CHAPTER III

MATERIALS AND METHODS

Materials

Following materials were used in the experimental process.

1. Samples

A total of 90 maxillary and mandibular premolar teeth which were extracted from patients with the age range from 10 to 20 years were used in this investigations. According to Dean's fluorosis index all teeth were catogorized in three groups (Table 2). The first group consisted of 17 maxillary and 13 mandibular non-fluorosis teeth (score 0). The second and the third groups consisted of the same proportion of fluorosis teeth (17 maxillary and 13 mandibular teeth) classified as score 1 or score 2 in group 2 and score 3 or 4 in group 3. The teeth were stored in tap water before the investigation.

Table 2   Sample distribution in the three groups

Group	Number of teeth		total
	Maxillary teeth	Mandibular teeth	
Group 1	17	13	30
Group 2	17	13	30
Group 3	17	13	30

Figure 7   Samples in group 1 (normal teeth, Score 0)

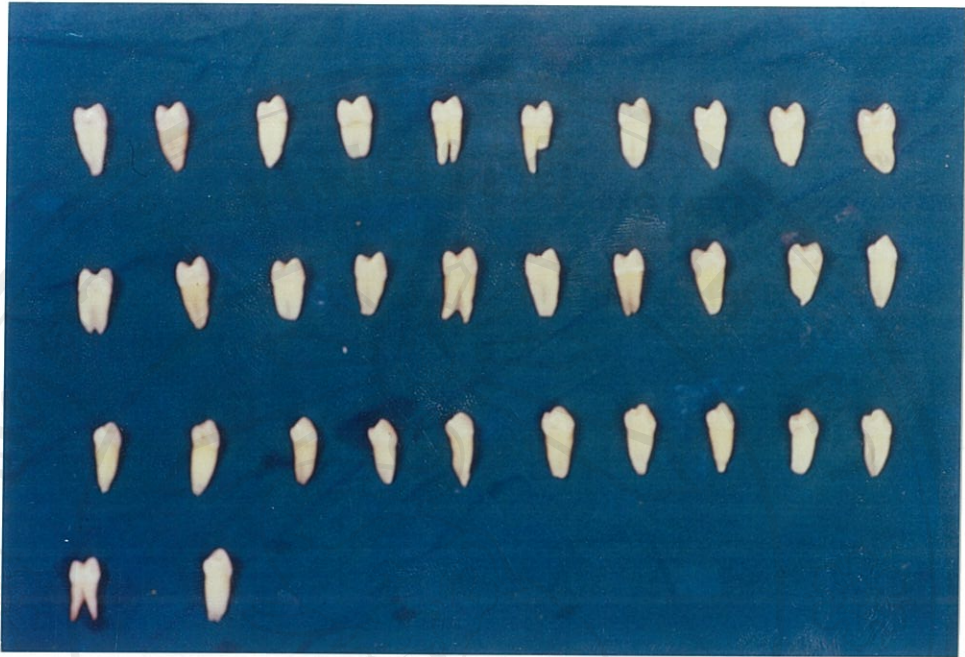Figure 8   Samples in group 2 (fluorosis teeth, Score 1 and 2)

Figure 9   Samples in group 3 (fluorosis teeth, Score 3 and 4)

2. Brackets (Ormco, batch No. 350-0506, Ormco Glendora, California, Figure 10)

Full metal bracket of 0.018" x 0.022" slot premolar standard Edgewise brackets, Minidiamond type (Ormco Company).   There are two components in these foil/mesh backed brackets: body and base. 17-4 Stainless steel bracket body were joined with 316 stainless steel foil/mesh base by brazing with gold alloy. Total area of each bracket was 8.4 square millimeters and foil/mesh has 100 interlock holes per inch.

3. Adhesive   (System 1[+]), (Ormco, Ormco Glendora, California, Figure 11)

The adhesive for this investigation was chemically cured composite resin.

4. Standard fluoride solution   (No 940907, Orion Research Inc., Cambridges, Mass, Figure 12)

The Standard fluoride solutions were used for calibration curve of fluoride during the fluoride determination.

5. An commercial ionic strength-adjusting buffer (TISAB III 940911, Orion Research Inc., Cambridges, Mass, Figure 13)

These buffer solutions prepared for adjusting the PH of fluoride solutions suitable for fluoride testing.

6. Perchloric acid 0.5 Molar (Analyzing grade), (Figure 14)

The acid prepared from fluoride free analyzing grade concentrated perchloric acid from Department of Chemistry, Faculty of Science, Chiang Mai University.

7. Double distilled water (De-ionized water), (Figure 15)

These fluoride free water was prepared from Department of Chemistry, Faculty of Science, Chiang Mai University.
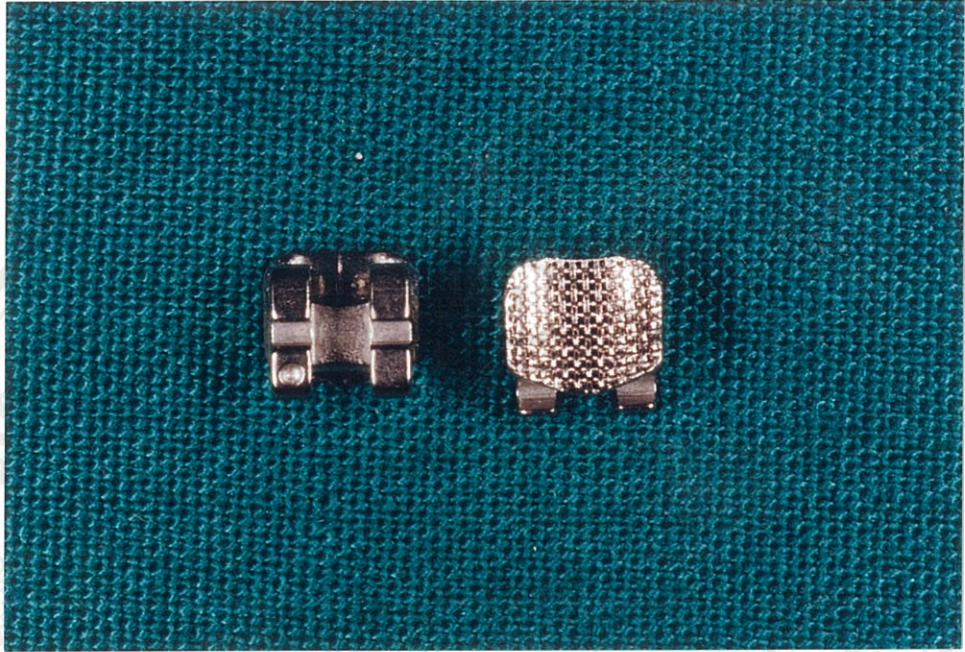
Figure 10   Standard full metal (mesh-back) Edgewise premolar brackets

Figure 11 System 1$^+$ adhesive

Figure 12   Standard fluoride solution

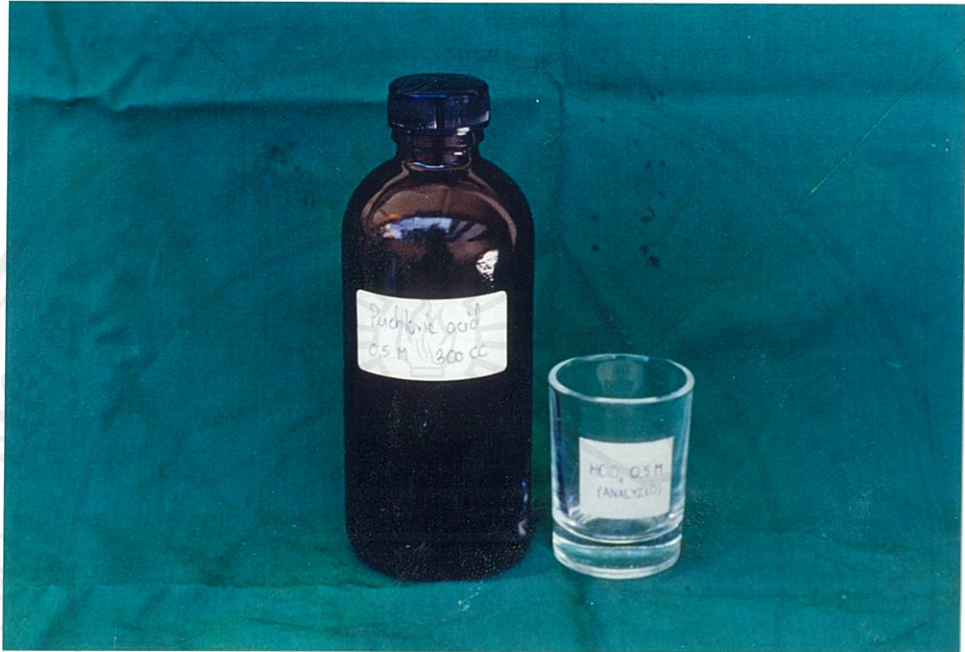Figure 13   An commercial ionic strength-adjusting buffer (TISAB III)

Figure 14   0.5 Molar perchloric acid solution (Analyzing grade)

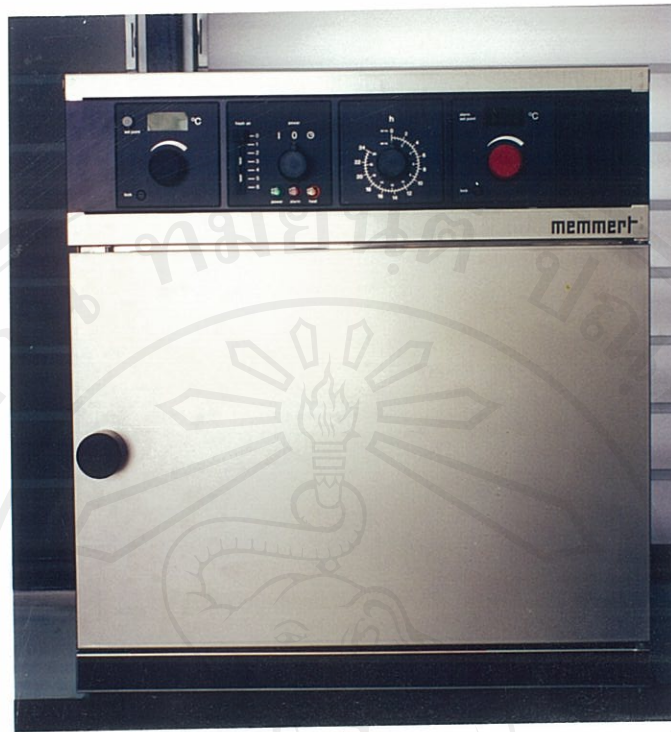Figure 15   Double distilled water (De-ionized water)

Figure 16   Incubator

Figure 17   2-20 microliters "Socorex" type micropipette

Figure 18 Fluoride analyzing unit

Figure 19 Fluoride electrode

Figure 20   a. Instron® universal testing machine b.   Five kilonewtons load cell
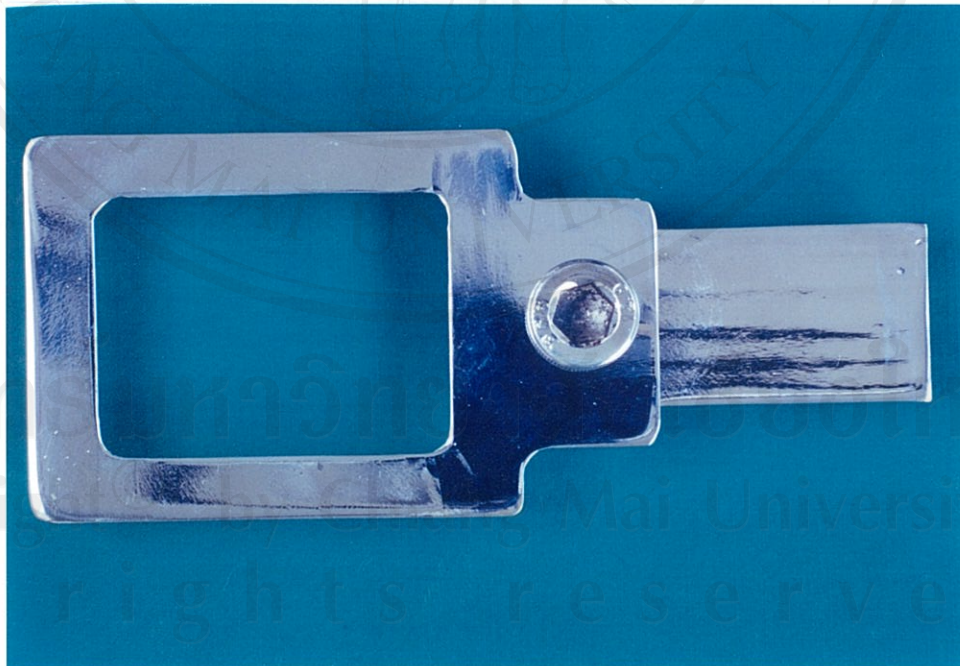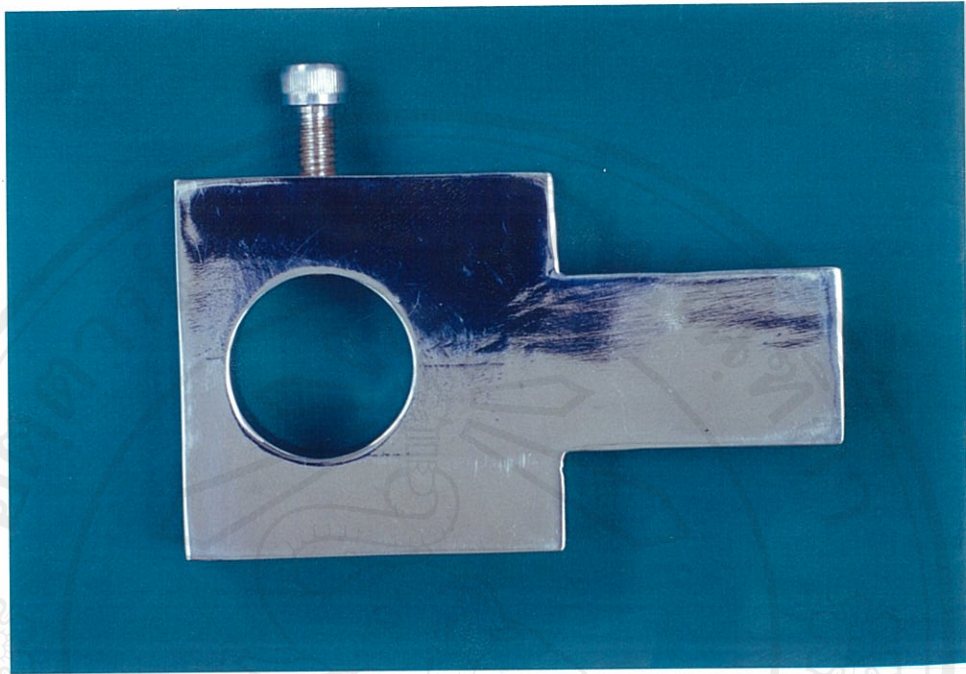

Figure 21   Debonding plate

Figure 22 Mounting jig

Methods

The experiments were divided into 2 parts.

Part I : Fluoride concentration analysis that was carried out at Community Dentistry Department, Faculty of Dentistry, Chiang Mai University.

Part II : Shear bond strength testing that was carried out at Faculty of Agriculture, Chiang Mai University.

Part I : Fluoride concentration analysis

The fluoride concentrations were determined on the lingual surface, and shear bond strengths were tested on the buccal surface. Gedalia and Kalderon (1964) reported that there was no significant difference of fluoride concentrations between contralateral teeth or between the buccal and lingual aspect of the same tooth. The fluoride concentrations were determined by modified method described by Vogel et al. (1983). The lingual surface of each crown was lightly

determination was completed. Means of the both determinations were calculated for fluoride in 10 microliters acid solution by multiply with 20,000.

a.

b.

Figure 23 a. Upper and Lower premolars, b. Lingual surface of each tooth was used for fluoride determination.

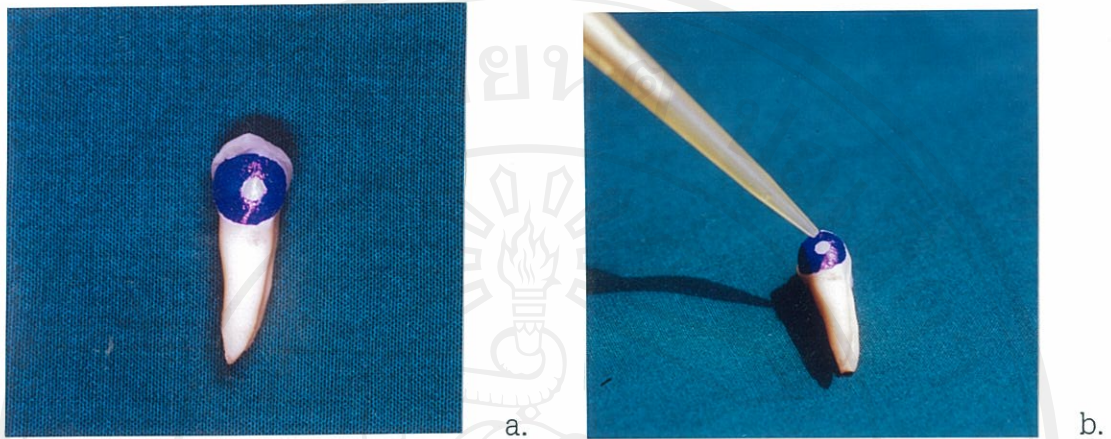a.   b.

Figure 24   a.   An adhesive tape (No. 500, 3M Company) cover the middle third
area of lingual surface of tooth., b.   The micropipette with 10 microliters of 0.5
Molar perchloric acid was deposited on the exposed lingual surface of tooth.

Figure 25   Samples solution before fluoride determination

ensure that no excessive resin cover to the bonding area. Only the tooth-bracket assemble surface was exposed. All specimens were left to fully cure and then were transferred to a water bath with distilled water at 37° C for 24 hours before testing (Tan et al., 1997). Shear bond strength was determined by using an Instron® testing machine (Instron 5565, Instron corp., England) with five kilonewtons load cell (Figure 20a and b). The stainless steel hook was attached to the debonding plate that fixed in the upper pneumatic grip and fully engaged to the buttom of the bracket wing at the time of testing procedure. The mounting jig was adjusted the vertical position of hook and the sample block in parallel plane to the direction of force (Figure 30, 31). Debonding shear force in Newton (N) required to dislodge the brackets was measured by employing a crosshead speed of 0.1 millimeter per minute (mm/min). Then shear bond strength of each sample was divided by 8.4 to provided the force in newton per square millimeters (N/mm^2). All bonding and debonding procedures were carried out by one operator.

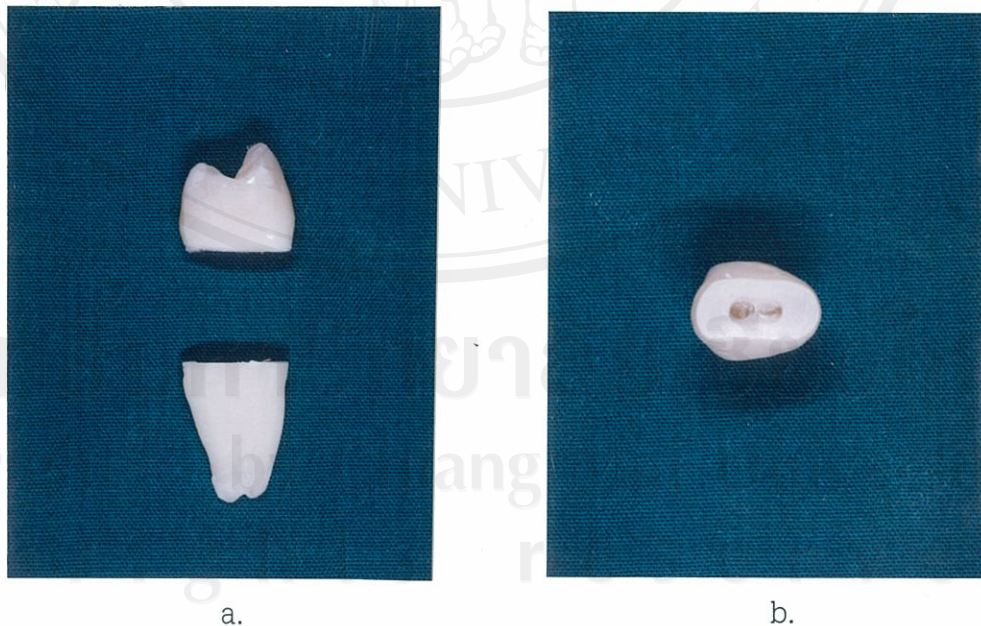a.   b.

Figure 26   a. The tooth was sectioned the root from the crown, b. The enlarged pulp chamber to ensure the retention in acrylic resin block

Figure 27 Tooth-bracket assemble by using the System 1^{+} adhesive

Figure 28   The 0.018" x 0.022" stainless steel wire ligated to tooth-bracket assemble with elastic ligature was placed above the polyvinylchloride (PVC) block 2 millimeters by the thickness of plastic plate
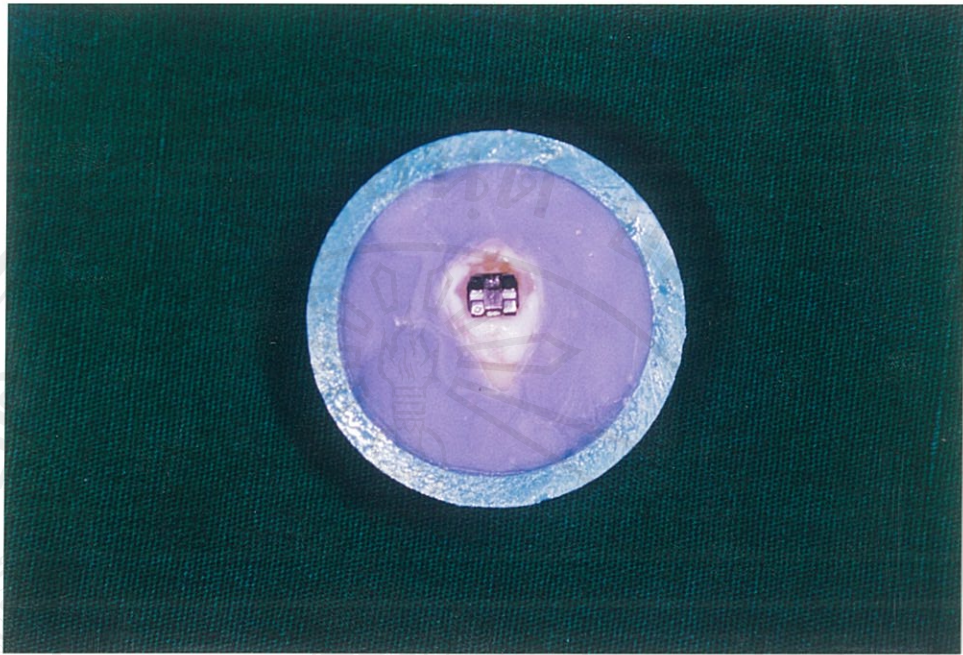
Figure 29 Tooth embedding in polyvinylchloride (PVC) block with blue-colored self cured acrylic resin
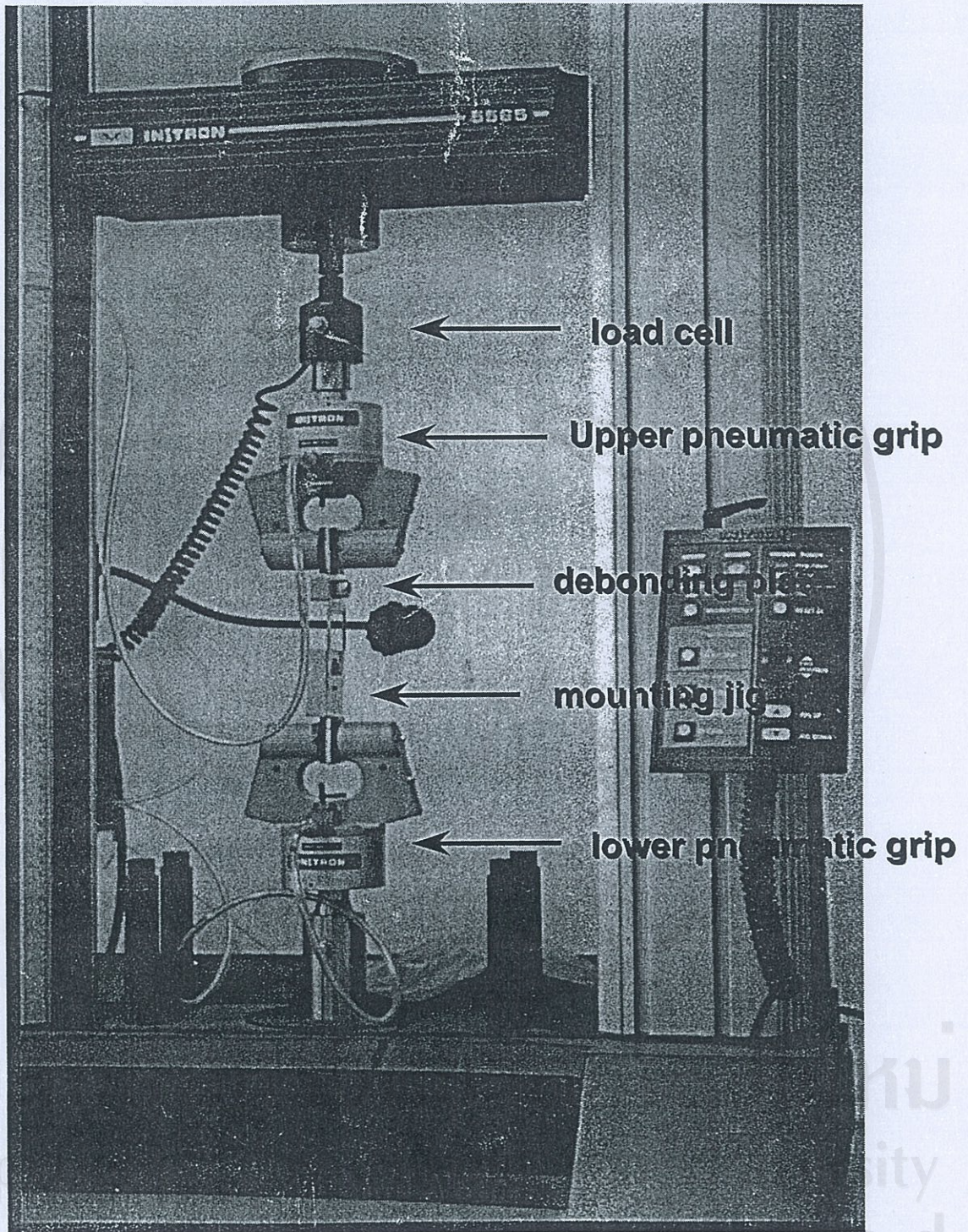
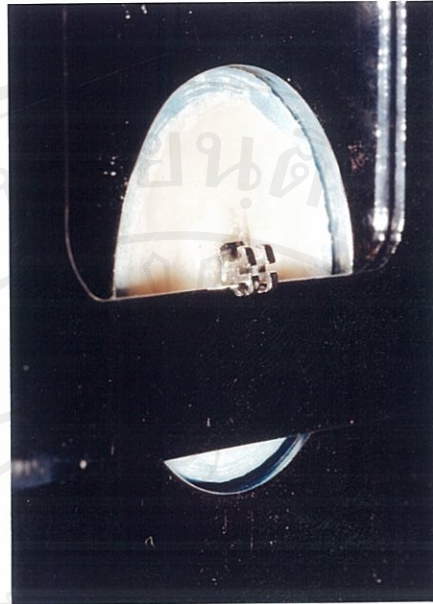Figure 30 Composition and position of instrument during the shear bond strength testing

Figure 31 Position of debonding hook and tooth-bracket assemble in acrylic block
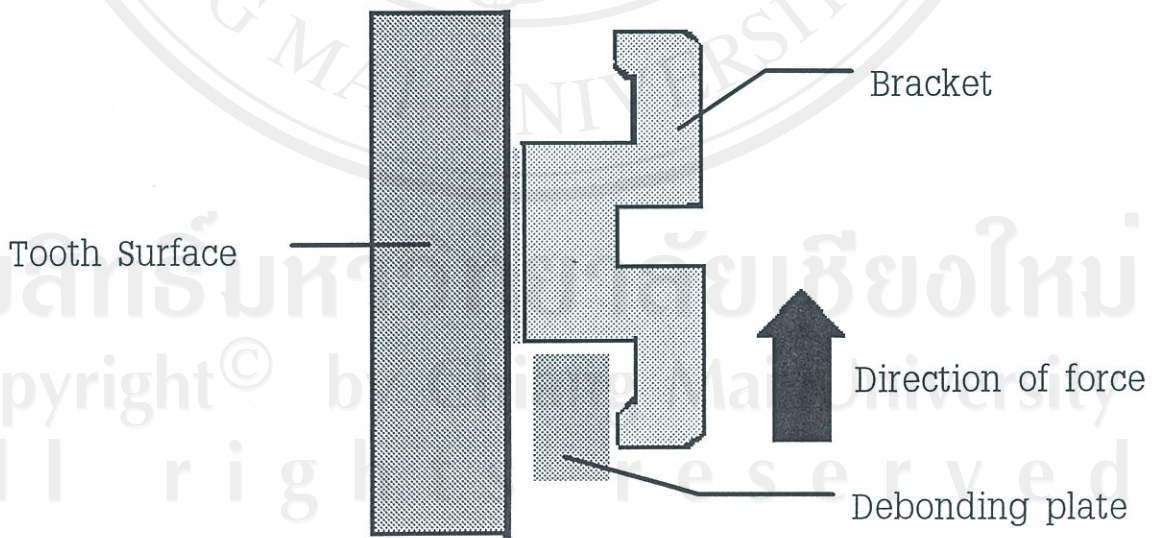ready for shear bond strength testing

Bracket

Tooth Surface

Direction of force

Debonding plate

Figure 32 Schematic diagram of force direction for shear bond strength testing

Statistical Analyses

1. Descriptive analysis was used for determining means, standard deviations and ranges of;

      1.1 fluoride concentration in each group of fluorosis and non-fluorosis teeth,

      1.2 shear bond strength in each group of fluorosis and non-fluorosis teeth.

2. One-way ANOVA analysis was used for comparing the means of;

      2.1 fluoride concentration in each group of fluorosis and non-fluorosis teeth,

      2.2 shear bond strength in each group of fluorosis and non-fluorosis teeth.

If ANOVA analysis shows significant difference, at $p < 0.01$, the multiple comparison (Duncan's multiple range test) would be analysed at the same significant level.

3. The linear correlations analysis (Pearson's product moment) was used for analyzing the correlations between fluoride concentration and shear bond strength of all flurosis samples (group 2 and 3).