

CHAPTER 4

RESULTS

The microtensile bond strength of composite rods attached to the tip dentin surface of deciduous mandibular incisors decreases when the tooth specimens were connected to the water manometer. The mean±SD for the groups of dry tooth, -30, 0 and 30 cmH₂O were 12.09±1.04, 11.29±0.32, 10.14±0.79, and 6.36±1.02 MPa, respectively (Table 3).

Table 3 The mean±SD values of microtensile bond strength of dry teeth, -30, 0 and 30 cmH₂O group from 40 lower primary incisor teeth.

Group	Microtensile bond strength (MPa) mean±SD
Dry teeth	12.09±1.04
-30 cmH ₂ O	11.29±0.32
0 cmH ₂ O	10.14±0.79
30 cmH ₂ O	6.36±1.02

* indicated the significant different ($P<0.001$)

** indicated the significant different ($P=0.022$)

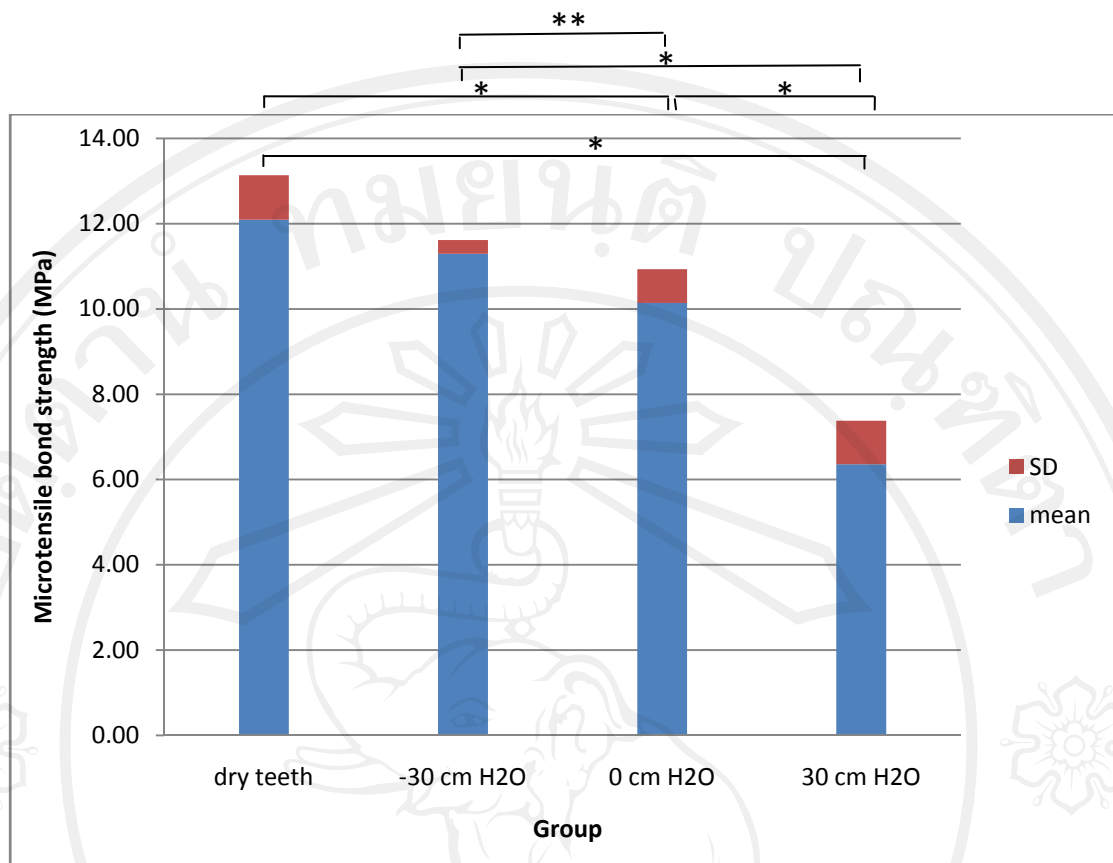


Figure 15 represents the means and SD values of microtensile bond strength in the form of bar charts which * indicated the significant different ($P < 0.001$) and ** indicated the significant different ($P = 0.022$).

The statistical analysis using one way ANOVA suggested that the changing in hydrostatic pressure applying to the pulp cavity had significant effect on microtensile bond strength of the bonding system at the outer dentin. In more detail, the dry tooth group had the highest microtensile bond strength which was statistically significant higher than those of 0 and 30 cmH₂O groups ($P < 0.05$), however was not statistically different from those of -30 cmH₂O group. The 0 cmH₂O group had significant higher value than +30 cmH₂O group, and significantly lower value than -30 cmH₂O group. Also, the -30 cmH₂O group had significantly higher value than +30 cmH₂O group.

Table 4 shows the values of load and microtensile bond strength of all specimens in the group of dry teeth.

Specimen	Load (N)	Microtensile bond strength (MPa)
1	11.77	14.98
2	9.20	11.70
3	9.68	12.32
4	9.18	11.69
5	9.01	11.48
6	9.17	11.67
7	9.15	11.65
8	9.23	11.75
9	9.51	12.10
10	9.12	11.60
Mean±SD	9.50±0.82	12.09±1.04

The values of load and microtensile bond strength of specimens in the dry teeth were shown in Table 4 and Figure 16.

The mean±SD values of both measurements were 9.50±0.82 N and 12.09±1.04 MPa and the ranges were 9.01-11.77 N and 11.60-14.98 MPa, respectively.

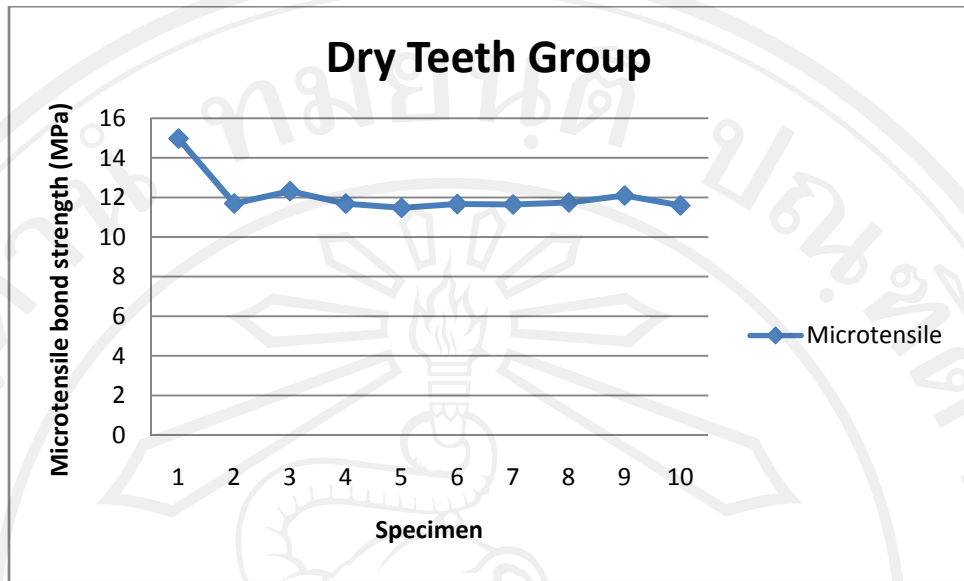


Figure 16 shows the linear graph of microtensile bond strength values of each specimen in dry teeth group.

Table 5 shows the individual values of load and microtensile bond strength of the -30 cmH₂O group.

Specimen	Load (N)	Microtensile bond strength (MPa)
1	9.17	11.67
2	9.19	11.71
3	8.75	11.14
4	8.58	10.93
5	9.18	11.69
6	8.74	11.13
7	8.61	10.96
8	8.57	10.91
9	8.90	11.33
10	9.01	11.47
Mean±SD	8.87±0.25	11.29±0.32

The values of load and microtensile bond strength of specimens in the group of -30 cmH₂O were shown in Table 5 and Figure 17.

The mean±SD values of both measurements 8.87±0.25 N and 11.29±0.32 MPa and the ranges were 8.57-9.19 N and 10.91-11.71 MPa, respectively.

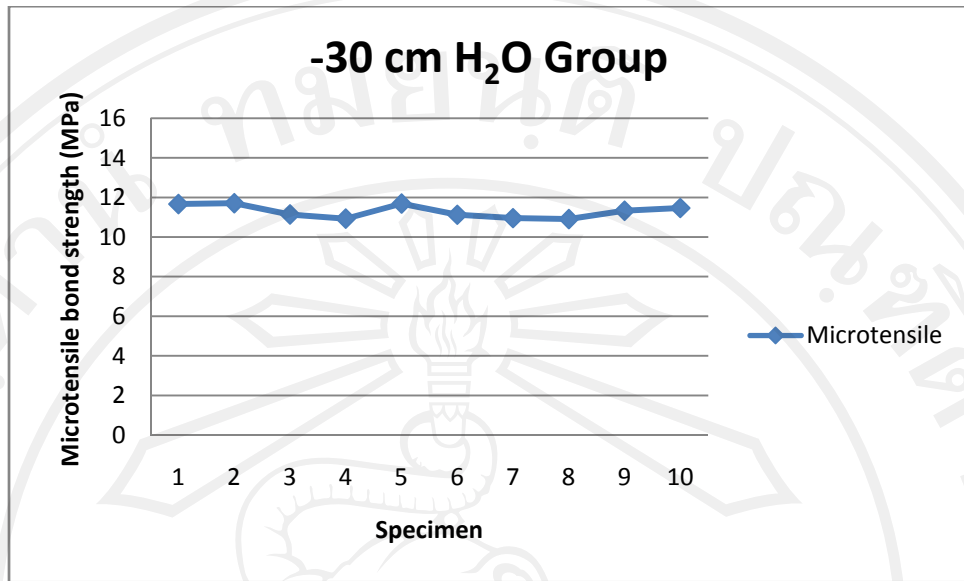


Figure 17 shows the linear graph of microtensile bond strength values of each specimen in the -30 cmH₂O group.

Table 6 shows the values of load and microtensile bond strength of all specimens of the 0 cmH₂O group.

Specimen	Load (N)	Microtensile bond strength (MPa)
1	8.59	10.94
2	8.74	11.13
3	7.80	9.93
4	7.57	9.64
5	8.58	10.93
6	7.16	9.12
7	7.78	9.90
8	8.70	11.02
9	7.20	9.16
10	7.61	9.66
Mean±SD	7.79±0.62	10.14±0.79

The values of load and microtensile bond strength of specimens in the group of 0 cmH₂O were shown in Table 6 and Figure 18.

The mean±SD values of both measurements 7.79±0.62 N and 10.14±0.79 MPa and the ranges were 7.16-8.74 N and 9.12-11.13 MPa, respectively.

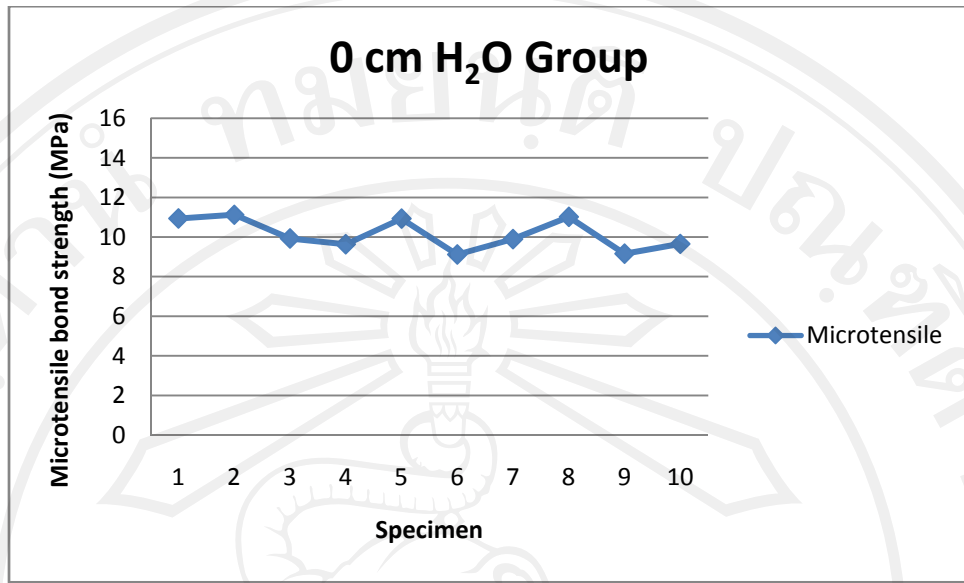


Figure 18 shows the linear graph of microtensile bond strength values of each specimen in the 0 cmH₂O group.

Table 7 shows the individual values of load and microtensile bond strength of 30 cmH₂O group.

Specimen	Load (N)	Microtensile bond strength (MPa)
1	5.70	7.28
2	4.18	5.32
3	4.75	6.05
4	3.9	4.97
5	4.58	5.83
6	6.17	7.86
7	5.99	7.63
8	5.43	6.91
9	4.21	5.37
10	4.99	6.35
Mean±SD	4.99±0.80	6.36±1.02

The values of load and microtensile bond strength of specimens in the group of 30 cmH₂O were shown in Table 7 and Figure 19.

The mean±SD values of both measurements 4.99±0.80 N and 6.36±1.02 MPa and the ranges were 3.90-6.17 N and 4.97-7.86 MPa, respectively.

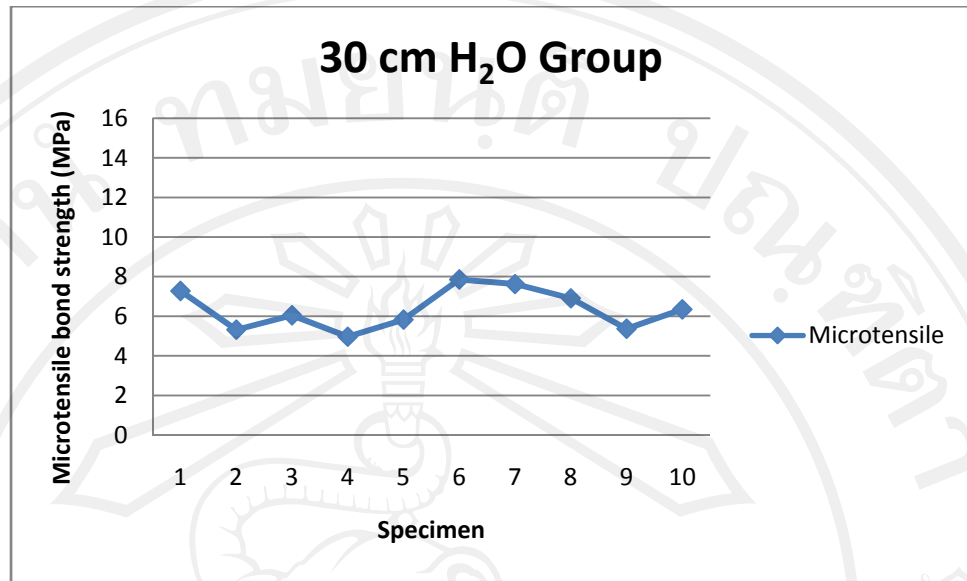


Figure 19 shows the linear graph of microtensile bond strength values of each specimen in the 30 cmH₂O group.

Examples of graphs of load application until failure in bonding of adhesive at -30, 0, 30 cmH₂O and dry teeth were shown in Figures 20, 21, 22 and 23, respectively.

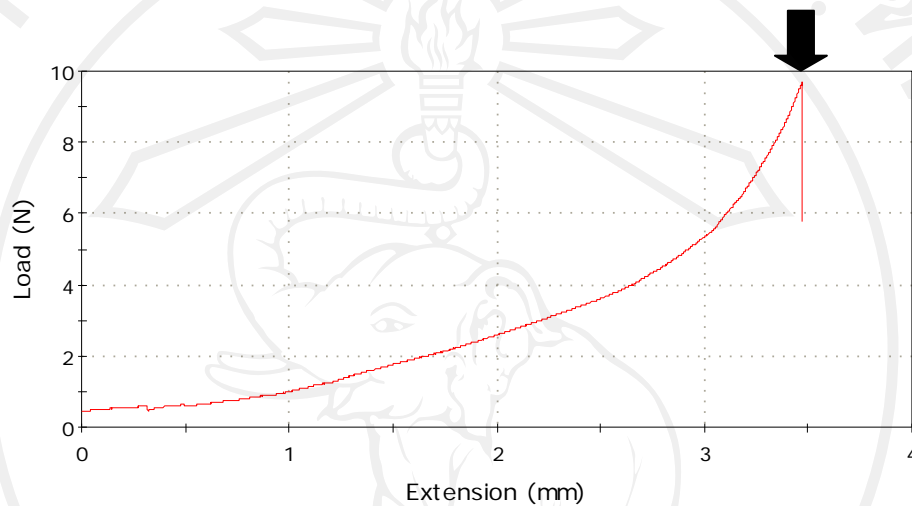


Figure 20 shows an example of graphs in the group of dry teeth which load at 9.68 N caused the failure in bonding. The arrow shows the point of load at failure.

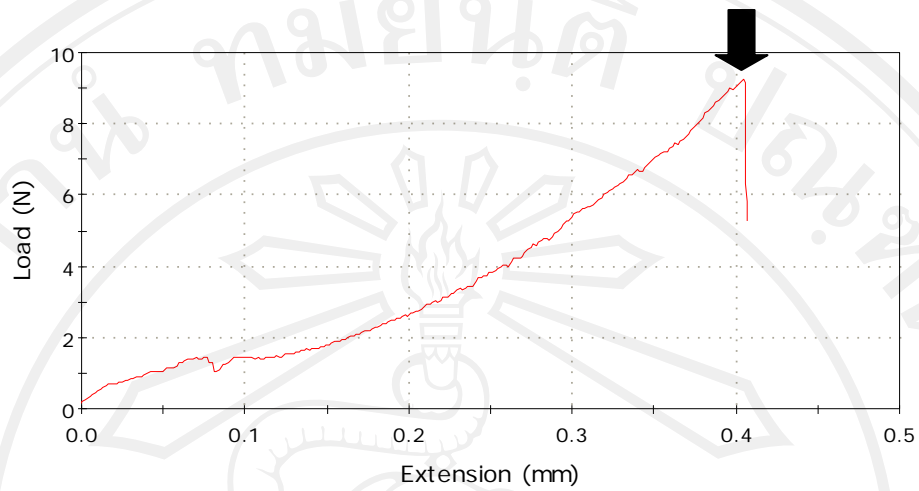


Figure 21 shows an example of graphs in the group of $-30 \text{ cmH}_2\text{O}$ which load at 9.17 N caused the failure in bonding. The arrow shows the point of load at failure.

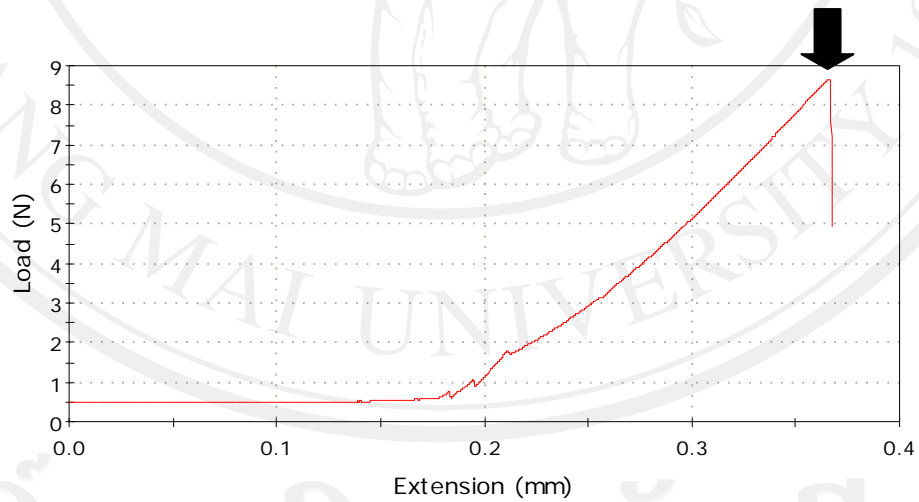


Figure 22 shows an example of graphs in the group of $0 \text{ cmH}_2\text{O}$ which load at 8.59 N caused the failure in bonding. The arrow shows the point of load at failure.

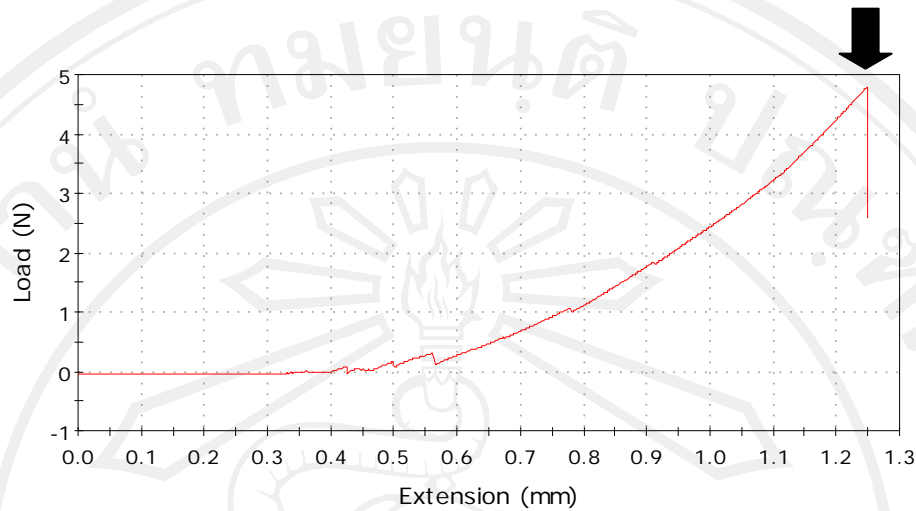


Figure 23 shows an example of graphs in the group of 30 cmH₂O which load at 4.75 N caused the failure in bonding. The arrow shows the point of load at failure.

These graphs show the load values at different simulated intrapulpal pressures. The highest and lowest loads which contributed to failure in bonding were represented in the group of dry teeth and 30 cmH₂O, respectively.

Examples of Scanning Electron Microscope images of the specimens after microtensile bond strength test at dry teeth, -30, 0, and 30 cmH₂O were shown in Figures 24, 25, 26 and 27, respectively.

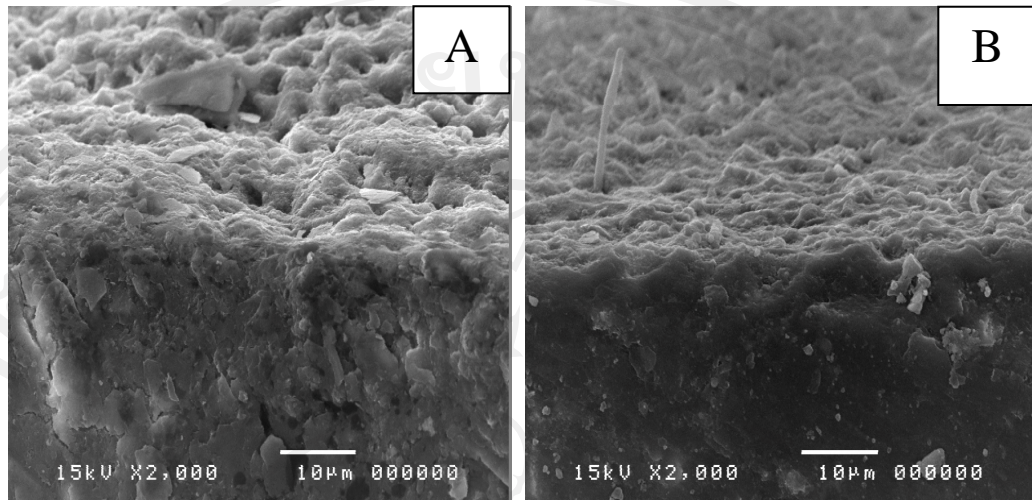


Figure 24 Example of Scanning Electron Micrographs (SEM) shows mode of failure in the group of dry teeth (A) and detached composite rod (B). These were taken from magnification of $\times 2,000$. The calibrated bar indicate length of $10\ \mu\text{m}$. The details of dentinal tubules such as porous appearances were observed (A). On surface of composite rod, the characteristic of dentin surface was also observed (B). The thin rod was found on the surface of composite rod. This could be lamina limitan or resin tag which was pull out from dentinal tubule. The bond failure in this case was classified as type 2: cohesive failure within dentin.

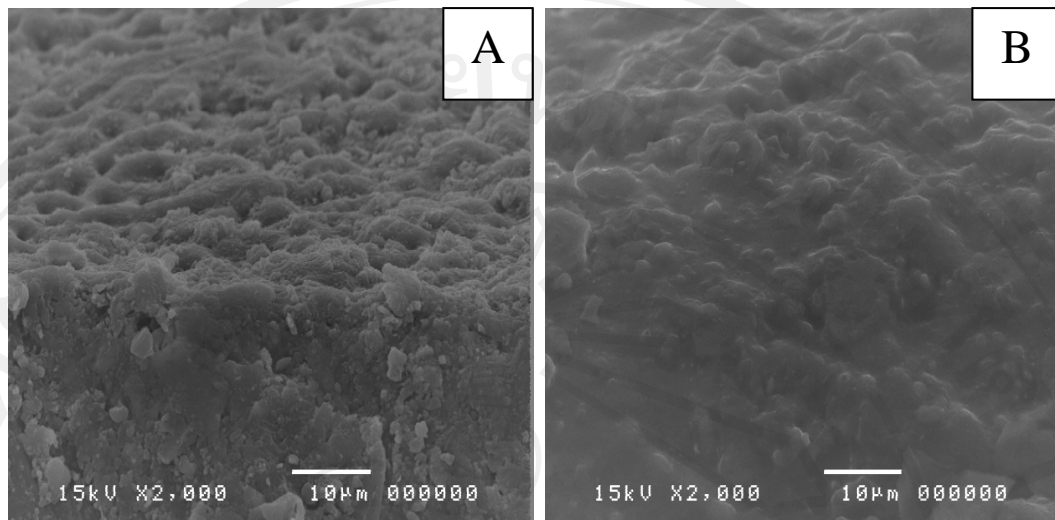


Figure 25 Example of Scanning Electron Micrographs shows mode of failure in the group of -30 cmH₂O (A) and detached composite rod (B). These were taken from magnification of $\times 2,000$. The calibrated bar indicate length of 10 μm . The details of dentinal tubules such as porous appearances were observed (A). The surface of composite rod was not smooth but still found porosity like the characteristic of dentin surface (B). Thus the bond failure was possibly classified as type 2: cohesive failure within dentin.

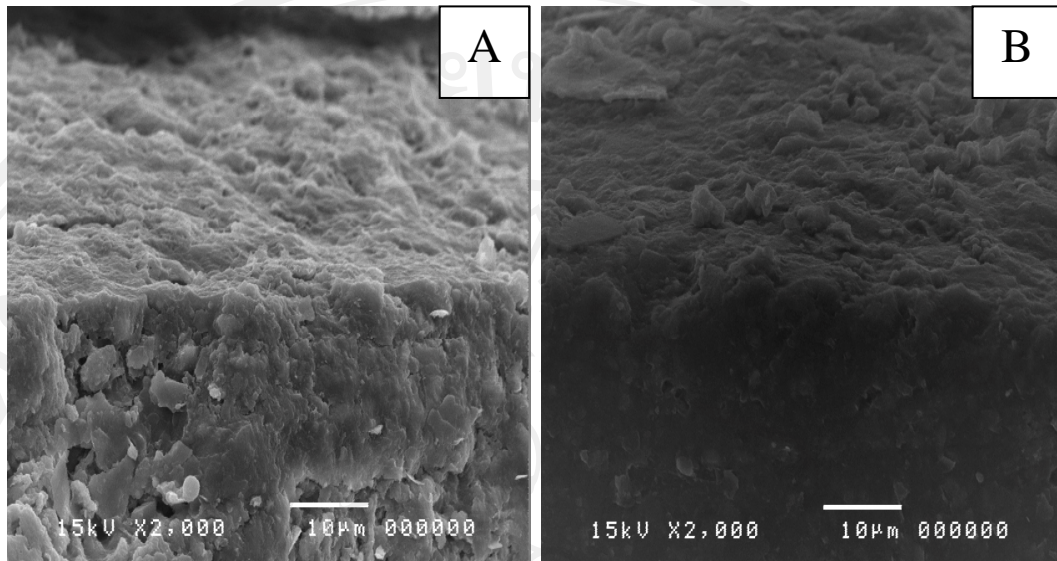


Figure 26 Example of Scanning Electron Micrographs shows mode of failure in the group of 0 cmH₂O (A) and detached composite rod (B). These were taken from magnification of $\times 2,000$. The calibrated bar indicate length of 10 μm . The tooth surface was not smooth, however no apparent characteristics of dentin structure could be observed (A). This is likely that the surface of composite rod in which fracture traces within composite could not be found (B). Thus the bond failure was possibly classified as type 1: adhesive failure.

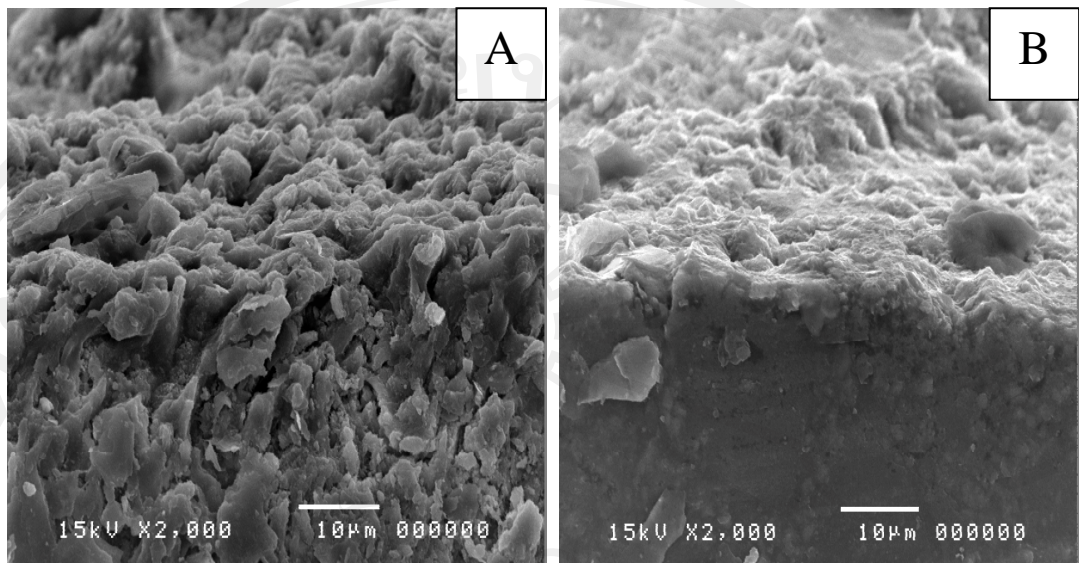


Figure 27 Example of Scanning Electron Micrographs shows mode of failure in the group of 30 cmH₂O (A) and detached composite rod (B). These were taken from magnification of $\times 2,000$. The calibrated bar indicate length of 10 μm . On tooth surface was covered with something flossy (A). This could be the remaining organic matrix on dentin surface. The composite rod could be observed the surface roughness, however, none of dentin structure was detached from the tooth surface (B). Thus the bond failure was classified as type 1: adhesive failure.