

CHAPTER IV

Results

Analysis of 10 randomly selected platelets from resting condition in controls showed, mean value of, 5.9 ± 0.2 dense granules, 168.6 ± 0.2 alpha granules, 19.2 ± 1.1 mitochondria, and 12.8 ± 1.9 dilated canals. After activation there were 6.2 ± 0.4 dense granules, 161.8 ± 0.4 alpha granules, 21.1 ± 7.3 mitochondria, and 16.5 ± 1.9 dilated canals. Previous study reported by D'Andrea et al, there were 19 ± 5 dense granules and 193 ± 37 alpha granules per 25 platelets obtained from normal subjects (D'Andrea et al., 1989).

Comparison between migraine patients and normal control

The platelets of migraine patients were morphologically different from those of controls. They showed a greater number of dense granules in the migraine group as compare to normal control in both resting condition (9.4 ± 0.6 and 5.9 ± 0.9 granules/10 platelets for patients with migraine and normal control group, respectively, $p < 0.01$) and activated condition (9.6 ± 0.9 and 6.2 ± 0.4 granules/10 platelets, respectively, $p < 0.01$). The data are shown in Table 6A and Figure 6A. The number of alpha granules and mitochondria did not however show any significant difference between these two groups (Table 6B, 6C and Figure 6B, 6C). Furthermore, platelets from migraine patients showed significant increase in number of dilated canal after being exposed to glass surface (19.6 ± 2.9 and 29.9 ± 2.4 canals/10 platelet for resting and activated platelet respectively, $p < 0.01$). However such canalicular dilatation could not be observed in platelets from the control group (Table 6D and Figure 6D).

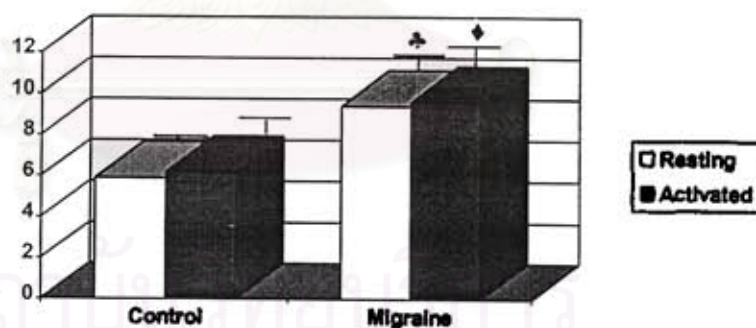
Table 6. Enumeration of platelets organelles in migraine patients and controls

Table 6 A : Dense granules

Dense granules (granules/10 cells)			
	Control (C)	Migraine (M)	M vs C
Resting(R)	5.9 ± 0.2	9.4 ± 0.4	p < 0.01
Activated(A)	6.2 ± 0.4	9.6 ± 0.9	p < 0.01
A vs R	NS	NS	

Based on 10 platelets / subject ; mean ± SEM

NS : No significant difference.



* P < 0.01 Compared with resting controls

♦ P < 0.01 Compared with activated controls

Figure 6A. Effect of glass surface activation on dense granules in platelets obtained from migraine patients and normal controls.

Table 6 B : Alpha granules

Alpha granules (granules/ 10 cells)			
	Control (C)	Migraine (M)	M vs C
Resting(R)	168.6 ± 0.2	154.4 ± 6.8	NS
Activated(A)	161.8 ± 0.4	162.0 ± 5.5	NS
A vs R	NS	NS	

Based on 10 platelets / subject ; mean ± SEM

NS : No significant difference.

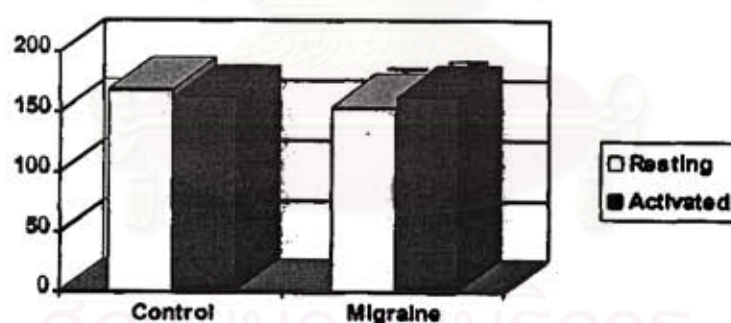


Figure 6B. Effect of glass surface activation on alpha granules in platelets obtained from migraine patients and normal controls.

Table 6 C : Mitochondria

Mitochondria (number/ 10 cells)			
	Control (C)	Migraine (M)	M vs C
Resting(R)	19.2 ± 1.1	20.6 ± 0.9	NS
Activated(A)	21.1 ± 0.7	20.3 ± 1.3	NS
A vs R	NS	NS	

Based on 10 platelets / subject ; mean ± SEM

NS : No significant difference.

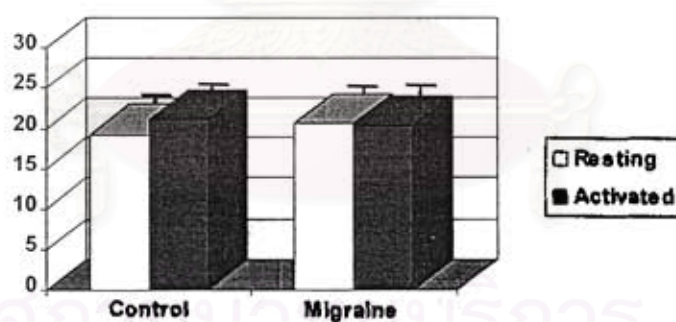


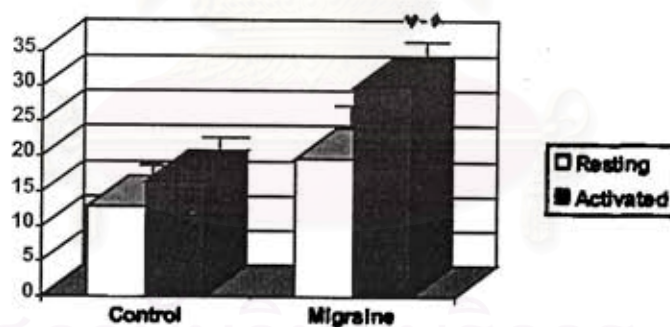
Figure 6C. Effect of glass surface activation on mitochondria in platelets obtained from migraine patients and normal controls.

Table 6 D : Dilated canals

Dilated canals (canals/10 cells)			
	Control (C)	Migraine (M)	M vs C
Resting(R)	12.8 ± 1.9	19.6 ± 2.9	NS
Activated(A)	16.5 ± 1.9	29.9 ± 2.4	p < 0.01
A vs R	NS	p < 0.01	

Based on 10 platelets / subject ; mean ± SEM

NS : No significant difference.



♥ P < 0.01 Compared with resting

♦ P < 0.01 Compared with activated controls

Figure 6D. Effect of glass surface activation on the open canalicular system (OCS) in platelets obtained from migraine patients and normal controls.

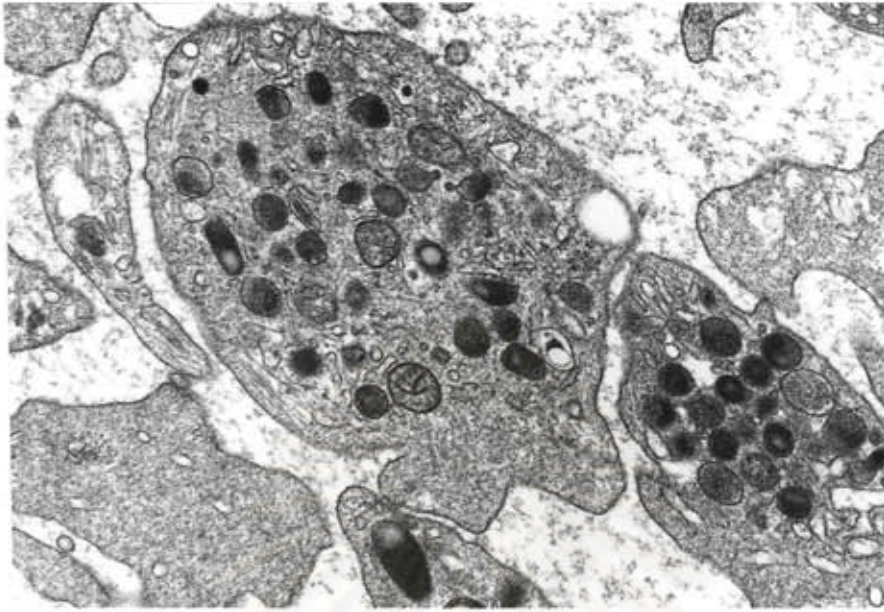
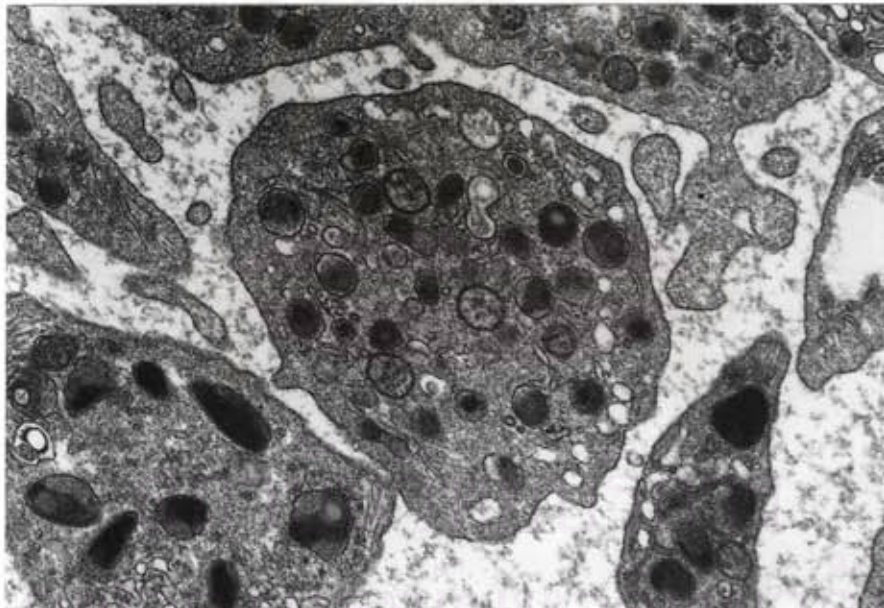
**A****B**

Figure 7. Electron micrographs of platelets obtained from control subjects.

A. Resting state showing normal ultrastructure appearance. $\times 22000$.

B. Activated state showing mild dilatation of canaliculi. $\times 22000$.

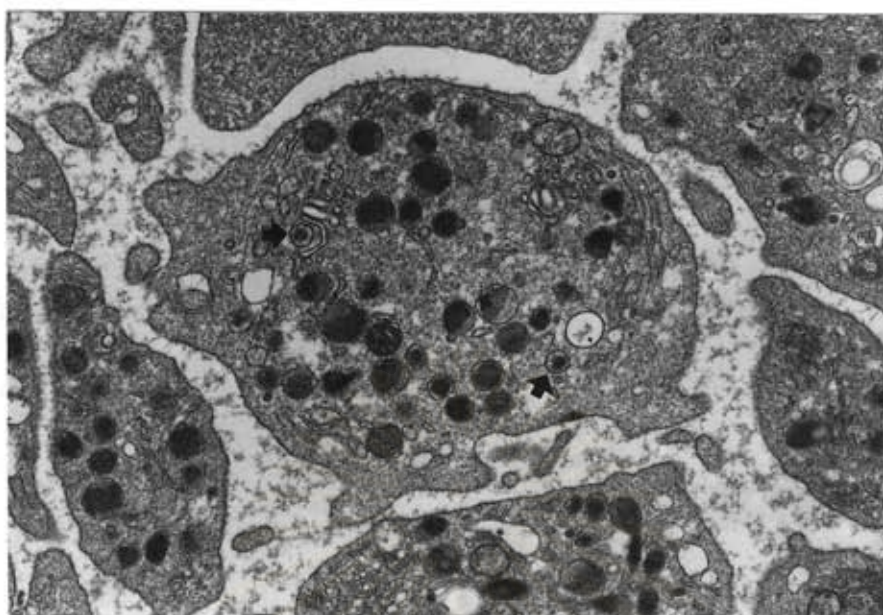
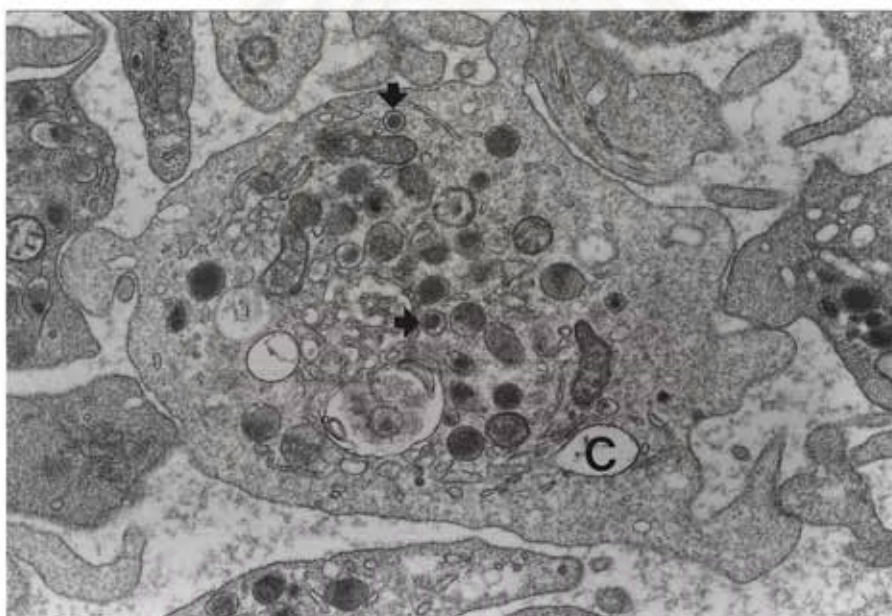
**A****B**

Figure 8. Electron micrograph of platelets obtained from migraine patients.

- A. Resting state showing an increase in the number of dense granules (arrows). x22000
- B. Activated state showing a significantly higher number and increase of dense granules (arrows) and dilated canalicular system (C)

Comparison between migraine with depression and normal control

Platelets from migraine patients with depression and the control groups did not show any statistically difference in number of dense granules, alpha granules or mitochondria (Table 7A, 7B, 7C and Figure 9A, 9B, 9C). However the significant increase in number of dilated canaliculi was demonstrated in former group(26 ± 2.6 and 12.8 ± 1.9 canals/10platelet, respectively, $p < 0.01$) and activated condition (35.4 ± 4.4 and 16.5 ± 1.9 canals/10platelet, respectively, $p < 0.01$). Platelet obtained from migraine patient with depression demonstrated increasing number of dilated canals after activation by glass surface. The total number of dilated canals before and after glass exposure were 26 ± 2.6 and 35.4 ± 4.4 canals/10platelet, $p < 0.05$). (Table 7D and Figure 9D)



Comparison between migraine patients with and without depression

The number of platelet dense granules obtained from migraine with depression group was significantly lower than that in the migraine group ($p < 0.01$). In the resting state, the number of platelet dense granules in migraine patients without depression and migraine patients with depression were 9.4 ± 0.8 and 5.9 ± 0.4 granules/10 cells, and were 9.6 ± 0.9 and 5.5 ± 0.6 granules/10cells after activation, respectively (Table 7A and Figure 9A). No significant difference in the number of alpha granules, mitochondria or dilated canals between these two groups (Table 7B, 7C and Figure 9B, 9C).

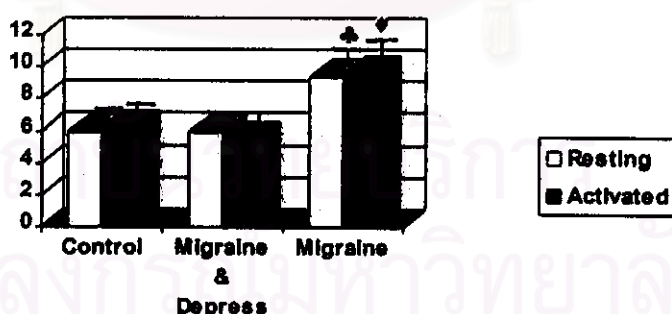
Table 7. Enumeration of platelets organelles in migraine patients with depression, migraine patients without depression and controls.

Table 7 A : Dense granules

Dense granules (granules/10 cells)					
	Control		Migraine with depression		Migraine
	(C)	MD vs C	(MD)	MD vs M	M
Resting(R)	5.9 ± 0.2	NS	5.9 ± 0.3	p < 0.01	9.4 ± 0.6
Activated(A)	6.2 ± 0.4	NS	5.5 ± 0.5	p < 0.01	9.6 ± 0.9
A vs R	NS		NS		NS

Based on 10 platelets / subject ; mean ± SEM

NS : No significant difference.



◆ P < 0.01 Compared with resting controls

◆ P < 0.01 Compared with activated controls

Figure 9A. Effect of glass surface activation on dense granules in platelets obtained from migraine patients with depression, migraine patients without depression and normal controls.

Table 7 B : Alpha granules

Alpha granules (granules/cell)					
	Control	Migraine with depression		Migraine	
	(C)	MD vs C	(MD)	MD vs M	M
Resting(R)	168.6 ± 0.9	NS	165.1 ± 5.8	NS	154.4 ± 6.8
Activated(A)	161.8 ± 4.7	NS	155.7 ± 0.6	NS	162 ± 5.5
A vs R	NS		NS		NS

Based on 10 platelets / subject ; mean ± SEM

NS : No significant difference.

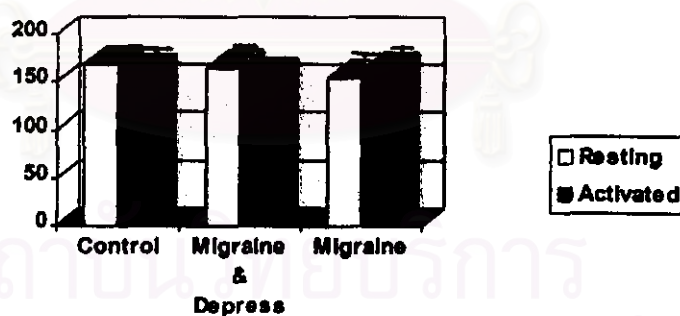


Figure 9B. Effect of glass surface activation on alpha granules in platelets obtained from migraine patients with depression, migraine patients without depression and normal controls.

Table 7 C : Mitochondria

Mitochondria (number/ 10 cells)					
	Control		Migraine with depression		Migraine
	(C)	MD vs C	(MD)	MD vs M	M
Resting(R)	19.2 ± 1.1	NS	24.7 ± 2.2	NS	20.6 ± 0.9
Activated(A)	21.1 ± 0.73	NS	23.9 ± 6.7	NS	20.3 ± 1.3
A vs R	NS		NS		NS

Based on 10 platelets / subject ; mean ± SEM

NS : No significant difference.

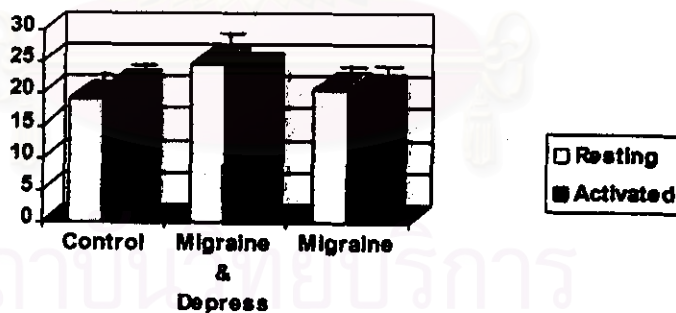


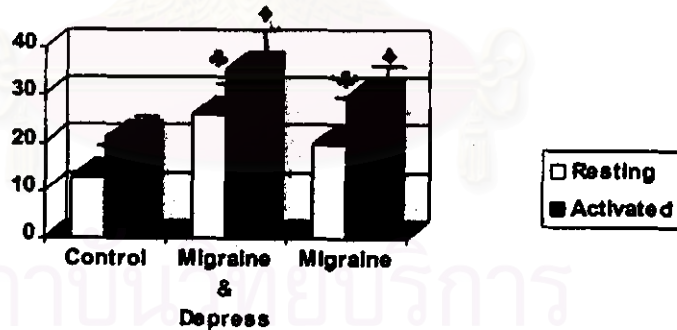
Figure 9C. Effect of glass surface activation on mitochondria in platelets obtained from migraine patients with depression, migraine patients without depression and normal controls.

Table 7D : Dilated canals

Dilated canals (canals/10cell)					
	Control		Migraine with depression		Migraine
	(C)	MD vs C	(MD)	MD vs M	M
Resting(R)	12.8 ± 1.9	p<0.01	26 ± 2.6	NS	19.6 ± 2.9
Activated(A)	21.1 ± 0.7	p < 0.01	35.4 ± 4.4	NS	29.9 ± 2.4
A vs R	NS		p<0.05		p < 0.01

Based on 10 platelets / subject ; mean ± SEM

NS : No significant difference.



◆ P < 0.01 Compared with resting controls
 ◆ P < 0.01 Compared with activated controls
 ◆ P < 0.05 Compared with resting

Figure 9D. Effect of glass surface activation on the open canalicular system (OCS) in platelets obtained from migraine patients with depression, migraine patients without depression and normal controls.

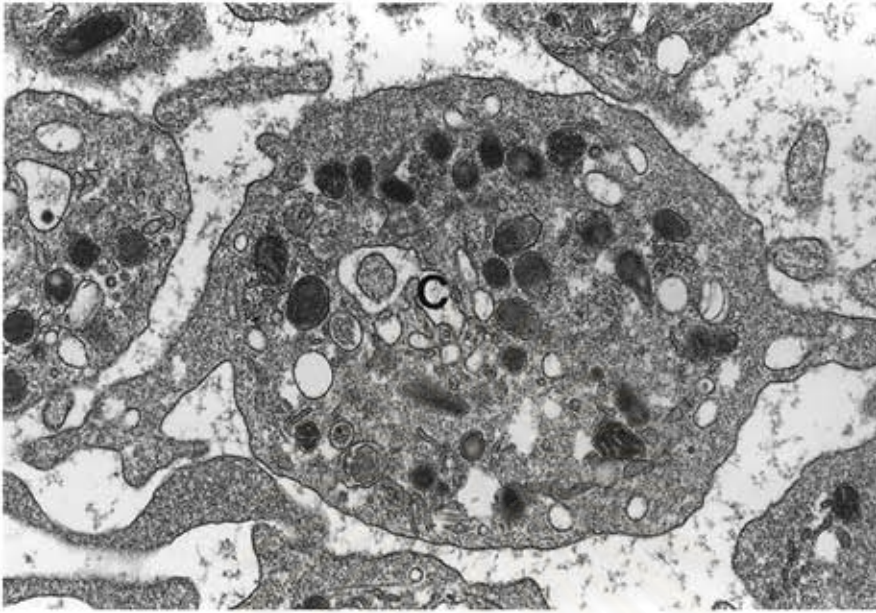
**A****B**

Figure 10. Electronmicrographs of platelets obtained from migraine patients with depression.

A. Resting state showing a moderate degree of canalicular dilatation

(C). x22000

B. Activated state showing of marked canalicular dilatation (C).

x22000



Comparison between Parkinson's disease patients and normal control

At resting state, the number of dense granules was significantly increased in platelets obtained from the patients with Parkinson's disease when compare to the normal platelets (8.3 ± 0.5 and 5.9 ± 0.23 , respectively, $p < 0.01$). However, there was no significant difference between these two groups after exposure to glass surface (Table 8A and Figure 11A). In resting platelets obtained from PD group, the significant decrease in number of alpha granules was demonstrated (168.6 ± 9.8 and 143.3 ± 5.5 granules/10 platelets for control and PD group respectively, $p < 0.005$). In addition, a significant increase in number of dilated canals was demonstrated in platelets of patients with PD in both resting (32.2 ± 3.4 and 12.8 ± 1.9 canals/10 platelet for patients with PD and normal controls respectively, $p < 0.01$) and activated condition (42.6 ± 2.9 and 16.5 ± 1.6 respectively, $p < 0.01$). Mitochondria did not show difference in both morphology and number.

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Table 8. Enumeration of platelet organelles in Parkinson's disease patients and controls

Table 8 A : Dense granules

Dense granules (granules/10 cells)			
	Control (C)	Parkinson's disease (P)	P vs C
Resting(R)	5.9 ± 0.23	8.3 ± 0.51	p < 0.01
Activated(A)	6.2 ± 0.44	6.2 ± 0.41	NS
A vs R	NS	NS	

Based on 10 platelets / subject ; mean ± SEM

NS : No significant difference.

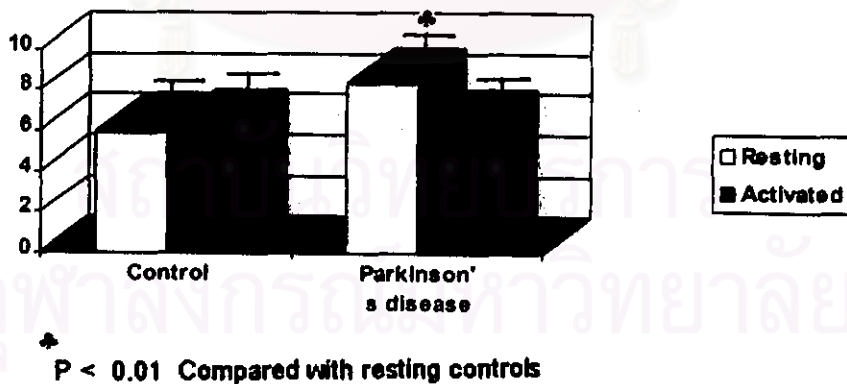


Figure 11A. Effect of glass surface activation on dense granules in platelets obtained from patients with Parkinson's disease and controls

Table 8 B : Alpha granules

Alpha granules (granules/ 10 cells)			
	Control (C)	Parkinson's disease (P)	P vs C
Resting(R)	168.6 ± 9.8	143.3 ± 5.5	p < 0.05
Activated(A)	161.8 ± 4.7	164.2 ± 7.6	NS
A vs R	NS	NS	

Based on 10 platelets / subject ; mean ± SEM

NS : No significant difference.

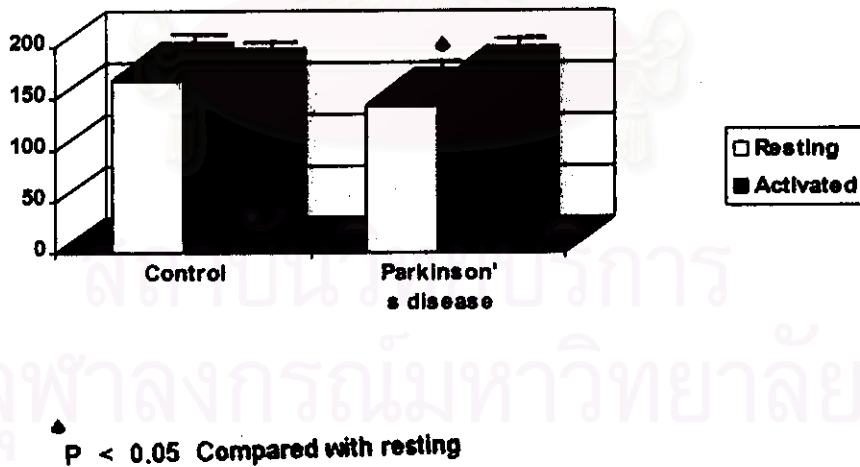


Figure 11B. Effect of glass surface activation on alpha granules in platelets obtained from patients with Parkinson's disease and controls.

Table 8 C : Mitochondria

Mitochondria (number/ cells)			
	Control (C)	Parkinson's disease (P)	P vs C
Resting(R)	19.2 ± 1.1	21.1 ± 1.8	NS
Activated(A)	21.1 ± 0.73	22.2 ± 1.6	NS
A vs R	NS	NS	

Based on 10 platelets / subject ; mean ± SEM

NS : No significant difference.



Figure 11C. Effect of glass surface activation on mitochondria in platelets obtained from patients with Parkinson's disease and controls.

Table 8 D : Dilated canals

Dilated canals (canals/10cells)			
	Control (C)	Parkinson' disease (P)	P vs C
Resting(R)	12.8 + 1.9	32.2 + 3.4	p < 0.01
Activated(A)	16.5 ± 1.9	42.6 + 3.9	p < 0.01
A vs R	NS	NS	

Based on 10 platelets / subject ; mean ± SEM

NS : No significant difference.

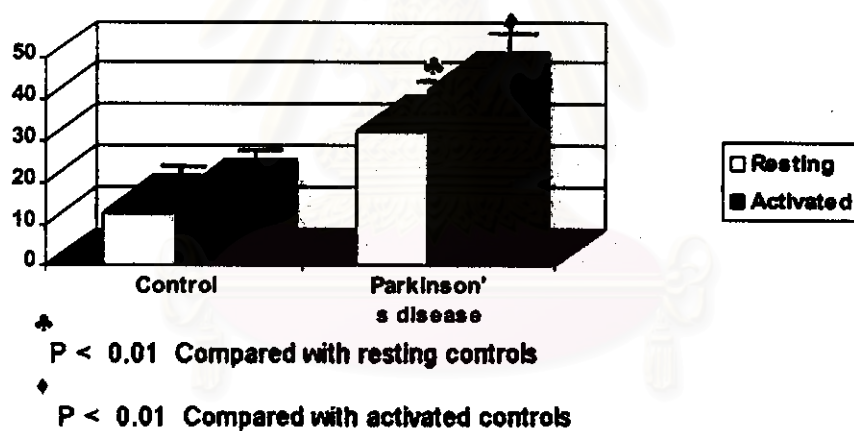
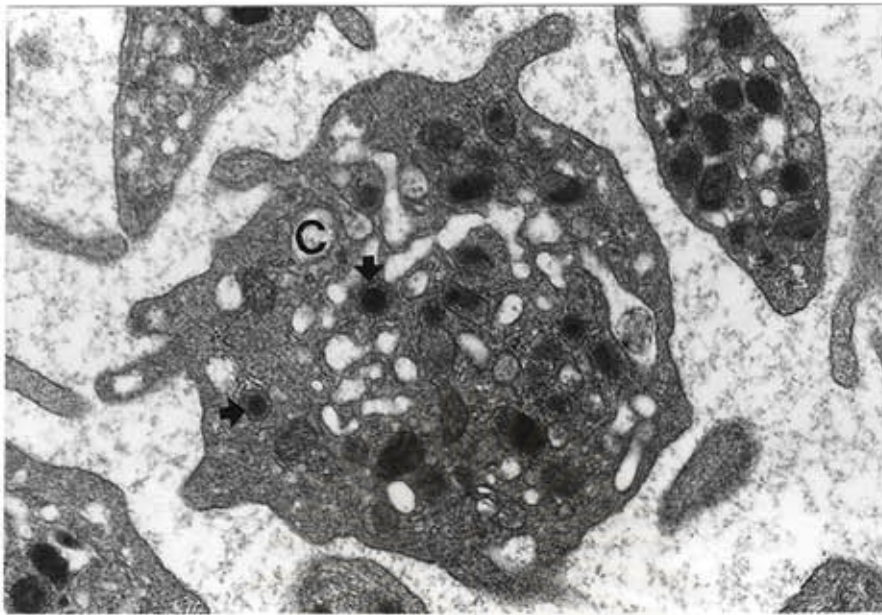
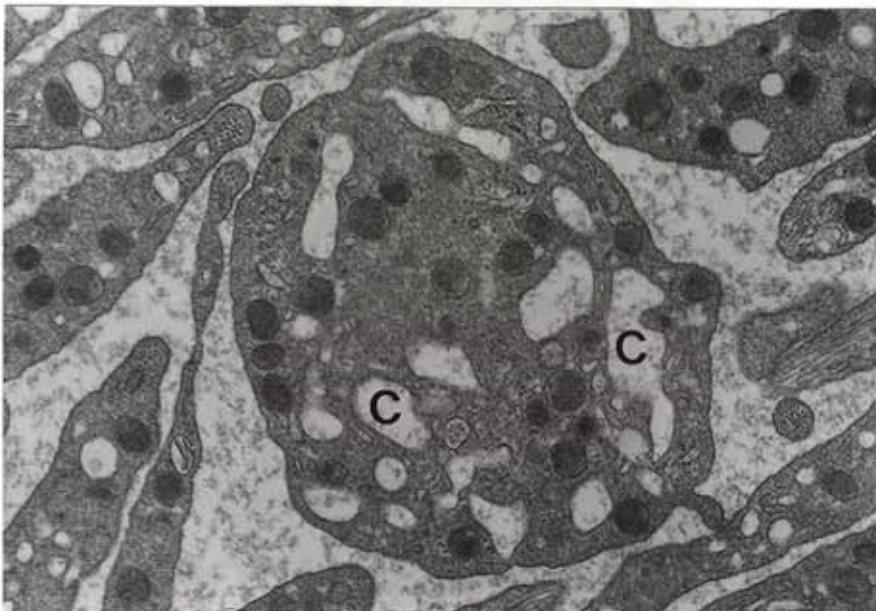


Figure 11D. Effect of glass surface activation on open canalicular system (OCS) in platelets obtained from patients with Parkinson's disease and controls.

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A



B

Figure 12. Electron micrographs of platelets obtained from patients with Parkinson's disease.

- A. Resting state showing a significant increase in the number of dense granules (arrows) and dilated canals. x22,000
- B. Activated state showing numerous large intracytoplasmic vacuoles (C). x22,000

