 6  ce = .4973  for Equality of Variantity of Means	3.2972 .7 2.7998 .5 nces: F= .167	788 .322 592 .242
ELONGATE never cast bef cast 1 time (4/	ore 6  1) 6  ce = .4973  for Equality of Variantity of Means	3.2972 .7 2.7998 .5 nces: F= .167	788 .322 592 .242 P= .691
ELONGATE never cast bef cast 1 time (4/	ore 6  1) 6  ce = .4973  for Equality of Varian lity of Means  lue df 2-Tail Sig	3.2972 .7 2.7998 .5 nces: F= .167	788 .322 592 .242 P= .691

Variable	Numi	per of Cases	Mean	SD SE	of Mean
STRAIN					
never cas	t before	6	.0006	.000	.000
cast 1 tim	ne (4/1)	6	.0004	.000	.000
***********	46 84 84 84 84 84 84 84			88 66 86 66 86 88 66 66 86	
Mean Diff	erence = .	0002			
Levene's	Test for Ed	juality of Vari	ances: F= .60	7 P= .45	4
t-test for i	Equality of	Means			
Variances	t-value d	df 2-Tail Si	g SE of Diff	99% CI	for Diff
		***********	14 46 46 86 86 86 86 86 86 86		
Equal	1.75	10 .111	.000	(.000,	.001)
Unequal	1.75	9.91 .112	.000	(.000,	.001)
Variable	Numb	per of Cases	Mean	SD S	E of Mean
		16 46 16 16 16 14 16 18 16 16 16			16 64 86 <del>44</del> 88 <del>44</del> 48 44 64 64 64 64 64 64 64 64 64
HARDNE	SS				•
never cast	t before	6	65.4833	3.010	1.229
cast 1 tim	e (4/1)	6	61.7000	3.775	1.541
46 44 54 44 54 54 65 65	** ** ** ** ** ** **	** ** ** ** ** ** ** ** ** **	4 66 60 62 60 82 64 64 64 64 66 6	* ** ** ** ** ** ** **	
Mean Diff	erence = 3	.7833			
		וו גווו	ances: F= .12	6 P= .730	5
Levene's		uality of Varia	ances: F= .12	6 P= .730	รี เาลัย
Levene's t-test for E	Test for Eq	uality of Vario	ances: F= .12 g SE of Dif		
Levene's t-test for E	Test for Eq	uality of Vario			
Levene's t-test for E	Test for Eq Equality of t-value o	uality of Vario		f 99% C	
Levene's t-test for E	Test for Eq Equality of t-value o	uality of Vario	g SE of Dif	f 99% C	for Diff

Variable	Numb	er of Cases	Mean	SD	SE of Mean
65 66 66 64 66 66 66 66 66	. 46 44 66 46 66 46 46 66		*********	*****	******************
TENSILE					
never cast b	pefore	6 11	3057.9298	2504.815	1022.586
cast 2 times	s (4/2)	6 8	3987.1097	7768.858	3171.623
66 66 66 66 66 66 66 66 66	64 56 64 56 64 66 46 6	4 44 <del>44 44 44 44 44 44</del> 44 44 44 44 44 44 44		* ** ** ** ** ** ** ** **	4) 52 40 54 46 50 62 46 46 46 46 46 46 46 46 46 46 46 46
Mean Differ	ence = 29	9070.8202			
Levene's Te	st for Equ	uality of Vari	ances: F= 6.	.841 P= .0	026
t-test for Eq	uality of N	Means			
Variances t	-value d	f 2-Tail Sig	SE of D	iff 999	6 Cl for Diff
** ** ** ** ** ** ** ** **			6 14 44 44 64 64 64 64 64 64 64 64 64 64 64	4 44 44 64 86 64 64 64 64	46 44 56 46 45 55 55 55 56 56 56 56 56 56 56 56 56 56
Equal	8.72 1	000. 0	3332.39	8 (1850	7.23, 39634.41)
Unequal	8.72	6.03 .000	3332.39	8 (1671	2.88, 41428.76)
Variable	Numbe	er of Cases	Mean	SD S	E of Mean
Variable	Numbe	er of Cases	Mean	SD S	E of Mean
Variable """" ELONGATE	14 ** 64 ** 64 64 64 64	er of Cases	Mean	SD S	E of Mean
65 66 66 65 66 66 66 66 66 66	=	er of Cases	Mean	SD S	E of Mean
ELONGAT	= efore	44 44 54 65 54 65 64 64 64 64 64	5 44 45 44 45 54 44 44 64 54 54	•	11 44 11 44 14 14 14 14 14 14 14 14 14 1
ELONGATI	= efore	6	3.2972	.788	.322
ELONGATI	efore (4/2)	6	3.2972	.788	.322
ELONGATE never cast b cast 2 times	efore (4/2) ence = 1.4	6 6	3.2972 1.8642	.788	.322
ELONGATE never cast b cast 2 times	efore (4/2) ence = 1.4	6 6 	3.2972 1.8642	.788	.322
ELONGATION Never cast becast 2 times  Mean Difference Levene's Test	efore  (4/2)  ence = 1.4  st for Equivalently of M	6 6 4330 ality of Varia	3.2972 1.8642	.788 .692	.322 .283
ELONGATE never cast b cast 2 times	efore  (4/2)  ence = 1.4  st for Equivalety of Moveline df	6 6 4330 ality of Varia	3.2972 1.8642 ances: F= .04	.788 .692 	.322 .283
ELONGATE never cast b cast 2 times  Mean Differe Levene's Test t-test for Equ Variances t-	efore  (4/2)  ence = 1.4  st for Equivalety of Moveline df	6 6 4330 ality of Variations feans 2-Tail Sig	3.2972 1.8642 ances: F= .04	.788 .692 42 P= .84	.322 .283 

Variable	Num	ber of Cas	es Mean	SD	SE of Mean	
54 85 86 54 65 54 65 66 66		6 46 44 56 44 66 44 44 44	ee so se se se ee so ee so ee s	P4 00 00 00 00 00 00 00 00 00 00 00 00 00	is es te 44 es 51 es 51 es 51 es 51 64 64 64	64 64 64 64 6
STRAIN						
never cast	before	6	.0006	.000	.000	
cast 2 time	es (4/2)	6	.0003	.000	.000	
**********	i 14 <del>14</del> 14 14 64 14 44 6	• • • • • • • • • • • • • • • • • • • •	***************		4 44 44 44 54 54 64 64 44 44 44 44 44 44	<del>44 44 44</del> 4
Mean Diffe	erence = .	0004				
Levene's T	est for Ed	quality of \	/ariances: F=	.514 P= .4	490	
t-test for E	quality of	Means				
Variances	t-value	df 2-Tail	Sig SE of I	Diff 99%	CI for Diff	
**********					+ 64 44 64 64 64 64 64 64 64 64 64 64 64	41 44 64 64 64
Equal	2.96	10 .01	.000	(.00	00, .001)	
Unequal	2.96	9.85 .01	.000	(.00	00, .001)	
					····	
Variable	Num	per of Cas	es Mean	SD	SE of Mean	
** ** ** ** ** ** ** **	** ** ** ** ** ** **		** ** ** ** ** ** ** ** ** **		• • • • • • • • • • • • • • • • • • • •	
HARDNES	ss					
never cast	before	6	65.4833	3.010 -	1.229	
cast 2 time	s (4/2)	6	61.7167	3.212	1.311	
***********	66 66 68 68 66 66 66 66	***** *** ** ** **	16 16 46 46 16 16 06 56 46 56 66 66	* ** ** ** ** ** ** ** *	i <del>e</del> i <del>e e</del> e i e e e e e e e e e e e e e e e e	LA 64 64 64
Mean Diffe	rence = 3	3.7667				
Levene's T	est for Ec	uality of V	/ariances: F= .	233 P= .6	340	
t-test for E			101004	200	91229	
Variances			Sig SE of [	)iff 99%	Cl for Diff	
				00%		14 64 64 64 <b>6</b> 4
_	2.10	10 .06	3 1.797	7 1.1	930, 9.464)	
Equal			U 1.737	\ <del>-</del> 1.	JUU, J.404)	
Equal Unequal	2.10	9.96 .06		7 11	930, 9.464)	

Variable	Number of Cases	Mean	SD	SE of Mean
	55 At 34 Ac 34 44 At 46 At 46 At 46 At 46 At 46 At		• • • • • • • • • • • • • • • • • • • •	
TENSILE				
never cast befo	ore 6 113	3057.9298 2	2504.815	1022.586
cast 3 times (4	/3) 6 71	1291.8742 7	7901.210	3225.655
** ** ** ** ** ** ** ** ** ** **		54 66 54 64 54 66 56 64 54 64 54	• •• •• •• •• •• •• •	• • • • • • • • • • • • • • • • • • • •
Mean Difference	ce = 41766.0557			
Levene's Test	for Equality of Varia	nces: F= 3.3	24 P= .0	98
t-test for Equali	ty of Means			
Variances t-val	ue df 2-Tail Sig	SE of Diff	f 99	% CI for Diff
*************				4 10 44 07 44 <del>44</del> 54 66 54 46 64 56 46 56 66 66
Equal 12.3	10 .000	3383.864	4 (3103	9.32, 52492.79)
Unequal 12.3	5.99 .000	3383.864	4 (2921	7.26, 54314.85)
·			·	
Variable	Number of Cases	Mean	SD S	SE of Mean
44 94 64 64 64 64 64 64 64 64 64 64 6	4 64 64 64 54 64 64 64 64 64 64 64 64 64 64 64 64 64	86 85 86 86 86 86 86 86 86 86	i 66 64 66 66 66 66 66 6	* ** ** ** ** ** ** ** ** ** ** ** ** *
ELONGATE				•
never cast befo	ore 6	3.2972	.788	.322
cast 3 times (4,	/3) 6	.7818	1.184	.483
*************	• •• •• •• •• •• •• •• •• •• •• •• •• •	******	64 66 66 66 66 66 66 66	
Mean Differenc	e = 2.5153			
Levene's Test f	or Equality of Varia	nces: F= .43	5 P= .52	24
t-test for Equali	ty of Means			
Variances t-val	ue df 2-Tail Sig	SE of Diff	99% CI	for Diff
		************	********	46 46 44 64 44 44 44 44 44 64 44 64 64 6
Equal 4.3	3 10 .001	.581	(.675,	4.356)

(.628, 4.402)

.581

Unequal

4.33

8.70 .002

	Numi	per of Cases	Mean	SD	SE of Mean
64 64 64 64 64 66 66	i <del>es</del> 11 <b>11 14 14 14 14 14 1</b> 4 1	• • • • • • • • • • • • • • • • • • •	·· · · · · · · · · · · · · · · · · · ·		16 46 46 46 <del>44</del> 54 54 64 51 44 54 54 64 64 64 64 64 64 64
STRAIN					
never cas	t before	6	.0006	.000	.000
cast 3 tim	nes (4/3)	5	.0012	.001	.000
44 44 44 44 44 44 44	********	66 64 64 64 66 66 65 66 66 66 66 66	•	• • • • • • • • • • • • • • • • • • • •	t 66 56 66 66 64 64 50 64 64 64 64 64 64 64 64 64 64 64 64 64
Mean Diff	ference = -	.0006			
Levene's	Test for Ec	uality of Varia	ances: F= 33	3.533 P= .	000
t-test for l	Equality of	Means			
Variances	t-value d	f 2-Tail Sig	SE of Dif	f 99% (	Cl for Diff
64 54 65 66 56 64 64 66	** ** ** ** ** ** **	66 <del>64</del> 66 <del>64</del> 64 66 66 66 66 66	64 86 84 66 66 86 86 66 66 86 86	· • • • • • • • • • • • • • • • • • • •	. 44 44 44 54 44 54 64 54 54 54 64 64 64 64 64 64 64 64
Equal	-1.81	9 .103	.000	(00	2, .000)
Unequal	-1.67	4.58 .162	.000	(00	2, .001)
Variable	. Nu <mark>m</mark> b	er of Cases	Mean	SD	SE of Mean
44 44 44 94 45 46 46 46 8	**********	4 66 64 66 64 64 64 64 64 64	***********	** ** ** ** ** ** **	56 64 66 66 66 65 66 64 64 66 65 64 64 64 66 64 64
LIADDNE	SS				
HARDNE					
never cast	before	6	65.4833	3.010	1.229
			65.4833 64.0667	3.010 3.880	1.229 1.584
never cast			64.0667	3.880	
never cast	es (4/3)	6	64.0667	3.880	1.584
never cast cast 3 time	es (4/3) erence = 1.	6	64.0667	3.880	1.584
never cast cast 3 time	es (4/3) erence = 1. est for Equ	6 4167 ality of Varian	64.0667	3.880	1.584
never cast cast 3 time """"""""""""""""""""""""""""""""""""	es (4/3)  erence = 1.  est for Equ quality of N	6 4167 ality of Variar	64.0667 	3.880 2 P= .42	1.584
never cast cast 3 time Mean Diffe Levene's T t-test for E Variances	es (4/3)  erence = 1.  est for Equ quality of N t-value df	6 4167 ality of Varian	64.0667 nces: F= .69	3.880 2 P= .42	1.584
never cast cast 3 time Mean Diffe Levene's T t-test for E Variances	es (4/3)  erence = 1.  est for Equ quality of N t-value df	6 4167 Hality of Varian Means 2-Tail Sig	64.0667 nces: F= .69	3.880 2 P= .42 99% C	1.584

#### \*\*\* CELL MEANS \*\*\*

**TENSILE** 

by RECAST. the time of casting

RATIO ration of the old and new alloys' weight

Total Population

86050.93

(67)

(07)					
RECAST	1	2	3		
	102000.99	84520.25	71498.45		
	(23)	(21)	(23)		
RATIO	1	2	3	4	
	83992.64	80901.12	87090.36	91476.47	
	(16)	(16)	(17)	(18)	
RATIO	1	2	3	4	
RECAST 1	97172.15	94197.86	96183.03	119150.41	
	(6)	(5)	(6)	(6)	
2	83881.01	84184.71	86134.82	83987.11	
	(5)	(5)	(5)	(6)	
3	68288.85	67084.18	78793.97	71291.87	
	(5)	(6)	(6)	(6)	

## \* \* \* ANALYSIS OF VARIANCE \* \* \*

TENSILE

by RECAST the time of casting

RATIO ration of the old and new alloys' weight

EXPERIMENTAL sums of squares

Covariates entered FIRST

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	11754368644	5	2350873728.80	63.782	.000
RECAST	10714031941	2	5357015970.44	145.343	.000
RATIO	983044338	3	327681445.895	8.890	.000
2-Way Interactions					
RECAST RATIO	1934386374	6	322397728.957	8.747	.000
Explained	13688755018	11	1244432274.34	33.763	.000
Residual	2027176977	55	36857763.211		
Total	15715931994	66	238120181.732		

67 cases were processed.

0 cases (.0 pct) were missing.

## SPSS for MS WINDOWS Release 6.0

## \* \* \* CELL MEANS \* \* \*

## ELONGATE

(5)

(6)

(6)

(6)

by RECAST the time of casting

RATIO ration of the old and new alloys' weight

Total Population	n 1				
1.32					
(67)					
RECAST	1	2	3		
	1.40	1.29	1.28		
	(23)	(21)	(23)		
RATIO	1	2	3	4	
	.54	1.39	1.48	1.82	
	(16)	(16)	(17)	(18)	
RATIO	1	2	3	4	
RECAST 1	.66	.89	1.18	2.80	
	(6)	(5)	(6)	(6)	
2	.34	1.69	1.15	1.86	
	(5)	(5)	(5)	(6)	
3	.59	1.56	2.06	.78	

## SPSS for MS WINDOWS Release 6.0

## \* \* \* ANALYSIS OF VARIANCE \* \* \*

**ELONGATE** 

by RECAST the time of casting

RATIO ration of the old and new alloys' weight

EXPERIMENTAL sums of squares

Covariates entered FIRST

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	15.066	5	3.013	4.273	.002
RECAST	.365	2	.183	.259	.773
RATIO	14.841	3	4.947	7.016	.000
2-Way Interactions					
RECAST RATIO	17.177	6	2.863	4.060	.002
Explained	32.243	11	2.931	4.157	.000
Residual	38.781	55	.705		
Total	71.024	66	1.076		

<sup>67</sup> cases were processed.

<sup>0</sup> cases (.0 pct) were missing.

## SPSS for MS WINDOWS Release 6.0

## \* \* \* CELL MEANS \* \* \*

## **STRAIN**

(5)

(4)

(6)

(5)

by RECAST the time of casting

RATIO ration of the old and new alloys' weight

Total Po	pulatio	n					
.00							
(64)	)						
RECAST		1	2	3			
		.00	.00	.00			
		(23)	(21)	(20)			
RATIO		1	2	3	4		
		.00	.00	.00	.00		
		(16)	(14)	(17)	(17)		
RATIO		1	2	3	4		
RECAST	1	.00	.00	.00	.00		
		(6)	(5)	(6)	(6)		
	2	.00	.00	.00	.00		
		(5)	(5)	(5)	(6)		
	3	.00	.00	.00	.00	เกา	

## \* \* \* ANALYSIS OF VARIANCE \* \* \*

STRAIN

by RECAST the time of casting

RATIO ration of the old and new alloys' weight

EXPERIMENTAL sums of squares

Covariates entered FIRST

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	.000	5	.000	3.208	.013
RECAST	.000	2	.000	3.968	.025
RATIO	.000	3	.000	2.437	.075
2-Way Interactions	.000	6	.000	2.255	.052
RECAST RATIO	.000	6	.000	2.255	.052
Explained	.000	11	.000	2.688	.008
Residual	.000	<b>5</b> 2	.000		
Total	.000	63	.000		

<sup>67</sup> cases were processed.

<sup>3</sup> cases (4.5 pct) were missing.

## \* \* \* CELL MEANS \* \* \*

## **HARDNESS**

by RECAST the time of casting

RATIO ration of the old and new alloys' weight

Total Population					
61.16					
(67)					
RECAST	1	2	3		
	60.17	59.90	63.30		
	(23)	(21)	(23)		
RATIO	1	2	3	4	
	60.35	62.82	58.96	62.49	
	(16)	(16)	(17)	(18)	
RATIO	1	2	3	4	
RECAST 1	59.28	62.86	57.30	61.70	
	(6)	(5)	(6)	(6)	•
2	61.52	60.70	55.32	61.72	
	(5)	(5)	(5)	(6)	
3	60.46	64.55	63.65	64.07	

(6)

(6)

(6)

(5)

## \*\*\* ANALYSIS OF VARIANCE \*\*\*

**HARDNESS** 

by RECAST the time of casting

RATIO ration of the old and new alloys' weight

EXPERIMENTAL sums of squares

Covariates entered FIRST

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	326.926	5	65.385	6.461	.000
RECAST	157.985	2	78.992	7.806	.001
RATIO	166.143	3	55.381	5.473	.002
2-Way Interactions					
RECAST RATIO	D 133.190	6	22.198	2.194	.057
Explained	460.117	11	41.829	4.134	.000
Residual	556.560	55	10.119		
Total	1016.677	66	15.404		

<sup>67</sup> cases were processed.

<sup>0</sup> cases (.0 pct) were missing.

#### Variable TENSILE

## By Variable RECAST (the time of casting) RATIO 1

### Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	2275304970	1137652485	61.1660	.0000
Within Groups	13	241792556.1	18599427.40		
Total	15	2517097526			

Variable TENSILE

By Variable RECAST (the time of casting) RATIO 1

Multiple Range Tests: Scheffe test with significance level .05

Harmonic Mean Cell size = 5.2941

The actual range used is the listed RANGE \* 1874.3599

with the following value(s) for RANGE: 3.90

## (\*) Indicates significant differences which are shown in the lower triangle

Grp Grp Grp

Mean RECAST 3 2 1

68288.8470 Grp 3

83881.0068 Grp 2

97172.1512 Grp 1 \* - \*

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 3 Subset 2 Group Grp 2

\* Mean 68288,8470 Mean 83881,0068

Subset 3 Group Grp 1

Mean 97172,1512

# By Variable RECAST (the time of casting) RATIO 1

## Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	.3124	.1562	.7440	.4944
Within Groups	13	2.7297	.2100		
Total	15	3.0421			

Variable ELONGATE

By Variable RECAST (the time of casting) RATIO 1

Multiple Range Tests: Scheffe test with significance level .05

Harmonic Mean Cell size = 5.2941

The actual range used is the listed RANGE \* .1992

with the following value(s) for RANGE: 3.90

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 2 Grp 3 Grp 1

Mean .3364 .5884 .6648

,004

## By Variable RECAST (the time of casting) RATIO 1

## Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	.0000	.0000	1.9685	.1791
Within Groups	13	.0000	.0000		
Total	15	.0000			

Variable STRAIN

By Variable RECAST (the time of casting) RATIO 1

Multiple Range Tests: Scheffe test with significance level .05

Harmonic Mean Cell size = 5,2941

The actual range used is the listed RANGE \* .0001

with the following value(s) for RANGE: 3.90

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 2 Grp 3 Grp 1

Mean .0003 .0004 .0005

### Variable TENSILE

## By Variable RECAST (the time of casting) RATIO 2

#### Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	2083374030	1041687015	23.2512	.0001
Within Groups	13	582419379.7	44801490.7	5	
Total	15	2665793410			

Variable TENSILE

By Variable RECAST (the time of casting) RATIO 2

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

MEAN(J)-MEAN(I) >= 4732.9426 \* RANGE \* SQRT(1/N(I) + 1/N(J))

with the following value(s) for RANGE: 3.90

(\*) Indicates significant differences which are shown in the lower triangle

Grp Grp Grp

Mean RECAST 3 2 1

67084.1785 Grp 3

84184.7076 Grp 2

94197.8644 Grp 1

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 1 Grp 2

Mean 94197.8644 84184.7076

Subset 2 Group Grp 3

Mean 67084,1785

## By Variable RECAST (the time of casting) RATIO 2

### Analysis of Variance

Source	D.F.	Sum of Squares	MeanSquares	F Ratio	F Prob.
Between Groups	2	1.8804	9402	.9132	.4255
Within Groups	13	13.3841	1.0295		
Total	15	15.2646			

Variable ELONGATE

By Variable RECAST (the time of casting) RATIO 2

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

MEAN(J)-MEAN(I) >= .7175 \* RANGE \* SQRT(1/N(I) + 1/N(J))

with the following value(s) for RANGE: 3.90

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 1 Grp 2 Grp 3

Mean .887 1.688 1.599

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## By Variable RECAST (the time of casting) RATIO 2

## Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	.0000	.0000	1.8341	.2054
Within Groups	11	.0000	.0000		
Total	13	.0000			

Variable STRAIN

By Variable RECAST (the time of casting) RATIO 2

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

MEAN(J)-MEAN(I) >= .0005 \* RANGE \* SQRT(1/N(I) + 1/N(J))

with the following value(s) for RANGE: 3.99

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 1 Grp 2 Grp 3

Mean .0001 .0009 .0003

## Variable TENSILE

## By Variable RECAST (the time of casting) RATIO 3

## Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	913605359.8	456802679.9	12.9116	.0007
Within Groups	14	495309496.8	35379249.77		
Total	16	1408914857			

Variable TENSILE

By Variable RECAST (the time of casting) RATIO 3

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

MEAN(J)-MEAN(I) >= 4205.9036 \* RANGE \* SQRT(1/N(I) + 1/N(J))

with the following value(s) for RANGE: 3.87

## (\*) Indicates significant differences which are shown in the lower triangle

		Grp	Grp	Grp
Mean	RECAST	3	2	1
78793.9705	Grp 3			
86134.8172	Grp 2			
96183.0272	Grp 1	*	*	
	95		9 1.	

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 1

\* Mean 96183.0272

Subset 2 Group Grp 2 Grp 3

Mean 86134.8172 78793.9705

-----

## By Variable RECAST (the time of casting) RATIO 3

## Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	3.1105	1.5553	1.8910	.1875
Within Groups	14	11.5140	.8224		
Total	16	14.6245			

Variable **ELONGATE** 

By Variable RECAST (the time of casting) RATIO 3

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

MEAN(J)-MEAN(I) >= .6413 \* RANGE \* SQRT(1/N(I) + 1/N(J))

with the following value(s) for RANGE: 3.87

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 1 Grp 2 Grp 3

Mean 1.175 1.150 2.059

## By Variable RECAST (the time of casting) RATIO 3

## Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	.0000	.0000	2.7684	.0970
Within Groups	14	.0001	.0000		
Total	16	.0001			

Variable STRAIN

By Variable RECAST (the time of casting) RATIO 3

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

MEAN(J)-MEAN(I) >= .0016 \* RANGE \* SQRT(1/N(I) + 1/N(J))

with the following value(s) for RANGE: 3.87

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 1 Grp 2 Grp 3 Mean .0007 .0003 .0003

#### Variable TENSILE

By Variable RECAST (the time of casting) RATIO 4

## Analysis of Variance

D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
2	7376133954	3688066977	78.1750	.0000
15	707655543.9	47177036.2	6	
17	8083789498			
	2	2 7376133954 15 707655543.9	2 7376133954 3688066977 15 707655543.9 47177036.2	2 7376133954 3688066977 78.1750 15 707655543.9 47177036.26

Variable TENSILE

By Variable RECAST (the time of casting) RATIO 4

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

MEAN(J)-MEAN(I) >= 4856.8012 \* RANGE \* SQRT(1/N(I) + 1/N(J))

with the following value(s) for RANGE: 3.84

### (\*) Indicates significant differences which are shown in the lower triangle

Grp Grp Grp

Mean RECAST 3 2 1

71291.8742 Grp 3

83987.1097 Grp 2 \*

119150.4150 Grp 1 \* \*

Homogeneous Subsets (highest and lowest means are not significantly different)

 Subset 1 Group
 Grp 3
 Subset 2 Group
 Grp 2

 Mean
 71291.8742
 Mean
 83987.1097

Subset 3 Group Grp 1

Mean 119150.4150

## By Variable RECAST (the time of casting) RATIO 4

#### Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	.0000	.0000	6.9872	.0079
Within Groups	14	.0000	.0000	•	
Total	16	.0000			

Variable STRAIN

By Variable RECAST (the time of casting) RATIO 4

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

MEAN(J)-MEAN(I) > = .0003 \* RANGE \* SQRT(1/N(I) + 1/N(J))

with the following value(s) for RANGE: 3.87

## (\*) Indicates significant differences which are shown in the lower triangle

		Grp	Grp	Grp	
Mean	RECAST	2	1	3	
.0003	Grp 2				
.0004	Grp 1	, .			
.0012	Grp 3	19" 1	*		

.0012

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 3 Mean

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 2 Group Grp 2 Grp 1 Mean .0004 .0003

### By Variable RECAST (the time of casting) RATIO 4

## Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	.0000	.0000	6.9872	.0079
Within Groups	14	.0000	.0000		
Total	16	.0000			

Variable STRAIN

By Variable RECAST (the time of casting) RATIO 4

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

MEAN(J)-MEAN(I) >= .0003 \* RANGE \* SQRT(1/N(I) + 1/N(J))

with the following value(s) for RANGE: 3.87

## (\*) Indicates significant differences which are shown in the lower triangle

		Grp	Grp	Grp	
Mean	RECAST	2	1	3	
.0003	Grp 2				
.0004	Grp 1	,			
.0012	Grp 3	*	3		

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 3

Mean .0012

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 2 Group Grp 2 Grp 1

Mean .0004 .0003

\_\_\_\_\_\_

Variable TENSILE

By Variable RATIO (ratio of the old and new alloys weight) CASTING 1

#### Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	2412058769	804019589.6	66.0584	.0000
Within Groups	19	231255419.0	12171337.84		
Total	22	2643314188			

Variable TENSILE

By Variable RATIO (ratio of the old and new alloys weight) CASTING 1

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

MEAN(J)-MEAN(I) >= 2466.9149 \* RANGE \* SQRT(1/N(I) + 1/N(J))

with the following value(s) for RANGE: 4.33

## (\*) Indicates significant differences which are shown in the lower triangle

Grp Grp Grp Grp

Mean RATIO 2 3 1 4

94197.8644 Grp 2

96183.0272 Grp 3

97172.1512 Grp 1

119150.4150 Grp 4 \* \* \*

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 4

Mean 119150.4150

Subset 2 Group Grp 1 Grp 3 Grp 2

Mean 97172.1512 96183.0272 94197.8644

By Variable RATIO (ratio of the old and new alloys weight) CASTING 1

#### Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	16.6200	5.5400	16.4790	.0000
Within Groups	19	6.3875	.3362		
Total	22	23.0075			

Variable **ELONGATE** 

By Variable RATIO (ratio of the old and new alloys weight) CASTING 1

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

MEAN(J)-MEAN(I) >= .4100 \* RANGE \* SQRT(1/N(I) + 1/N(J))

with the following value(s) for RANGE: 4.33

(\*) Indicates significant differences which are shown in the lower triangle

Grp Grp Grp

Mean RATIO 1 2 3 4

.6648 Grp 1

.8868 Grp 2

1.1752 Grp 3

2.7998 Grp 4

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 4

Mean 2.7998

Subset 2 Group Grp 3 Grp 2 Grp 1

Mean 1.1752 .8868 .6648

## By Variable RATIO (ratio of the old and new alloys weight) CASTING 1

### Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	.0000	.0000	2.9808	.0573
Within Groups	19	.0000	.0000		
Total	22	.0000			

Variable STRAIN

By Variable RATIO (ratio of the old and new alloys weight) CASTING 1

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

MEAN(J)-MEAN(I) >= .0002 \* RANGE \* SQRT(1/N(I) + 1/N(J))

with the following value(s) for RANGE: 4.33

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 1 Grp 2 Grp 3 Grp 4

Mean .0005 .0001 .0007 Homogeneous Subsets

#### Variable TENSILE

By Variable RATIO (ratio of the old and new alloys weight) CASTING 2

## Analysis of Variance

D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
3	17345670.76	5781890.254	.1609	.9212
17	610818411.1	35930494.77		
20	628164081.9			
	3 17	3 17345670.76 17 610818411.1	3 17345670.76 5781890.254 17 610818411.1 35930494.77	3 17345670.76 5781890.254 .1609 17 610818411.1 35930494.77

Variable TENSILE

By Variable RATIO (ratio of the old and new alloys weight) CASTING 2

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

MEAN(J)-MEAN(I) >= 4238.5431 \* RANGE \* SQRT(1/N(I) + 1/N(J))

with the following value(s) for RANGE: 4.38

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 1 Grp 2 Grp 3 Grp 4

Mean 83,881.007 84,184.708 86,134.817 83,987.109

## By Variable RATIO (ratio of the old and new alloys weight) CASTING 2

### Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	7.4145	2.4715	5.2934	.0092
Within Groups	17	7.9373	.4669		
Total	20	15.3518			

#### Variable ELONGATE

By Variable RATIO (ratio of the old and new alloys weight) CASTING 2

Multiple Range Tests: Scheffe test with significance level .05

Harmonic Mean Cell size = 5.2174

The actual range used is the listed RANGE \* .2991

with the following value(s) for RANGE: 4.38

### (\*) Indicates significant differences which are shown in the lower triangle

•		Grp	Grp	Grp	Grp	
Mean	RATIO	1	3	2	4	
.3364	Grp 1					
1.1502	Grp 3					
1.6880	Grp 2	19				
1.8642	Grp 4					

Homogeneous Subsets (highest and lowest means are not significantly different)

	Subset 1	Group	Grp 1	Grp 3	
	•	Mean	.3364	1.1502	
٠					
	Subset 2	Group	Grp 3	Grp 2	Grp 4
		Mean	1.1502	1.6880	1.8642

## By Variable RATIO (ratio of the old and new alloys weight) CASTING 2

## Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	.0000	.0000	1.7047	.2038
Within Groups	17	.0000	.0000		
Total	20	.0000			

Variable STRAIN

By Variable RATIO (ratio of the old and new alloys weight) CASTING 2

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

MEAN(J)-MEAN(I) >= .0004 \* RANGE \* SQRT(1/N(I) + 1/N(J))

with the following value(s) for RANGE: 4.38

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 2 Grp 4 Grp 3 Grp 1

Mean .0009 .0003 .0003 .0003

.......

#### Variable TENSILE

By Variable RATIO (ratio of the old and new alloys weight) CASTING 3

## Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	488026272.0	162675424.0	2.6081	.0815
Within Groups	19	1185103147	62373849.82	,	
Total	22	1673129418			

Variable TENSILE

By Variable RATIO (ratio of the old and new alloys weight) CASTING 3

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

MEAN(J)-MEAN(I) >= 5584.5255 \* RANGE \* SQRT(1/N(I) + 1/N(J))

with the following value(s) for RANGE: 4.33

No two groups are significantly different at the ...050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 3 Grp 4 Grp 1 Grp 2

Mean 78,793.969 71,299.874 68,288.847 67,084.180

By Variable RATIO (ratio of the old and new alloys weight) CASTING 3

## Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	7.9834	2.6611	2.0674	.1385
Within Groups	19	24.4565	1.2872		
Total	22	32.4399			

Variable **ELONGATE** 

By Variable RATIO (ratio of the old and new alloys weight) CASTING 3

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

MEAN(J)-MEAN(I) >= .8022 \* RANGE \* SQRT(1/N(I) + 1/N(J))

with the following value(s) for RANGE: 4.33

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 3 Grp 2 Grp 4 Grp 1

Mean 2.059 1.559 0.782 0.588

By Variable RATIO (ratio of the old and new alloys weight) CASTING 3

## Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	.0000	.0000.	2.1661	.1319
Within Groups	16	.0001	.0000		
Total	19	.0001			

Variable STRAIN

By Variable RATIO (ratio of the old and new alloys weight) CASTING 3

Multiple Range Tests: Scheffe test with significance level .05

The difference between two means is significant if

MEAN(J)-MEAN(I) >= .0015 \* RANGE \* SQRT(1/N(I) + 1/N(J))

with the following value(s) for RANGE: 4.41

No two groups are significantly different at the .050 level

Homogeneous Subsets (highest and lowest means are not significantly different)

Subset 1 Group Grp 3 Grp 4 Grp 1 Grp 2

Mean .0032 .0012 .0003 .0003

# ประวัติผู้เขียน

นายปรินทร หริรักษาพิทักษ์ เกิดวันที่ 24 เมษายน พ.ศ. 2512 ที่อำเภอหาดใหญ่ จังหวัดสงขลา สำเร็จการศึกษาปริญญาตรีทันตแพทยศาสตรบัณฑิต คณะทันตแพทยศาสตร์ มหาวิทยาลัยสงขลานครินทร์ ในปีการศึกษา 2536 สำเร็จการศึกษาระดับประกาศนียบัตรบัณฑิต สาขาวิทยาศาสตร์การแพทย์คลินิก (ทันตกรรมประดิษฐ์) คณะทันตแพทยศาสตร์ จุฬาลงกรณ์ มหาวิทยาลัย ในปีการศึกษา 2538 และเข้าศึกษาต่อในหลักสูตรวิทยาศาสตรมหาบัณฑิต สาขาวิชาทันตกรรมประดิษฐ์ ที่จุฬาลงกรณ์มหาวิทยาลัย เมื่อ พ.ศ. 2538 ปัจจุบันรับราชการใน ตำแหน่งอาจารย์ประจำภาควิชาทันตกรรมอนุรักษ์ คณะทันตแพทยศาสตร์ มหาวิทยาลัยสงขลานครินทร์



สถาบันวิทยบริการ จุฬาลงกรณ์มหาวิทยาลัย