CHAPTER 3

RESULTS

RESULTS

3.1 The irradiated and non-irradiated surface hardness of Eclipse

The mean values for irradiated and non-irradited surface hardness of Eclipse polymer at different polymerization times are shown in Table 3.1. One-way ANOVA indicated that there was a significant difference in the hardness values with different polymarization times for both irradiated ($p=1.0 \times 10^{-8}$) and non-irradiated surfaces ($p=2.73 \times 10^{-8}$) (Table 3.2 and Table 3.3). Post-hoc Scheffe's test indicated that at 4, 6 and 8 minutes polymerization time, no significant difference in the hardness values was observed between the specimens in the irradiated and non-irradiated groups. However, there was a significant increase in the hardness with 10 minutes polymerization time ($p < 0.05$). No significant difference in hardness value was observed with 10, 12 and 14 minutes polymerization time ($p > 0.05$).

For each polymerization time, a comparison between irradiated and non-irradiated surfaces was made (Figure 3.1). The result of the student t-test is summerized in Table 3.4. The result indicated that at 4 minutes ($p= 3.93 \times 10^{-5}$), 6 minutes ($p=1.54 \times 10^{-5}$) and 8 minutes ($p=0.0174$) polymerization time, there was a significant difference in the hardness between the two surfaces. However, when polymerized for longer time, 10 minutes ($p=0.4219$), 12 minutes ($p=0.7921$) and 14 minutes ($p=0.3320$) polymerization time, a comparison of the hardness between irradiated and non-irradiated surfaces indicated no significant difference in the hardness values between the two surfaces.

Because of these results, 10 min irradiation time was used in the subsequent study as it could be considered as the optimal time to achieve complete polymerization

throughout the specimen's thickness. Ten min of polymerization time is also the recommended time by the manufacturer.

3.2 Surface hardness of three denture base polymers.

The means of surface hardness values of Eclipse, Meliodent and Probase Cold materials, are presented in Table 3.5 and diagrammatically represented in Figure 3.2.

One-way ANOVA indicated that there was a significant different in the hardness between the three denture base polymers ($p=6.23 \times 10^{-21}$) (Table 3.6). Post-hoc Scheffe's test was performed at Scheffe's confidence interval I = 0.46. The results indicated that the surface hardness values of denture base polymers were significantly different from one another. Eclipse material exhibited the highest value of Vickers hardness (19.4) and Probase Cold material exhibited the lowest value of hardness (16.0).

3.3 A comparison of flexural strength of three denture base polymers.

The mean flexural strength values (MPa) of Eclipse, Meliodent and Probase Cold materials are presented in Table 3.7 and diagrammatically represented in Fig 3.3.

One-way ANOVA indicated that there was significant difference in the flexural strength between the three denture base polymers ($p=4.46 \times 10^{-16}$) (Table 3.8). Post-hoc Scheffe's test was performed at Scheffe's confidence interval,I = 5.5. The result indicated that the flexural strengths of denture base polymers were significantly

different from one another. Eclipse material exhibited the highest flexural strength (103 MPa) and Probase Cold material exhibited the lowest flexural strength (63 MPa).

3.4 A comparison of flexural modulus of three types denture base polymers

The mean values of flexural modulus (MPa) of Eclipse, Meliodent and Probase Cold materials are presented in Table 3.9 and diagrammatically represented in Fig 3.4.

One-way ANOVA indicated that there was significant difference in the flexural modulus between the three denture base polymers ($p=4.434 \times 10^{-14}$) (Table 3.10). Post-hoc Scheffe's test was performed at Scheffe's confidence interval,I = 118.40. The result indicated that the flexural moduli of denture base polymers were significantly different from one another. Eclipse material exhibited the highest flexural modulus (2498 MPa) and Probase Cold material exhibited the lowest flexural modulus (1832 MPa).

Table 3.1: Irradiated and non-irradiated surface hardness of Eclipse material polymerized at various curing times

Polymerization time (min)	Hardness mean ± SD	
	Irradited surface	***Non-irradiated Surface***
4	18.1 ± 0.8	16.6 ± 0.5
6	18.3 ± 0.6	16.5 ± 0.7
8	18.2 ± 0.4	17.8 ± 0.5
10	19.4 ± 0.7	19.2 ± 0.6
12	19.2 ± 0.4	19.2 ± 0.5
14	19.1 ± 0.6	18.9 ± 0.4

n =15

SD = Standard deviation

ANOVA indicated significant differences within the same colomn ($p<0.05$)

Groups connected by vertical line within the same colomn are not significantly different at $p<0.05$ when using post-hoc Scheffe's test

Scheffe's confidence interval, I: Irradiated surface = 0.71

Non-irradiated surface = 0.78

Table 3.2: One-way ANOVA result for irradiated surface hardness of Eclipse material polymerized at various polymerization times

Polymerization time (min)	Count	Sum	Average	Variance
4	15	271.7	18.11333	0.762667
6	15	275.8	18.38667	0.362667
8	15	273.9	18.26	0.165429
10	15	290.6	19.37333	0.500667
12	15	288.7	19.247	0.207
14	15	286.7	19.11333	0.336952

Source of variation	SS	df	MS	F	P-value	F crit
Between polymerization time	23.17	5	4.634	11.906	$1.0x10^{-8}$	2.3231
Within polymerization time	32.697	84	0.3892			
Total	55.865	89				

SS = Sum of square

Df = degrees of freedom

MS = Mean square

F-crit = F-critical

Table 3.3: One-way ANOVA result for non-irradiated surface hardness of Eclipse material polymerized at various polymerization times

Polymerization time (min)	Count	Sum	Average	Variance
4	15	249.7	16.647	0.762667
6	15	248.08	16.533	0.362667
8	15	267.6	17.840	0.165429
10	15	288.2	19.213	0.500667
12	15	287.9	19.193	0.207
14	15	265.6	18.973	0.336952

Source of variation	SS	df	MS	F	P-value	F crit
Between polymerization time	22.409	5	4.4818	11.2024	$2.73x10^{-8}$	2.3231
Within polymerization time	33.606	84	0.4000			
Total	56.016	89				

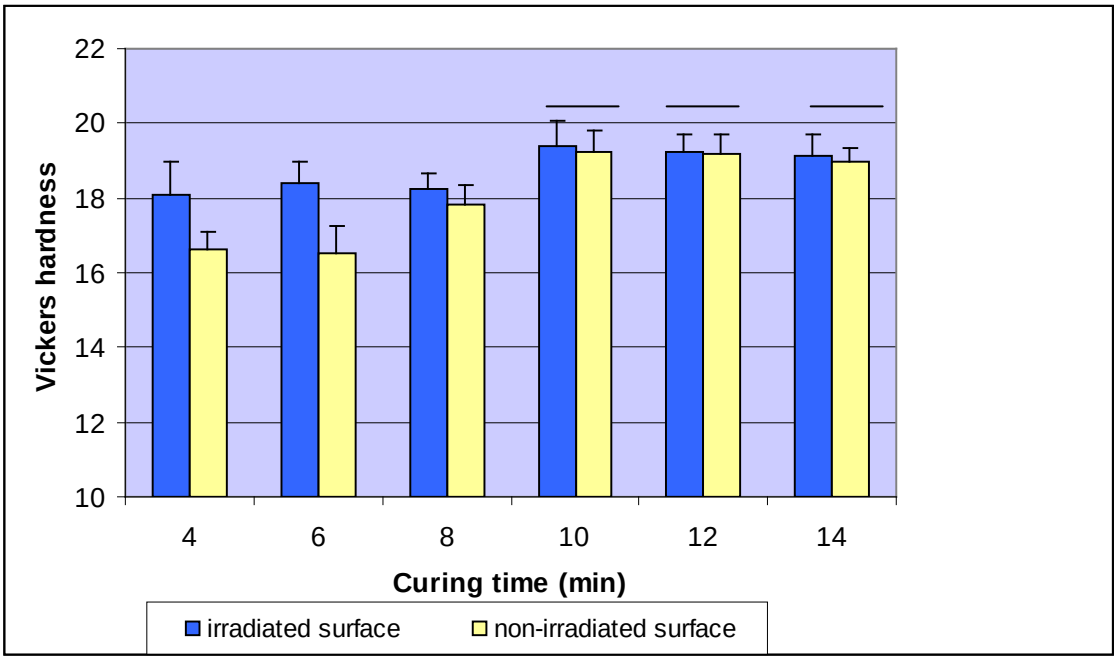
SS = Sum of square

Df = degrees of freedom

MS = Mean square

F-crit = F-critical

Figure 3.1 Comparison of irradiated and non-irradiated surface hardness of Eclipse material polymerized at various polymerization times



For each polymerization time, horizontal line indicates no significant difference between irradiated and non-irradiated surfaces (using Student t-test).

Table 3.4: Statistical analysis with t-test comparing irradiated and non-irradiated surface hardness polymerized at various polymerization times

Polymerization time	*P-value*	*Significance at p<0.05*
4	3.93×10^{-5}	S
6	1.54×10^{-5}	S
8	0.0174	S
10	0.4219	NS
12	0.7921	NS
14	0.3320	NS

p = 0.05

S = Significance

NS = Not significance

Table 3.5: Surface hardness of three denture base polymers

Material	Vickers hardness Mean ± SD
Eclipse	19.4 ± 0.7
Meliodent	17.0 ± 0.4
Probase Cold	16.0 ± 0.4

n = 15

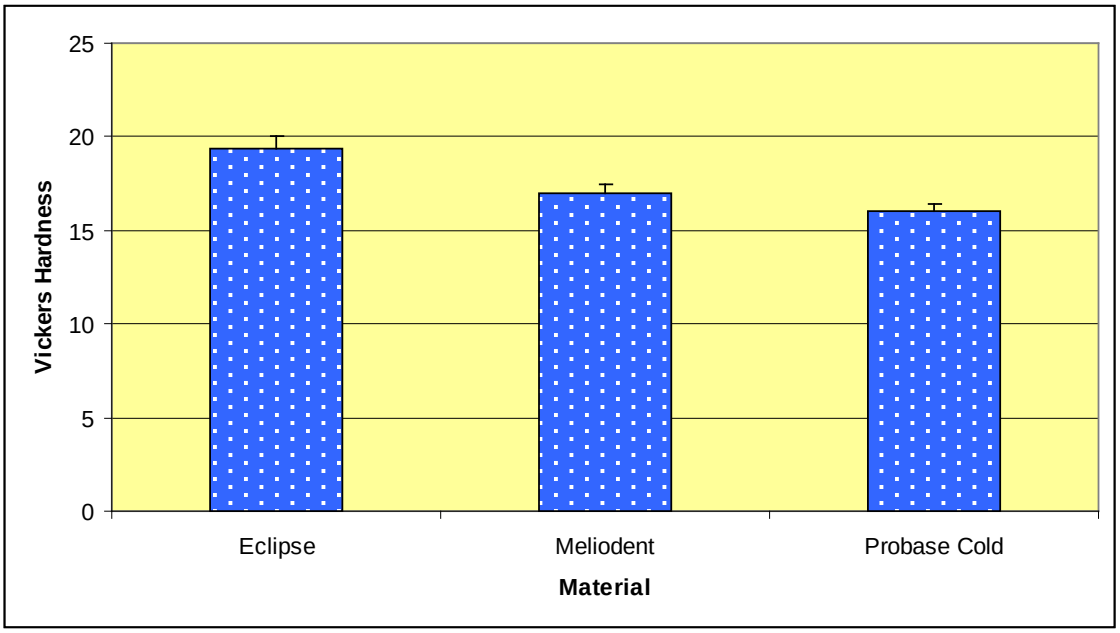
SD = standard deviation

One-way ANOVA indicated a significant difference in hardness among the materials ($p<0.05$)

Post-hoc Scheffe's test indicated that the materials were significantly different from each other

Scheffe's confidence interval, I = 0.46

Figure 3.2 Surface hardness of three denture base polymers



One-way ANOVA indicated a significant difference in hardness among the materials ($p<0.05$)

Post-hoc Scheffe's test indicated that all materials are significantly different from one another

Scheffe's confidence interval, I = 0.46

Table 3.6: One-way ANOVA results for surface hardness of three denture base polymers.

Material	Count	sum	average	Variance
Eclipse	15	290.0	19.373	0.500667
Meliodent	15	255.5	17.033	0.15381
Probase Cold	15	240.0	16.033	0.116667

Source of variation	SS	df	MS	F	P-value	F crit
Between materials	88.156	2	44.078	171.478	$6.23x10^{-21}$	3.219
Within materials	10.796	42	0.257048			
Total	98.952	44				

SS = Sum of square

Df = degrees of freedom

MS = Mean square

F-crit = F-critical

Scheffe's confidence interval,I = 0.46

Table 3.7: Flexural strength (MPa) of three denture base polymers

Material	Mean ± SD
Eclipse	103 ± 4
Meliodent	78 ± 3
Probase Cold	63 ± 4

n = 10

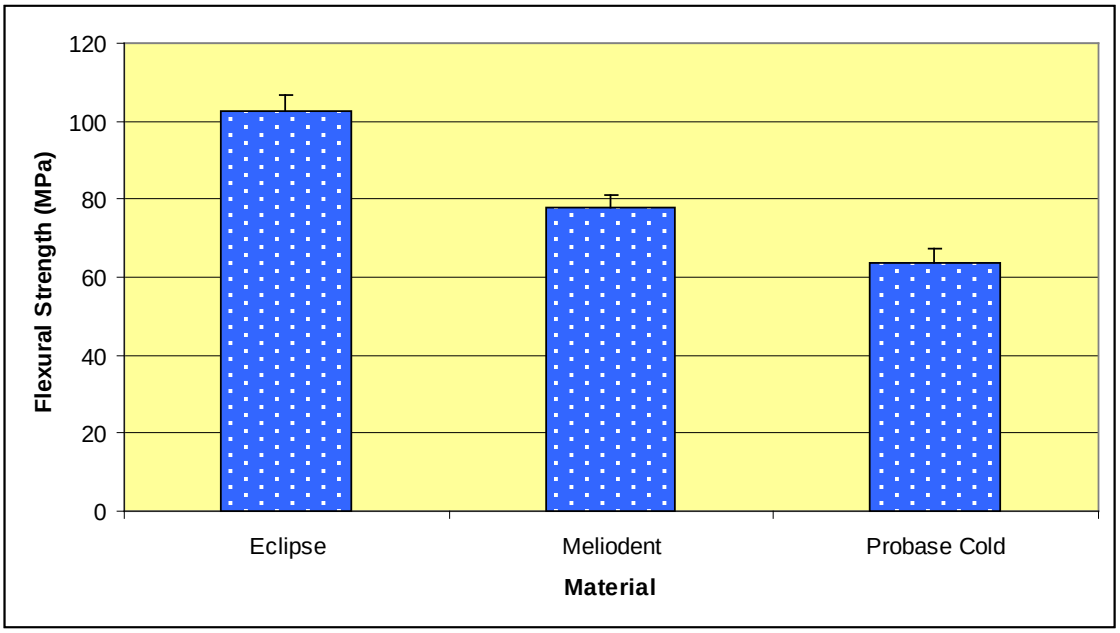
S.D = Standard deviation

One-way ANOVA indicated a significant difference in flexural strength between the materials ($P<0.05$)

Post-hoc Scheffe's test indicated that the materials were significantly different from one another

Scheffe's confidence interval, I = 5.5

Figure 3.3 Flexural strength (MPa) of denture base polymers



One-way ANOVA indicated a significant difference in flexural strength among the materials.

Post-hoc Scheffe's test indicated that the materials were significantly different from one another

Scheffe's confidence interval, I = 5.5

Table 3.8: One-way ANOVA results for flexural strength of denture base polymers

Materials	Count	Sum	Average	Variance
Eclipse	10	1025	102.5	40.55
Meliodent	10	778.64	77.86	9.64
Probase Cold	10	634.46	63.45	17.97

Source of variation	SS	df	MS	F	P-value	F crit
Between materials	7800.08	2	3900.044	171.61	4.46×10^{-16}	3.354
within materials	613.58	27	22.725			
total	8413.67	29				

SS = Sum of square

Df = degrees of freedom

MS = Mean square

F-crit = F-critical

Scheffe's confidence interval, I = 5.5

Table 3.9: Flexural modulus (MPa) of three denture base polymers

Material	Mean ±SD
Eclipse	2498 ± 143
Meliodent	1969 ± 55
Probase Cold	1832 ± 89

n = 15

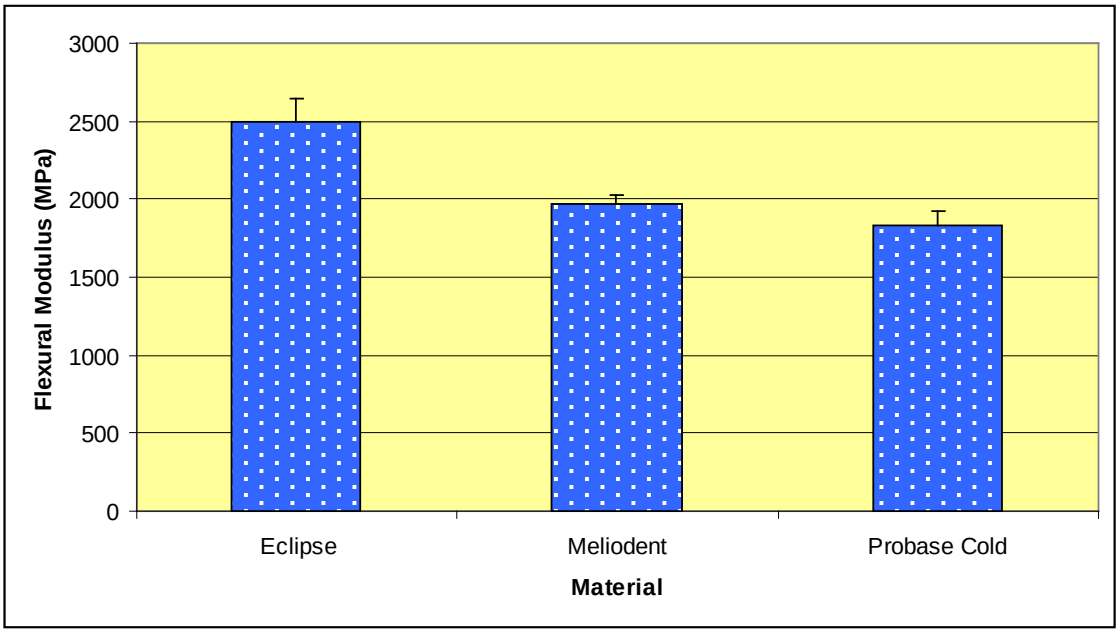
SD = Standard deviation

One-way ANOVA test indicated a significant difference in the flexural modulus among the materials.

Post-hoc Scheffe's test indicated that all materials are significantly difference from one another

Scheffe's confidence interval, I = 118.40

Figure 3.4: Flexural modulus of three denture base polymers



One-way ANOVA test indicated a significant difference in the flexural modulus among the materials.

Post-hoc Scheffe's test indicated that all the materials are significantly different from one another.

Scheffe's confidence interval, I = 118.40

Table 3.10: One-way ANOVA results for flexural modulus of three denture base polymers

Material	Count	Sum	Average	Variance
Eclipse	10	24976	2497.6	20443
Meliodent	10	19692	1969.2	3031.5
Probase Cold	10	18321	1832.1	7877

Source of variation	SS	df	MS	F	P-value	F crit
Between materials	2469644.1	2	1234823	118.16	4.434×10^{-14}	3.3541
Within materials	282160.9	27	10450.4			
total	2751805	29				

SS = Sum of square

Df = degrees of freedom

MS = Mean square

F-crit = F-critical

Scheffe's confidence interval, I = 118.40