

Statistical Analysis

Numerical data were explored for normality by checking the distribution of data and using tests of normality (Kolmogorov-Smirnov and Shapiro-Wilk tests). All data showed normal (parametric) distribution except for changes in bone width, crestal bone loss as well as bone density data which showed non-normal (non-parametric) distribution. Parametric data were presented as mean, standard deviation (SD) values while non-parametric data were presented as median and range values. For parametric data; two-way repeated measures ANOVA test was used to compare between the groups as well as to study the changes by time within each group. One-way ANOVA test was used to compare between mean age values in the three groups. Bonferroni's post-hoc test was used for pair-wise comparisons when ANOVA test is significant. For non-parametric data; Kruskal-Wallis test was used to compare between the three groups. Wilcoxon signed-rank test was used to compare between bone density values at base line and after six months. Gender data were presented as frequencies and percentages. Fisher's Exact test was used to compare between the three groups. The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.

Results

I. Demographic data

There was no statistically significant difference between gender distributions in the three groups. There was also no statistically significant difference between mean age values in the three groups.

Table 1: Descriptive statistics and results of Fisher's Exact test and one-way ANOVA tests for comparisons between demographic data of the three groups

Demographic data	Densah (n = 7)	Piezo (n = 7)	Osteotome (n = 7)	P-value
Gender [n, (%)]				
Male	2 (28.6%)	3 (42.9%)	4 (57.1%)	0.854
Female	5 (71.4%)	4 (57.1%)	3 (42.9%)	
Age [Mean, SD]	50.7 (5.6)	49.3 (7.2)	50.1 (7.7)	0.927

*: *Significant at $P \leq 0.05$*

II. Implant stability (RFA)

a. Comparison between groups

At base line; there was a statistically significant difference between mean implant stability measurements in the three groups. Pair-wise comparisons between groups revealed that Densah showed the statistically significantly highest mean implant stability. Osteotome showed statistically significantly lower mean value. Piezo showed the statistically significantly lowest mean implant stability.

After six months; there was a statistically significant difference between mean implant stability measurements in the three groups. Pair-wise comparisons between groups revealed that Densah showed the statistically significantly highest mean implant stability. There was no statistically significant difference between Piezo and Osteotome; both showed the statistically significantly lowest mean implant stability measurements.

Table 2 : Descriptive statistics and results of two-way repeated measures ANOVA test for comparison between implant stability (RFA) in the two groups

Time	Densah (n = 7)		Piezo (n = 7)		Osteotome (n = 7)		P-value	Effect size (Partial Eta squared)
	Mean	SD	Mean	SD	Mean	SD		
Base line	85.4 ^A	4.4	63.7 ^C	5.1	69.1 ^B	4.3	<0.001*	0.822
6 months	78.9 ^A	4.1	71 ^B	6.1	71.9 ^B	3.6	0.011*	0.395

*: Significant at $P \leq 0.05$, Different superscripts in the same row are statistically significantly different

b. Changes within each group

As regards Densah group; there was a statistically significant decrease in implant stability after six months.

While for Piezo group; there was a statistically significant increase in implant stability after six months.

Finally regarding Osteotome group, there was no statistically significant change in implant stability after six months.

Table 3 : Descriptive statistics and results of two-way repeated measures ANOVA test for comparison between mesial bone height (mm) at different time periods within each group

Time	Densah (n = 7)		Piezo (n = 7)		Osteotome (n = 7)	
	Mean	SD	Mean	SD	Mean	SD
Base line	85.4	4.4	63.7	5.1	69.1	4.3
6 months	78.9	4.1	71	6.1	71.9	3.6
P-value	0.034*		0.020*		0.355	
Effect size (Partial Eta squared)	0.227		0.265		0.048	

*: Significant at $P \leq 0.05$

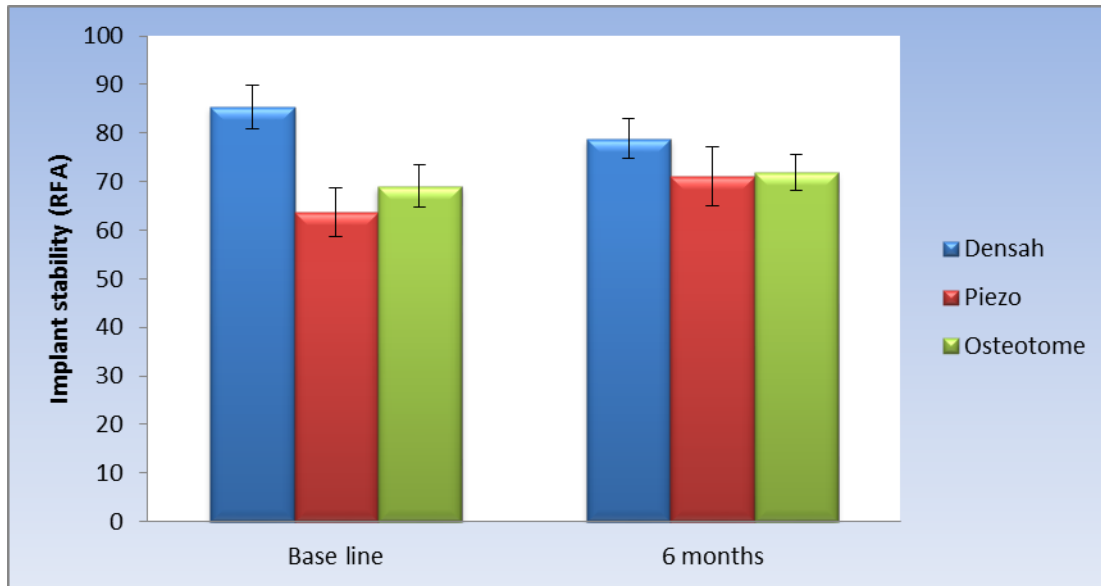


Figure 1 : Bar chart representing mean and standard deviation values for implant stability measurements in the three groups

III. Bone height (mm)

a. Comparison between bone height measurements in the three groups

At base line; there was no statistically significant difference between mean bone height measurements in the three groups.

After six months; there was a statistically significant difference between mean bone height measurements in the three groups. Pair-wise comparisons between groups revealed that Osteotome showed the statistically significantly highest mean bone height measurement. There was no statistically significant difference between Densah and Piezo; both showed the statistically significantly lowest mean bone height measurements.

Table 4 : Descriptive statistics and results of two-way repeated measures ANOVA test for comparison between bone height measurements (mm) in the three groups

Time	Densah (n = 7)		Piezo (n = 7)		Osteotome (n = 7)		P-value	Effect size (Partial Eta squared)
	Mean	SD	Mean	SD	Mean	SD		
Base line	4.66	0.37	4.7	0.45	4.68	0.26	0.982	0.002
6 months	10.47 ^B	0.59	10.41 ^B	0.49	11.61 ^A	0.53	0.001*	0.550

*: Significant at $P \leq 0.05$, Different superscripts in the same row are statistically significantly different

b. Changes within each group

In all groups; there was a statistically significant increase in bone height after six months.

Table 5 : Descriptive statistics and results of two-way repeated measures ANOVA test for comparison between bone height measurements (mm) at different time periods within each group

Time	Densah (n = 7)		Piezo (n = 7)		Osteotome (n = 7)	
	Mean	SD	Mean	SD	Mean	SD
Base line	4.66	0.37	4.7	0.45	4.68	0.26
6 months	10.47	0.59	10.41	0.49	11.61	0.53
<i>P</i> -value	<0.001*		<0.001*		<0.001*	
<i>Effect size (Partial Eta squared)</i>	0.984		0.983		0.988	

*: Significant at $P \leq 0.05$

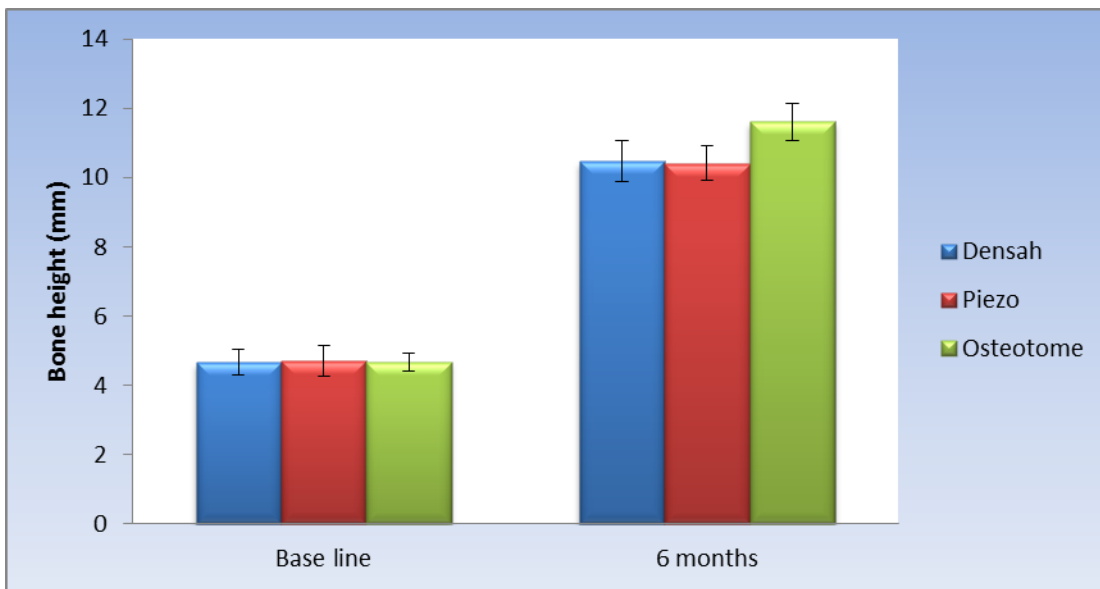


Figure 2 : Bar chart representing mean and standard deviation values for bone height measurements in the three groups

c. Comparison between amounts of bone gain in the three groups

After six months; there was a statistically significant difference between mean amounts of bone gain in the three groups. Pair-wise comparisons between groups revealed that Osteotome showed the statistically significantly highest mean bone gain. There was no statistically significant difference between Densah and Piezo; both showed the statistically significantly

lowest mean bone gain measurements.

Table 6 : Descriptive statistics and results of one-way ANOVA test for comparison between bone gain (mm) in the three groups

Densah (n = 7)		Piezo (n = 7)		Osteotome (n = 7)		P-value	Effect size (Eta squared)
Mean	SD	Mean	SD	Mean	SD		
5.81 ^B	0.51	5.72 ^B	0.44	6.93 ^A	0.45	<0.001*	0.617

*: Significant at $P \leq 0.05$

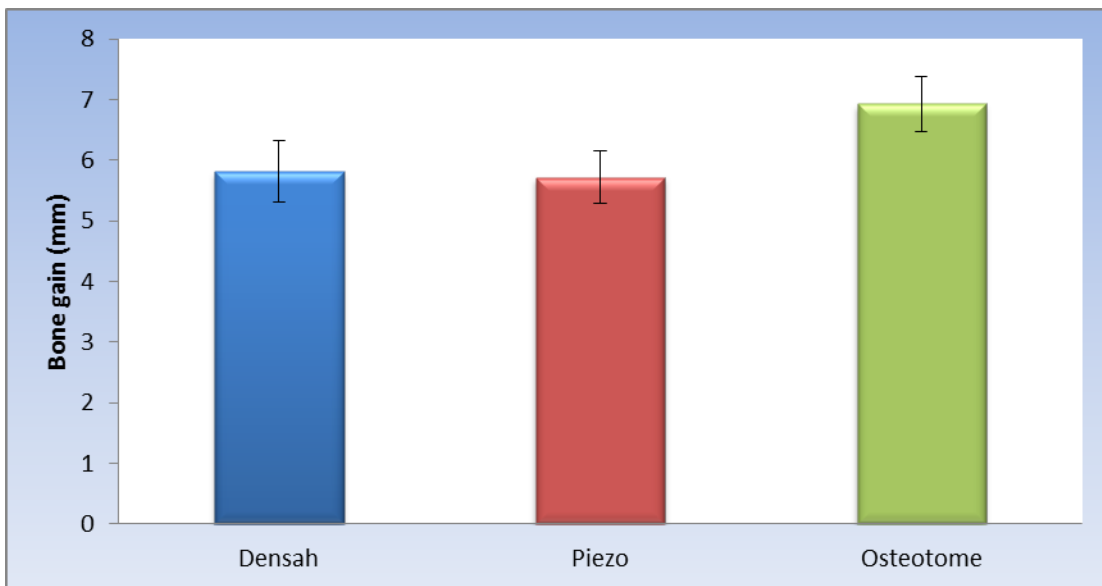


Figure 3 : Bar chart representing mean and standard deviation values for bone gain in the three groups

IV. Bone width (mm)

a. Comparison between bone width measurements in the three groups

At base line as well as after six months; there was no statistically significant difference between mean bone width measurements in the three groups.

Table 7 : Descriptive statistics and results of two-way repeated measures ANOVA test for comparison between bone width measurements (mm) in the three groups

Time	Densah (n = 7)		Piezo (n = 7)		Osteotome (n = 7)		P-value	Effect size (Partial Eta squared)
	Mean	SD	Mean	SD	Mean	SD		
Base line	7.28	1.53	7.27	1.25	7.36	1.26	0.990	0.001
6 months	7.36	1.73	7.22	1.17	7.12	1.02	0.946	0.006

*: Significant at $P \leq 0.05$

b. Changes within each group

In all groups; there was no statistically significant change in bone width after six months.

Table 8 : Descriptive statistics and results of two-way repeated measures ANOVA test for comparison between bone width measurements (mm) at different time periods within each group

Time	Densah (n = 7)		Piezo (n = 7)		Osteotome (n = 7)	
	Mean	SD	Mean	SD	Mean	SD
Base line	7.28	1.53	7.27	1.25	7.36	1.26
6 months	7.36	1.73	7.22	1.17	7.12	1.02
P-value	0.556		0.736		0.090	
Effect size (Partial Eta squared)	0.020		0.006		0.151	

*: Significant at $P \leq 0.05$

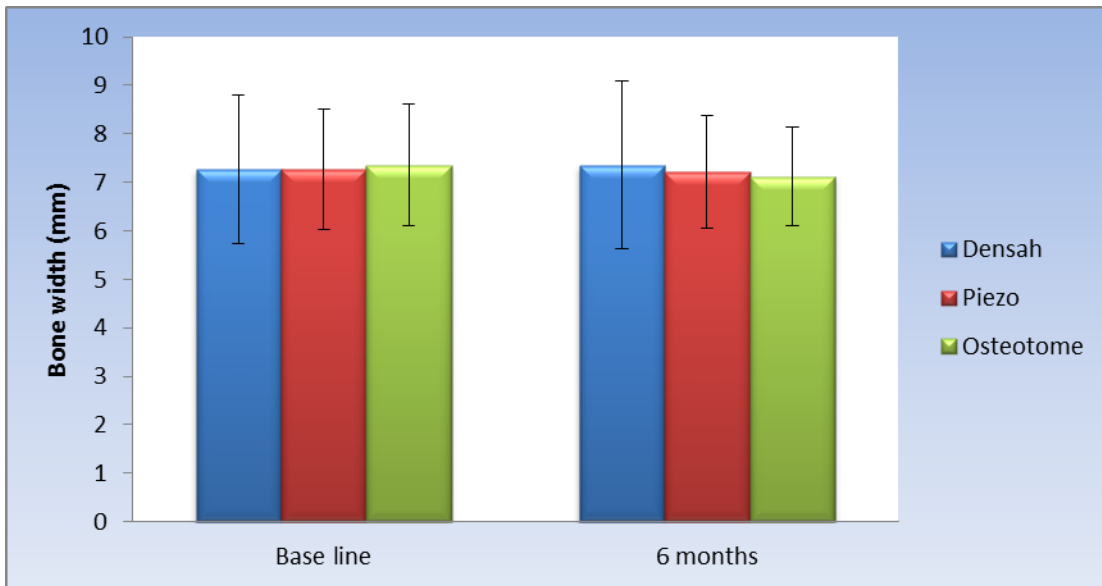


Figure 4 : Bar chart representing mean and standard deviation values for bone width measurements in the three groups

c. Comparison between changes in bone width in the three groups

After six months; there was no statistically significant difference between bone width changes in the three groups.

Table 9 : Descriptive statistics and results of Kruskal-Wallis test for comparison between changes in bone width (mm) in the three groups

Densah (n = 7)		Piezo (n = 7)		Osteotome (n = 7)		P-value	Effect size (Eta squared)
Median	Range	Median	Range	Median	Range		
0.2	-0.44 – 0.48	-0.03	-0.5 – 0.33	-0.2	-0.8 – 0.22	0.289	0.139

*: Significant at $P \leq 0.05$

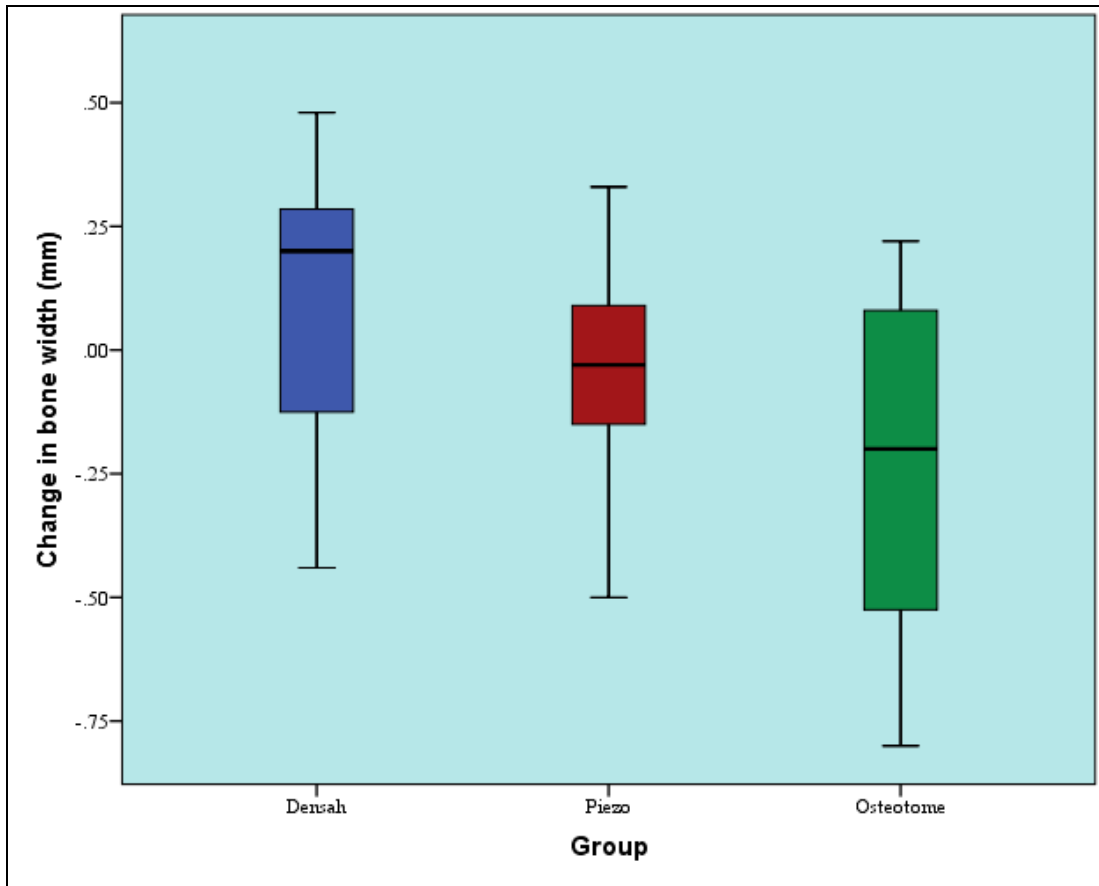


Figure 5 : Box plot representing median and range values for changes in bone width in the three groups

V. Crestal bone loss (mm)

At the buccal as well as palatal sides; there was no statistically significant difference between crestal bone loss in the three groups.

Similarly for the overall crestal bone loss (Mean of the buccal and palatal sides), there was no statistically significant difference between crestal bone loss in the three groups.

Table 10 : Descriptive statistics and results of Kruskal-Wallis test for comparison between crestal bone loss (mm) in the three groups

Side	Densah (n = 7)		Piezo (n = 7)		Osteotome (n = 7)		P-value	Effect size (Eta squared)
	Median	Range	Median	Range	Median	Range		
Buccal	0.24	0 – 0.96	0.7	0.45 – 1.2	0.6	0 – 1.14	0.193	0.188
Palatal	0.08	0 – 0.64	0.66	0.3 – 0.9	0.4	0 – 0.82	0.071	0.259
Overall	0.2	0 – 0.73	0.66	0.4 – 1.05	0.43	0 – 0.97	0.073	0.263

*: Significant at $P \leq 0.05$

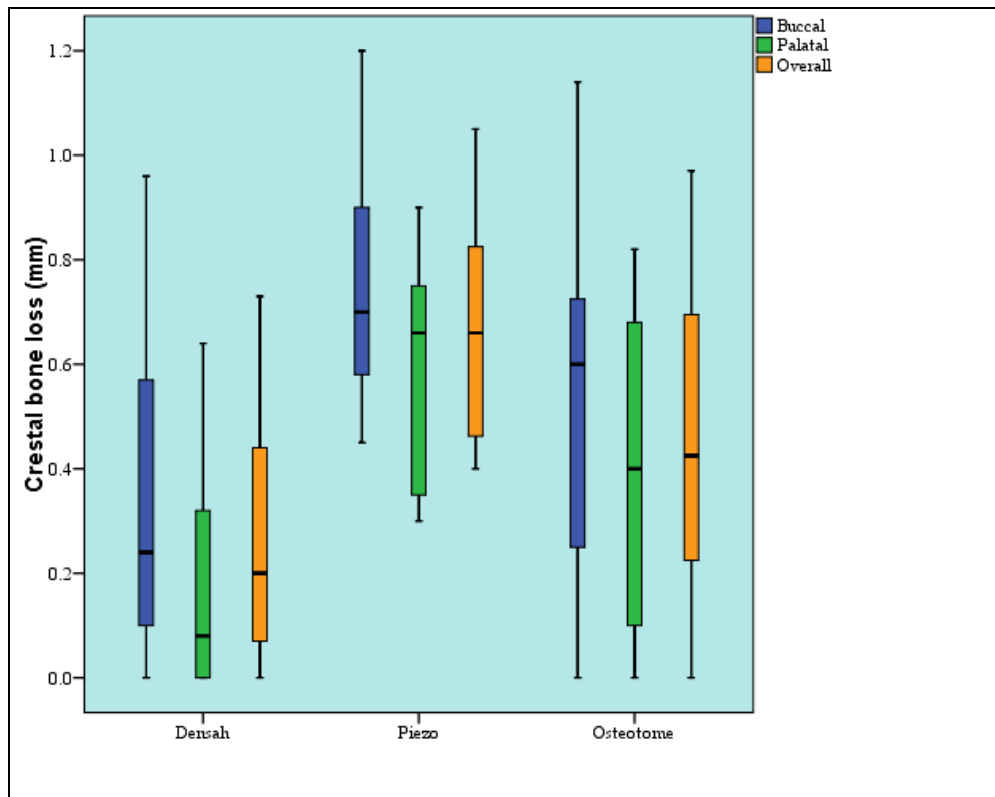


Figure 6 : Box plot representing median and range values for crestal bone loss in the three groups

VI. Bone density (HU)

a. Comparison between bone density measurements in the three groups

At base line as well as after six months; there was no statistically significant difference between bone density measurements in the three groups.

Table 11 : Descriptive statistics and results of Kruskal-Wallis test for comparison between bone density measurements (HU) in the three groups

Time	Densah (n = 7)		Piezo (n = 7)		Osteotome (n = 7)		P-value	Effect size (Eta squared)
	Median	Range	Median	Range	Median	Range		
Base line	266.4	106.6-464.4	224.8	124.9-412.1	248.8	166.2-523.9	0.754	0.023
6 months	660.3	350.9-740.2	560.4	388.1-701	530.4	444.8-890.7	0.580	0.031

*: Significant at $P \leq 0.05$

b. Changes within each group

In all groups; there was a statistically significant increase in bone density after six months.

Table 12 : Descriptive statistics and results of Wilcoxon signed-rank test for comparison between bone density measurements (HU) at different time periods within each group

Time	Densah (n = 7)		Piezo (n = 7)		Osteotome (n = 7)	
	Median	Range	Median	Range	Median	Range
Base line	266.4	106.6-464.4	224.8	124.9-412.1	248.8	166.2-523.9
6 months	660.3	350.9-740.2	560.4	388.1-701	530.4	444.8-890.7
P-value	0.018*		0.018*		0.018*	
Effect size (d)	3.996		3.996		3.996	

*: Significant at $P \leq 0.05$

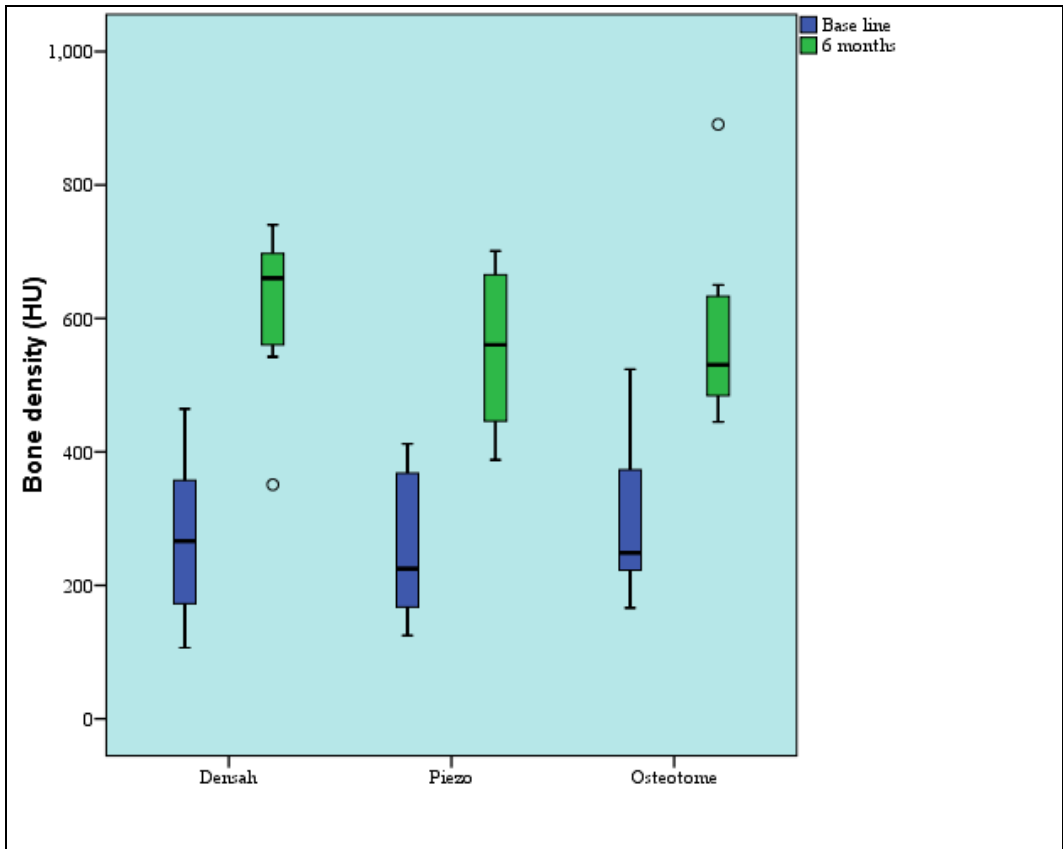


Figure 7 : Box plot representing median and range values for bone density measurements in the three groups (Circles represent outliers)