4. Result

4.1 Test specimens

4.1.1 Control Group

60% of the specimens that were immersed in pH 7 exhibited microleakage at the occlusal margin of the restoration. Microleakage score of 1, 2 and 3 were recorded in 10%, 20% and 30% of the specimens respectively (Table 4.1).Examination at the cervical margin showed 70% of the specimens had microleakage. Score 1 and 2 were seen in 20% of the specimens, while 30% exhibited score 3 (Table 4.4).

4.1.2 Acidic group

4.1.2.1 pH 2.5

80% of the specimens exhibited leakage at the occlusal margin of the restoration with 60% showed score 3 and 20% score 2 (Table 4.1). At the cervical margin, only 10% exhibited no leakage. Score 3 were seen in 60% of the specimens. 20% showed score 2 and only 10% showed score 1(Table 4.4).

4.1.2.2 pH 3.5

Occlusally, the amount of leakage and no leakage were equal. Score 3 were seen in 40% of the specimen and 10% showed scored 1(Table 4.1). Cervically, 60% of the specimens exhibited leakage with 40% showed score 3 and 10% showed score 2 and 1 (Table 4.4).

4.1.2.3 pH 4.5

In this group, 60% of the specimens had leakage at the occlusal margin.50% showed score 3 and 10% showed score 2 (Table 4.1).At the cervical margin, there were 60% leakage with 50% showed score 3 and 10% showed score 1 (Table 4.4).

4.1.2.4 pH 5.5

Half of the specimens exhibited leakage at the occlusal margin with score 3 (Table 4.1). Whereas at the cervical margin 60% of the specimens also had leakage, with score 3 (Table 4.4).

4.1.3 Alkaline Group

4.1.3.1 pH 8.5

Leakages at the occlusal margin were seen in 50% of the specimens. 30% showed score 3 and 10% each showed score 2 and 1(Table 4.1). Cervically, 70% of the specimens were leaked, score 3 and 2 showed 20% each and 30% showed with score 1(Table 4.4).

4.1.3.2 pH 11.5

At the occlusal margin, 50% of the specimens exhibited leakage with 40% score 3 and 10% score 2 (Table 4.1). While at the cervical margin only 10% of the specimens had no leakage. Specimens that leaked showed 30% score 3, 40% score 2 and 20% score 1 (Table 4.4).

4.2   Result of the SEM

In all three specimens, gap could be seen between composite restoration and the cavity walls. Larger gap could be seen at the cervical margin as compared to the occlusal margin (Figure 4.5, 4.6 and 4.7). Irregularities of the gap could be seen between the enamel and composite surface of the specimen in pH 2.5.

4.3 Summary of the results

The extent of microleakage was evaluated by examining the degree of dye penetration under an image analyzer using a scoring system. Microleakage at the occlusal and cervical margin was seen in all groups.

At the occlusal margin more leakage was seen in specimens that were immersed in pH 2.5. In this group, score 3 were higher (60%), compared to other groups (Figure 4.1 & 4.3). However Chi-Square Test showed that there was no significant association between pH and microleakage at this margin (p>0.05). When analyzed for the presence and absence of leakage between different pH groups with pairwise comparison using Fisher's Exact Test (Table 4.3), no significant association was also found.

At the cervical margin, samples in the most acidic (pH 2.5) and the most alkaline (pH 11.5) solution showed total leakage of 90%. In pH 2.5, score 3 was seen in 60% of the samples, while in pH 11.5, score 3 was seen in only 30% of the samples. 60% of the specimens that exhibited leakages in pH 5.5 were all score 3. From Chi-Square Test that was done, there was no significant association between pH and microleakage at the cervical margin (p>0.05) (Table 4.4 & 4.5). There was no significant association between pH and the presence or absence of leakage in difference pH group at the occlusal and the cervical margin. Pairwise comparison using Fisher's Exact Test showed p>0.05 (Table 4.6).

In this study, the microleakage pattern of Class V composite restoration showed more leakage at the cervical margin compared to the occlusal margin in all groups. 50 (71.4%) specimens showed leakage at the cervical margin, whereas at the occlusal margin leakage occurred in 40 (57.2%) specimens. However, pairwise comparison

using Fisher's Exact Test showed no statistical significant difference of leakage between the occlusal and cervical with p>0.05 (Table 4.7).

Table 4.1: Cross-tabulation table between pH and extent of microleakage at the occlusal margin of the cavity

pH	Extent of Microleakage at Occlusal Margin				Total
	0	1	2	3	
2.5	2 (20%)	0	2 (20%)	6 (60%)	10 (100%)
3.5	5 (50%)	1 (10%)	0	4 (40%)	10 (100%)
4.5	4 (40%)	0	1 (10%)	5 (50%)	10 (100%)
5.5	5 (50%)	0	0	5 (50%)	10 (100%)
7	4 (40%)	1 (10%)	2 (20%)	3 (30%)	10 (100%)
8.5	5 (50%)	1 (10%)	1 (10%)	3 (30%)	10 (100%)
11.5	5 (50%)	0	1 (10%)	4 (40%)	10 (100%)

Pearson Chi-Square value $=0.834$, $p>0.05$

Table 4.2: Cross-tabulation table between pH and microleakage at the occlusal margin of the cavity

pH	Occlusal Microleakage		Total
	No	Yes	
2.5	2 (20%)	8 (80%)	10 (100%)
3.5	5 (50%)	5 (50%)	10 (100%)
4.5	4 (40%)	6 (60%)	10 (100%)
5.5	5 (50%)	5 (50%)	10 (100%)
7	4 (40%)	6 (60%)	10 (100%)
8.5	5 (50%)	5 (50%)	10 (100%)
11.5	5 (50%)	5 (50%)	10 (100%)

Pearson Chi-Square value $= 0.301$, $p > 0.05$

Table 4.3: Pairwise comparison using Fisher's Exact Test for microleakage at the occlusal margin of the cavity

pH	3.5	4.5	5.5	7	8.5	11.5
2.5	ns 0.5	ns 0.5	ns 0.5	ns 0.5	ns 0.5	ns 0.5
3.5		ns 0.5	Leakage constant	ns 0.5	Leakage constant	Leakage constant
4.5			ns 0.5	Leakage constant	ns 0.5	ns 0.5
5.5				ns 0.5	Leakage constant	Leakage constant
7					Leakage constant	Leakage constant
8.5						Leakage constant

For p>0.05, ns: No significant differences

Table 4.4: Cross-tabulation table between pH and extent of microleakage at the cervical margin of the cavity

pH	Extent of Microleakage at Cervical Margin				Total
	0	1	2	3	
2.5	1	1	2	6	10
	(10%)	(10%)	(20%)	(60%)	(100%)
3.5	4	1	1	4	10
	(40%)	(10%)	(10%)	(40%)	(100%)
4.5	4	1		5	10
	(40%)	(10%)	0	(50%)	(100%)
5.5	4			6	10
	(40%)	0	0	(60%)	(100%)
7	3	2	2	3	10
	(30%)	(20%)	(20%)	(30%)	(100%)
8.5	3	3	2	2	10
	(30%)	(30%)	(20%)	(20%)	(100%)
11.5	1	2	4	3	10
	(10%)	(20%)	(40%)	(30%)	(100%)

Pearson Chi-Square value =0.339, p > 0.05

Table 4.5: Cross-tabulation table between pH and microleakage at the cervical margin of the cavity

pH	Cervical Microleakage		Total
	No	Yes	
2.5	1 (10%)	9 (90%)	10 (100%)
3.5	4 (40%)	6 (60%)	10 (100%)
4.5	4 (40%)	6 (60%)	10 (100%)
5.5	4 (40%)	6 (60%)	10 (100%)
7	3 (30%)	7 (70%)	10 (100%)
8.5	3 (30%)	7 (70%)	10 (100%)
11.5	1 (10%)	9 (90%)	10 (100%)

Pearson Chi-Square Value $= 0.279$, $p > 0.05$

Table 4.6: Pairwise comparison using Fisher's Exact Test for microleakage at the cervical margin of the cavity

pH	3.5	4.5	5.5	7	8.5	11.5
2.5	ns 0.5	ns 0.5	ns 0.5	ns 0.5	ns 0.5	Leakage constant
3.5		Leakage constant	Leakage constant	ns 0.5	ns 0.5	ns 0.5
4.5			Leakage constant	ns 0.5	ns 0.5	ns 0.5
5.5				ns 0.5	ns 0.5	ns 0.5
7					Leakage constant	ns 0.5
8.5						ns 0.5

For p>0.05 ns: No significant differences

Table 4.7: Comparison of microleakage at the occlusal margin and at the cervical margin of the cavity in all specimens

Location	No Leakage	Leakage	Total
Occlusal margin	30 (42.8%)	40 (57.2%)	70 (100%)
Cervical margin	20 (28.6%)	50 (71.4%)	70 (100%)

Pairwise comparison using Fisher's Exact Test showed p=0.5(p>0.05)
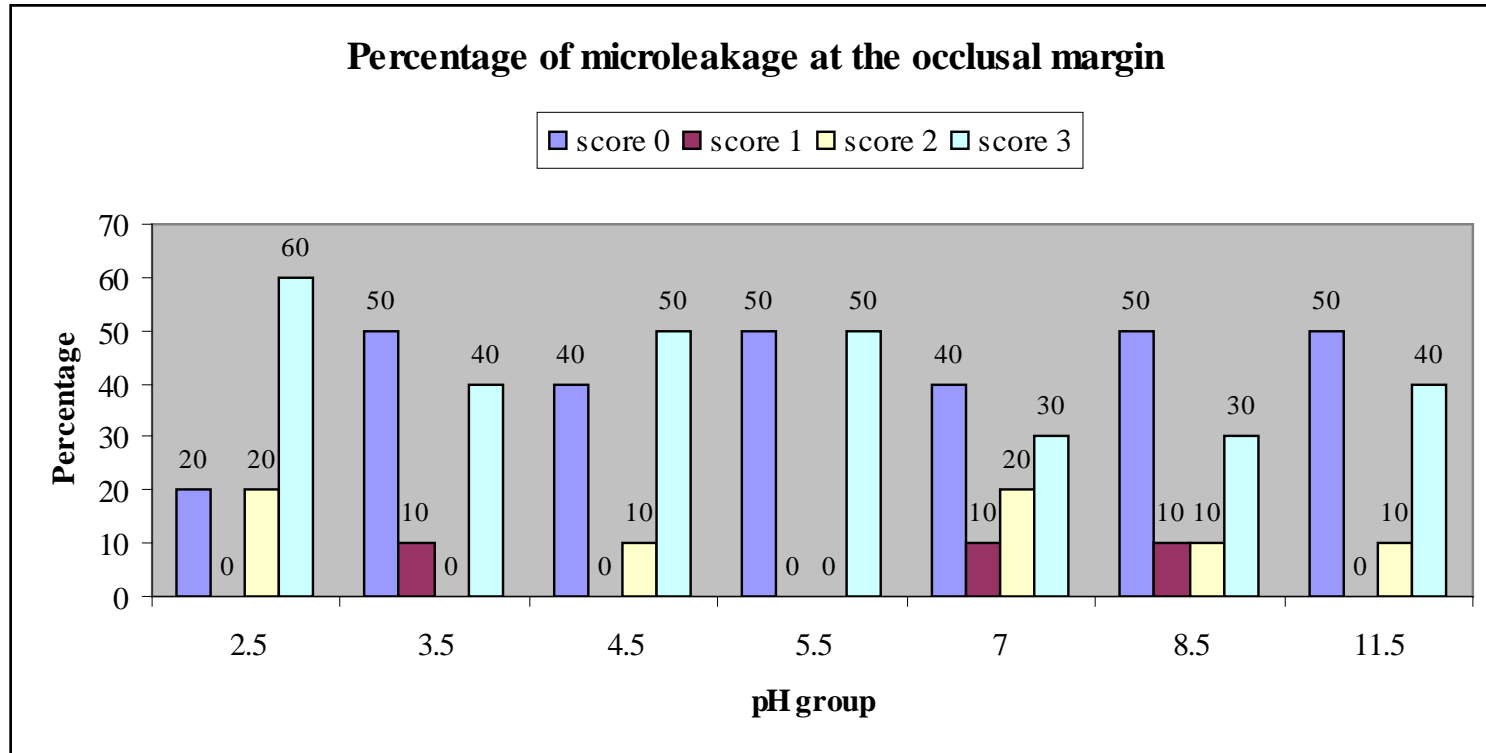
Figure 4.1: Percentage of microleakage at occlusal margin
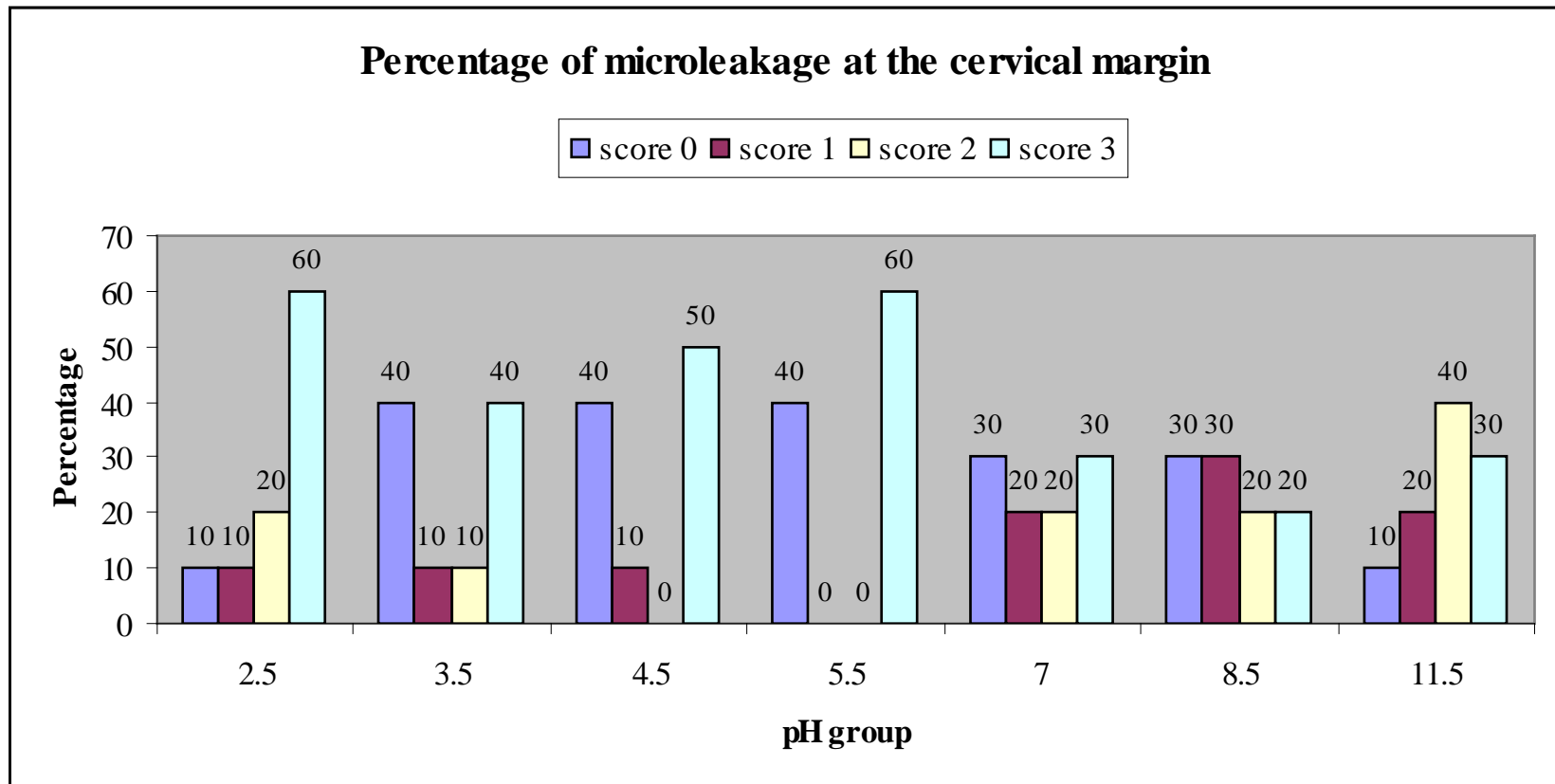
Figure 4.2: Percentage of microleakage at cervical margin
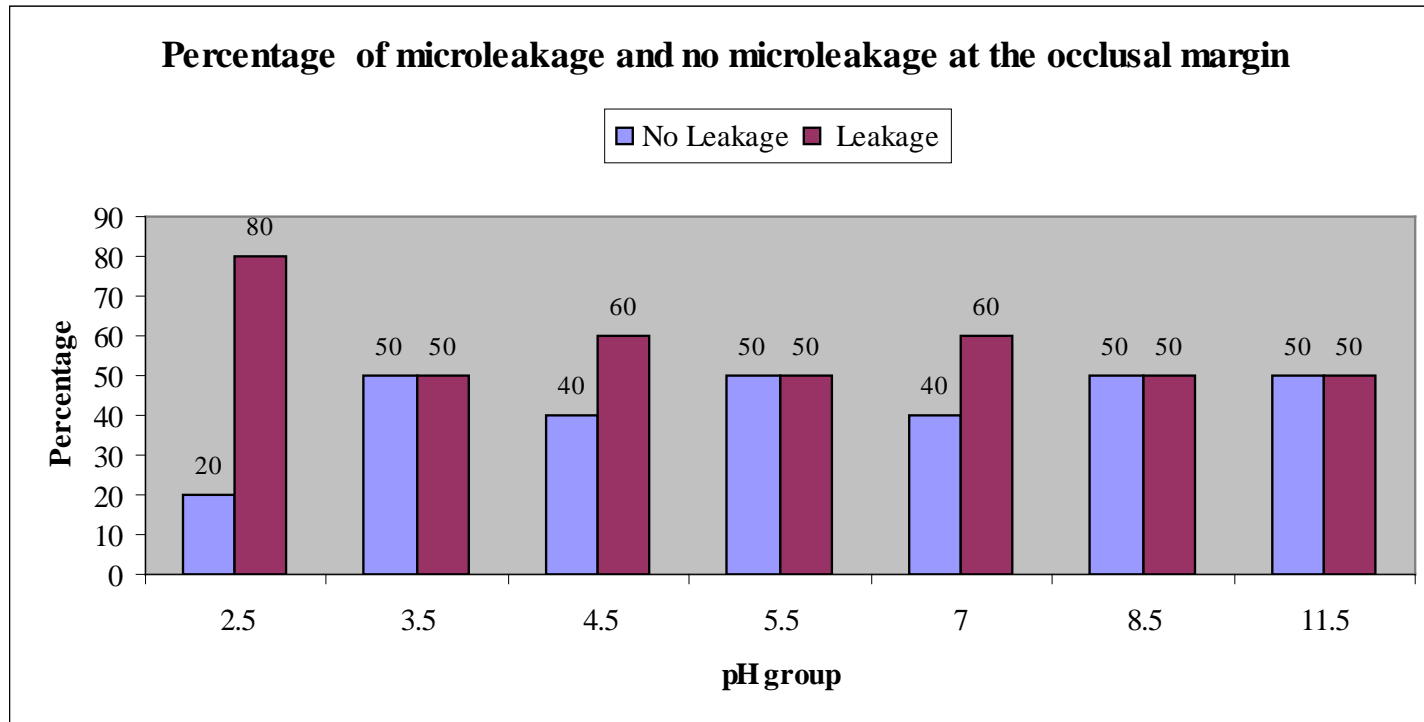
Figure 4.3: Percentage of microleakage and no microleakage at occlusal margin

Percentage of the microleakage and no microleakage at the cervical margin
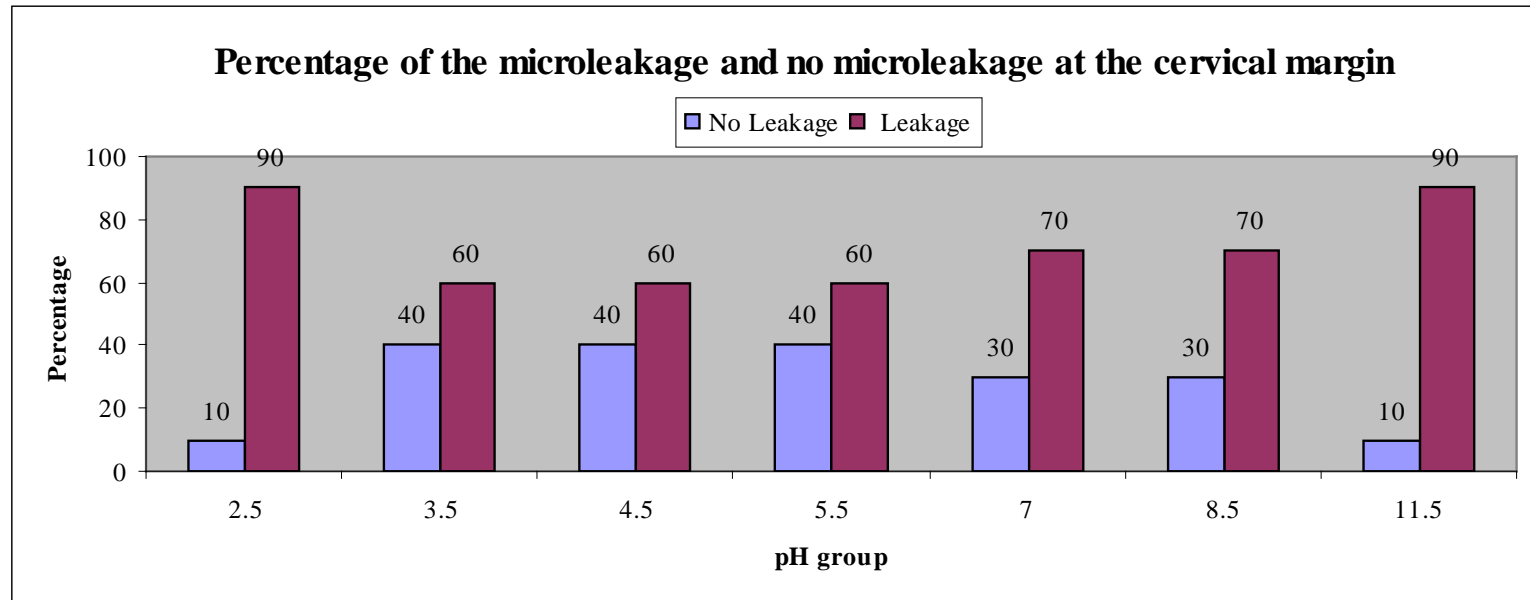
Figure 4.4: Percentage of microleakage and no microleakage at cervical margin
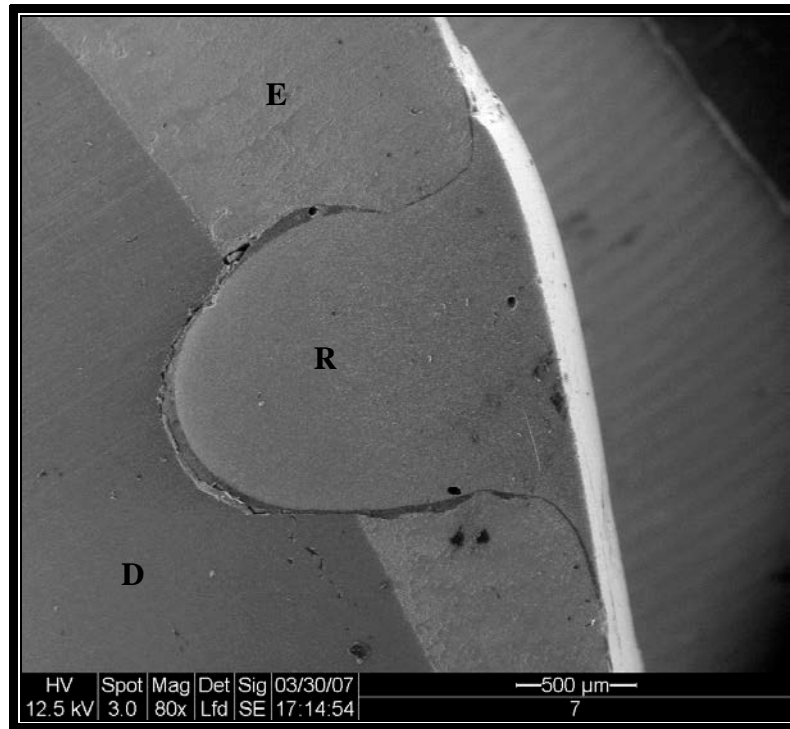
A
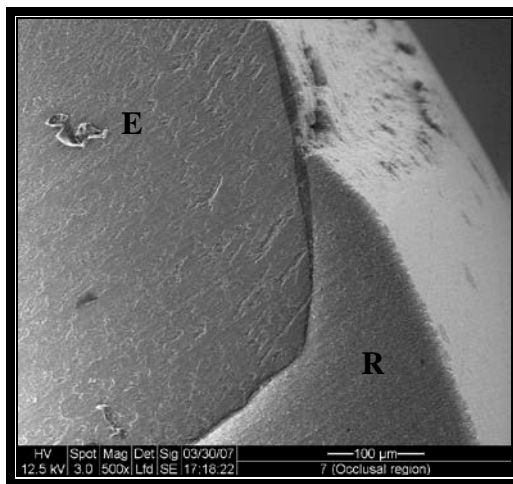
B
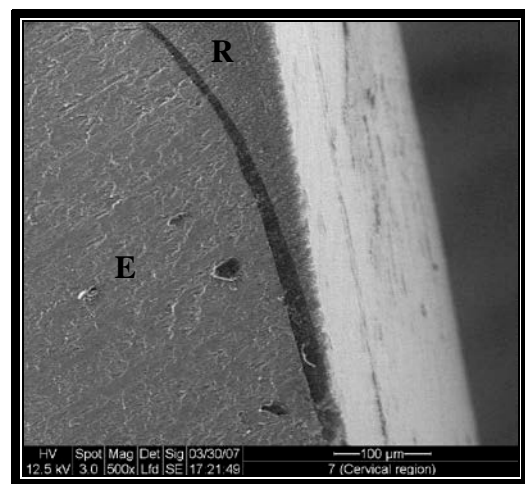
C

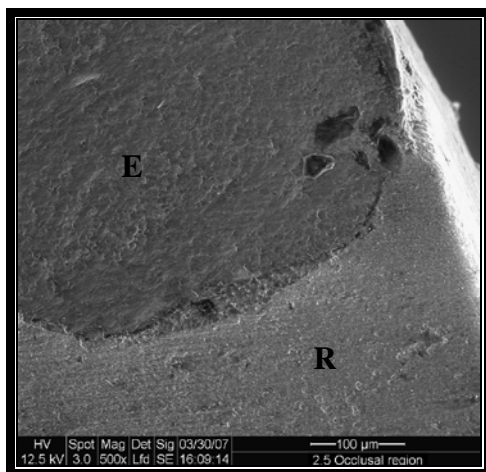**Figure 4.5: Specimen in pH 7 with occlusal & cervical score 3 viewed under SEM:**
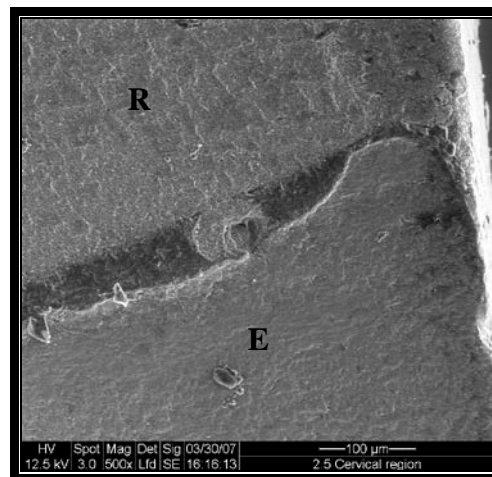
A: under low (80x) magnification
B: under high magnification (500x) at occlusal margin
C: under high magnification (500x) at cervical margin
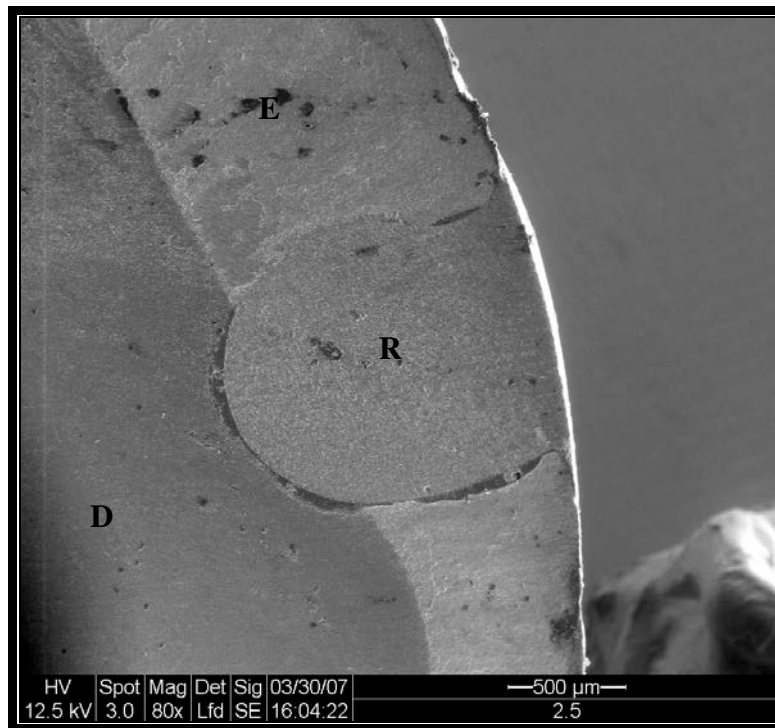
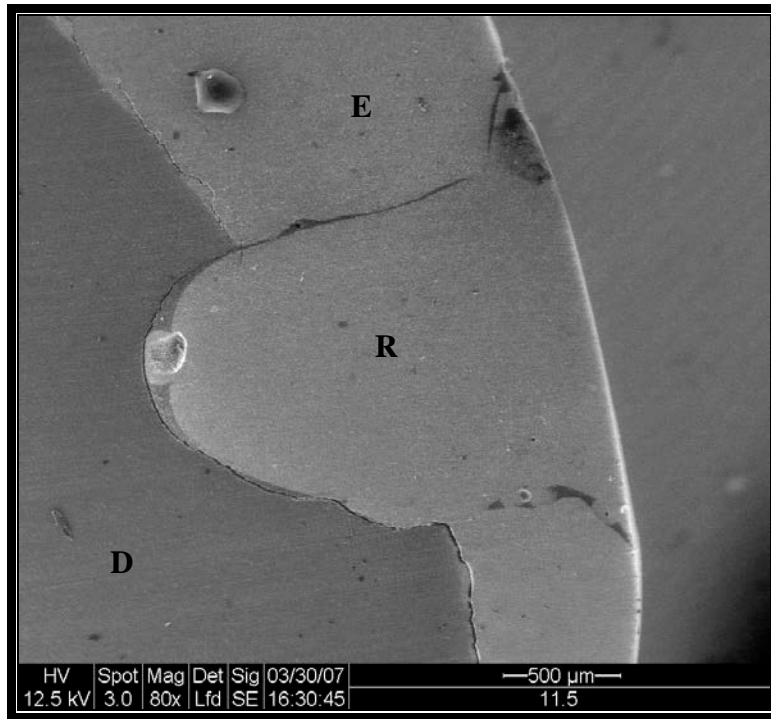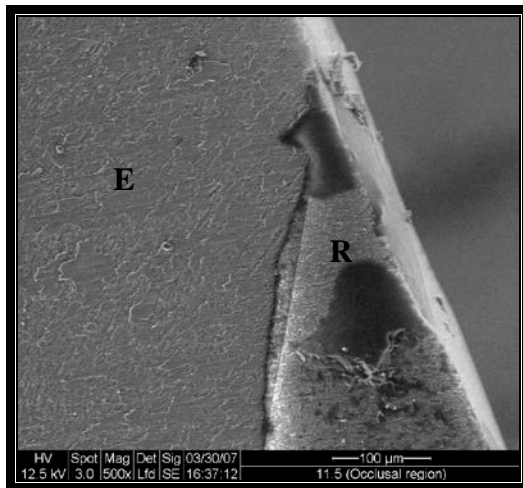**A**

B

C

Figure 4.6: Specimen in pH 2.5 with occlusal & cervical score 3 viewed under SEM:

A: under low (80x) magnification
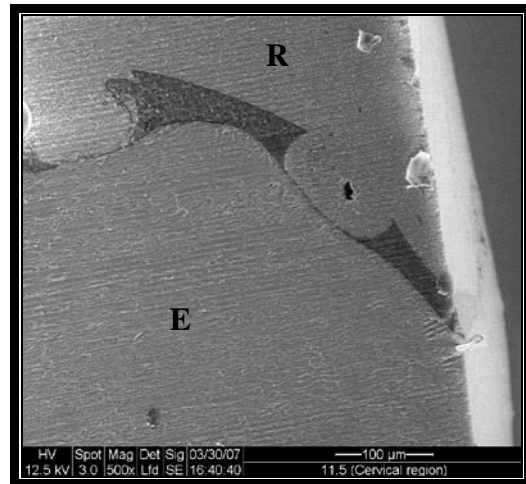B: under high magnification (500x) at occlusal margin
C: under high magnification (500x) at cervical margin

A

B

C

Figure 4.7: Specimen in pH 11.5 with occlusal & cervical score 3 viewed under SEM:

    A: under low (80x) magnification
    B: under high magnification (500x) at occlusal margin
    C: under high magnification (500x) at cervical margin