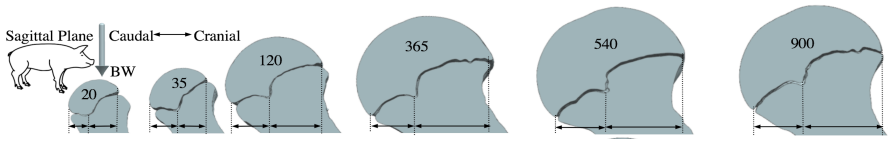
Sagittal Plane Epiphyseal Expansion [mm]

Age [Days]	Cranial	Caudal	Difference
120 1R	14.0	10.0	4.0
120 2R	13.0	8.0	5.0
120 3R	13.0	9.0	4.0
120 4R	14.0	9.0	5.0
1201L	14.0	9.0	5.0
120 2L	14.0	9.0	5.0
120 3L	14.0	9.0	5.0
120 4L	15.0	9.0	6.0
Mean	13.88	9.00	4.88
SD	0.64	0.53	0.64

Age [Days]	Cranial	Caudal	Difference
900 1R	23.0	15.0	8.0
900 2R	19.0	13.0	6.0
900 3R	21.0	13.0	8.0
9001L	24.0	15.0	9.0
900 2L	20.0	13.0	7.0
900 3L	20.0	13.0	7.0
Mean	21.17	13.67	7.50
SD	1.94	1.03	1.05



Cranial Expansion vs Cuadal Expansion 120 Days

Descriptive Statistics

	Difference
Mean	4.9
Standard Erro	0.226581742
Median	5.0
Mode	5
Standard Dev	0.640869944
Sample Varia	0.410714286
Kurtosis	0.741020794
Skewness	0.067842565
Range	2
Maximum	6.0
Minimum	4.0
Sum	39.0
Count	8
Geometric M	4.837713633
Harmonic Me	4.8
AAD	0.4375
MAD	0
IQR	0.25

Box Plot

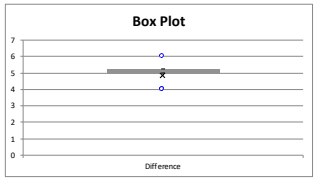
	Difference
Min	5
Q1-Min	0
Med-Q1	0.25
Q3-Med	0
Max-Q3	0
Mean	4.9
Min	5
Q1	4.75
Median	5.0
Q3	5
Max	5
Mean	4.9
Grand Min	0
Outliers	4.0
	4.0
	6.0

Shapiro-Wilk Test

	Difference
W-stat	0.81042498
p-value	0.03697051
alpha	0.05
normal	no

d'Agostino-Pearson

DA-stat	0.25852895
p-value	0.87874153
alpha	0.05
normal	yes



Cranial Expansion vs Cuadal Expansion 120 Days

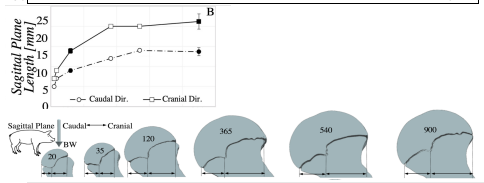
Wilcoxon Signed-Rank Test for Paired Samples

	Cranial	Caudal
median	14.0	9.0
	Difference	
count	8	5.0
# unequal	8	
T+	0	
T-	36	
T	0	
	one tail	two tail
alpha	0.05	
mean	18	
std dev	6.955213872	ties
z-score	2.587986557	
effect r	0.646996639	
T-crit	6.559691237	4.36803131
p-value	0.004826937	0.00965387
sig (norm)	yes	yes
T-crit	5	3
sig (table)	yes	yes
p-value	0.00390625	0.0078125
sig (exact)	yes	yes

Hodges-Lehmann estimation for the difference betweenpopulation medians

Walsh Averages (row+column)/2

4.0	4	4.5	4	4.5	4.5	4.5	4.5	5
5.0		5	4.5	5	5	5	5	5.5
4.0			4	4.5	4.5	4.5	4.5	5
5.0				5	5	5	5	5.5
5.0					5	5	5	5.5
5.0						5	5	5.5
5.0							5	5.5
6.0								6



The 120-day-old average cranial (*Mdn* = 14.0 mm) expansion with respect to the tubercle was larger than caudal (*Mdn* = 9.0 mm) expansion.
A Wilcoxon signed-rank test indicated this difference (5.0 mm) was statistically significant, 95% CI [4.0, 5.50], *T* = 0, *z* = 2.52 *P* = .001, with a large effect size (*r* = .64).

Calculate the 95% CI 1

alpha	0.05
T-crit	3.00
alpha	0.04
lower	4.00
upper	5.50
median	5.00
T-crit+	4.00
alpha	0.05
lower	4.50
upper	5.50

SRINV(alpha, N)
SRDIST(T-crit, N)
SMALL(H7:V21,T-crit)
LARGE(H7:V21,T-crit)
MEDIAN(H7:V21)
T-crit + 1
SRDIST(T-crit+, N)
SMALL(H7:V21,T-crit+)
LARGE(H7:V21,T-crit+)

The 95%CI for the median is:
95%CI = [4.00, 5.50]

Effect size	Effect size
Choen's *d* score	Choen's *r* score
0.2 Small	0.1 Small
0.5 Medium	0.3 Medium
0.8 Large	0.5 Large

Cranial Expansion vs Caudal Expansion 900 Days

Descriptive Statistics

	Difference
Mean	7.5
Standard Erro	0.428174419
Median	7.5
Mode	8
Standard Dev	1.048808848
Sample Varia	1.1
Kurtosis	-0.247933884
Skewness	9.99201E-17
Range	3
Maximum	9.0
Minimum	6.0
Sum	45.0
Count	6
Geometric M	7.43809354
Harmonic Me	7.375609756
AAD	0.833333333
MAD	0.5
IQR	1

Box Plot

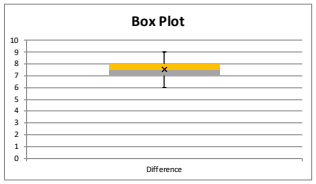
	Difference
Min	6
Q1-Min	1
Med-Q1	0.5
Q3-Med	0.5
Max-Q3	1
Mean	7.5
Min	6
Q1	7
Median	7.5
Q3	8
Max	9
Mean	7.5
Grand Min	0
Outliers	

Shapiro-Wilk Test

	Difference
W-stat	0.96004477
p-value	0.82008561
alpha	0.05
normal	yes

d'Agostino-Pearson

DA-stat	0.0202855
p-value	0.98990851
alpha	0.05
normal	yes



Cranial Expansion vs Caudal Expansion 900 Days

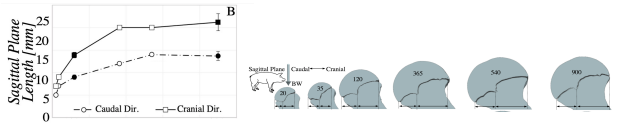
T Test: Two Paired Samples

SUMMARY — Alpha 0.05 — Hyp Mean Di 0

Groups	*Count*	*Mean*	*Std Dev*	*Std Err*	*t*	*df*	*Cohen d*	*Effect r*
Cranial	6	21.17	1.94079022					
Caudal	6	13.67	1.03279556					
Difference	6	7.50	1.04880885	0.42817442	17.5162262	5	7.15096942	0.99195011

T TEST

	p-value	*t-crit*	*lower*	*upper*	*sig*
One Tail	5.55935E-06	2.01504837			yes
Two Tail	1.11187E-05	2.57058184	6.39934262	8.60065738	yes



Effect size	Effect size
Choen's *d* score	Choen's *r* score
0.2 Small	0.1 Small
0.5 Medium	0.3 Medium
0.8 Large	0.5 Large

The 900-day-old average cranial (21.17 ± 1.94 mm) expansion with respect to the tubercle was larger than caudal (13.67 ± 1.03 mm) expansion.
This difference (7.50 mm), 95% CI [6.40, 8.60] was statistically significant ($t(5) = 17.52$, $P < .001$, with a large effect size ($d = 7.15$).

Cranial Expansion 120 to 900 Days

Normality Test For 120 Days

Descriptive Statistics

	Cranial
Mean	13.9
Standard Erro	0.226581742
Median	14.0
Mode	14
Standard Dev	0.640869944
Sample Varia	0.410714286
Kurtosis	0.741020794
Skewness	0.067842565
Range	2
Maximum	15.0
Minimum	13.0
Sum	111.0
Count	8
Geometric M	13.86204383
Harmonic Me	13.84908053
AAD	0.4375
MAD	0
IQR	0.25

Box Plot

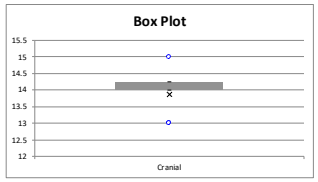
	Cranial
Min	14
Q1-Min	0
Med-Q1	0.25
Q3-Med	0
Max-Q3	0
Mean	13.9
Min	14
Q1	13.75
Median	14.0
Q3	14
Max	14
Mean	13.9
Grand Min	0
Outliers	13.0
	13.0
	15.0

Shapiro-Wilk Test

	Cranial
W-stat	0.81042498
p-value	0.03697051
alpha	0.05
normal	no

d'Agostino-Pearson

DA-stat	0.25852895
p-value	0.87874153
alpha	0.05
normal	yes



Normality Test For 900 Days

Descriptive Statistics

	Cranial
Mean	21.2
Standard Erro	0.792324288
Median	20.5
Mode	20
Standard Dev	1.940790217
Sample Varia	3.766666667
Kurtosis	-1.242853787
Skewness	0.638367817
Range	5
Maximum	24.0
Minimum	19.0
Sum	127.0
Count	6
Geometric M	21.09414826
Harmonic Me	21.02345294
AAD	1.555555556
MAD	1
IQR	2.5

Box Plot

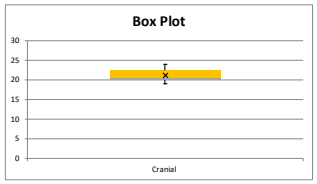
	Cranial
Min	19
Q1-Min	1
Med-Q1	0.5
Q3-Med	2
Max-Q3	1.5
Mean	21.2
Min	19
Q1	20
Median	20.5
Q3	22.5
Max	24
Mean	21.2
Grand Min	0
Outliers	

Shapiro-Wilk Test

	Cranial
W-stat	0.91237513
p-value	0.45220542
alpha	0.05
normal	yes

d'Agostino-Pearson

DA-stat	1.08026512
p-value	0.58267101
alpha	0.05
normal	yes



Cranial Expansion 120 to 900 Days

Mann-Whitney Test for Two Independent Samples

	Cranial	Cranial
count	6	8
median	20.50	14.00
rank sum	69	36
U	0	48

6.50

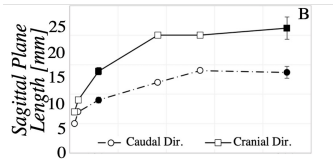
	one tail	two tail
alpha	0.05	
U	0	
mean	24	
std dev	7.556381482	ties
z-score	3.176123394	
effect r	0.848854683	
U-crit	11.57085851	9.18976444
p-value	0.000746287	0.00149257
sig (norm)	yes	yes
U-crit	10	7
sig (table)	yes	yes
p-value	0.000333	0.000666
sig (exact)	yes	yes

Calculate the 95% CI

Hodges-Lehmann estimation for the difference betweenpopulation medians

(m-n) table

	23	19	21	24	20	20
14.0	9.0	5.0	7.0	10.0	6.0	6.0
13.0	10.0	6.0	8.0	11.0	7.0	7.0
13.0	10.0	6.0	8.0	11.0	7.0	7.0
14.0	9.0	5.0	7.0	10.0	6.0	6.0
14.0	9.0	5.0	7.0	10.0	6.0	6.0
14.0	9.0	5.0	7.0	10.0	6.0	6.0
14.0	9.0	5.0	7.0	10.0	6.0	6.0
15.0	8.0	4.0	6.0	9.0	5.0	5.0



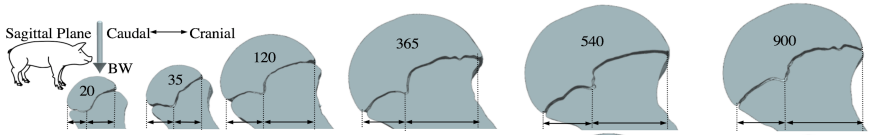
Calculate the 95% CI 3

alpha	0.05	
U-crit	8.00	MWINV(alpha, n2, n1)
alpha	0.04	MWDIST(U-crit, n1, n2)
lower	5.00	SMALL(F9:P20, U-crit)
upper	10.00	LARGE(F9:P20, U-Crit)
median	7.00	MEDIAN(F9:F20)
U-crit+	9.00	U-crit+1
alpha	0.06	MWDIST(U-crit+, n1, n2)
lower	6.00	SMALL(F9:P20, U-crit+)
upper	10.00	LARGE(F9:P20, U-Crit+)

95% CI = [5.0, 10.0]

Effect size Choen's *d* score	Effect size Choen's *r* score
0.2 Small	0.1 Small
0.5 Medium	0.3 Medium
0.8 Large	0.5 Large

The average cranial expansion with respect to the tubercel increased from 120-days-old (*Mdn* = 14.0 mm) to 900-days-old (*Mdn* = 20.5 mm).
A Mann-Whitney test indicated this difference (5.0 mm) was statistically significant, 95% CI [5.0, 10.0], $U(N_1 = 6, N_{120} = 8) = 0$, $z = 3.18$, $P < .001$, with a large effect size ($r = .84$).



Caudal Expansion 120 to 900 Days

Test For Normality 120 Days

Descriptive Statistics

	Caudal
Mean	9.0
Standard Erro	0.188982237
Median	9.0
Mode	9
Standard Dev	0.534522484
Sample Varia	0.285714286
Kurtosis	3.5
Skewness	0
Range	2
Maximum	10.0
Minimum	8.0
Sum	72.0
Count	8
Geometric M	8.98603551
Harmonic Me	8.971962617
AAD	0.25
MAD	0
IQR	0

Box Plot

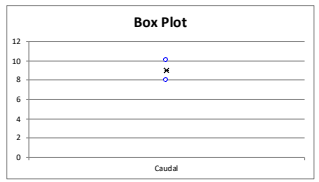
	Caudal
Min	9
Q1-Min	0
Med-Q1	0
Q3-Med	0
Max-Q3	0
Mean	9.0
Min	9
Q1	9
Median	9.0
Q3	9
Max	9
Mean	9.0
Grand Min	0
Outliers	10.0
	8.0

Shapiro-Wilk Test

	Caudal
W-stat	0.73219728
p-value	0.00518081
alpha	0.05
normal	no

d'Agostino-Pearson

DA-stat	5.5859375
p-value	0.06123914
alpha	0.05
normal	yes



Test For Normality 900 Days

Descriptive Statistics

	Caudal
Mean	13.7
Standard Erro	0.421637021
Median	13.0
Mode	13
Standard Dev	1.032795559
Sample Varia	1.066666667
Kurtosis	-1.875
Skewness	0.968245837
Range	2
Maximum	15.0
Minimum	13.0
Sum	82.0
Count	6
Geometric M	13.6351312
Harmonic Me	13.60465116
AAD	0.888888889
MAD	0
IQR	1.5

Box Plot

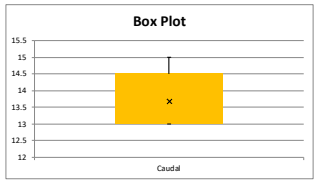
	Caudal
Min	13
Q1-Min	0
Med-Q1	0
Q3-Med	1.5
Max-Q3	0.5
Mean	13.7
Min	13
Q1	13
Median	13.0
Q3	14.5
Max	15
Mean	13.7
Grand Min	0
Outliers	

Shapiro-Wilk Test

	Caudal
W-stat	0.6398937
p-value	0.00135075
alpha	0.05
normal	no

d'Agostino-Pearson

DA-stat	2.47265625
p-value	0.29044875
alpha	0.05
normal	yes



Caudal Expansion 120 to 900 Days

Mann-Whitney Test for Two Independent Samples

	Caudal	Caudal
count	6	8
median	13.0	9.0
rank sum	69	36
U	0	48

4.0

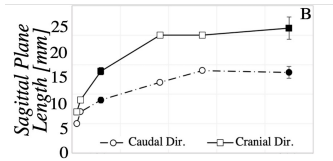
	one tail	two tail
alpha	0.05	
U	0	
mean	24	
std dev	7.343981613	ties
z-score	3.267982038	
effect r	0.873404938	
U-crit	11.92022521	9.60606054
p-value	0.000541586	0.00108317
sig (norm)	yes	yes
U-crit	10	7
sig (table)	yes	yes
p-value	0.000333	0.000666
sig (exact)	yes	yes

Calculate the 95% CI

Hodges-Lehmann estimation for the difference betweenpopulation medians

(m-n) table

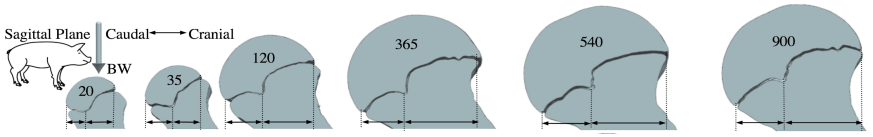
	15	13	13	15	13	13
10.0	5.0	3.0	3.0	5.0	3.0	3.0
8.0	7.0	5.0	5.0	7.0	5.0	5.0
9.0	6.0	4.0	4.0	6.0	4.0	4.0
9.0	6.0	4.0	4.0	6.0	4.0	4.0
9.0	6.0	4.0	4.0	6.0	4.0	4.0
9.0	6.0	4.0	4.0	6.0	4.0	4.0
9.0	6.0	4.0	4.0	6.0	4.0	4.0
9.0	6.0	4.0	4.0	6.0	4.0	4.0



Calculate the 95% CI 3

alpha	0.05	
U-crit	8.00	MWINV(alpha, n2, n1)
alpha	0.04	MWDIST(U-crit, n1, n2)
lower	4.00	SMALL(F9:P20, U-crit)
upper	6.00	LARGE(F9:P20, U-Crit)
median	4.00	MEDIAN(F9:F20)
U-crit+	9.00	U-crit+1
alpha	0.06	MWDIST(U-crit+, n1, n2)
lower	4.00	SMALL(F9:P20, U-crit+)
upper	6.00	LARGE(F9:P20, U-Crit+)

95% CI = [5.0, 10.0]

Effect size Choen's *d* score	Effect size Choen's *r* score
0.2 Small	0.1 Small
0.5 Medium	0.3 Medium
0.8 Large	0.5 Large

The average cudal expansion with respect to the tubercle increased from 120-days-old (*Mdn* = 9.0 mm) to 900-days-old (*Mdn* = 13.0 mm).
A Mann-Whitney test indicated this difference (4.0 mm) was statistically significant, 95% CI [4.0, 6.0], $U(N_1 = 6, N_{120} = 8) = 0$, $z = 3.27$, $P < .001$, with a large effect size ($r = .87$).