The Normal Value of Electrocardiogram in the Japanese

The Report of the Committee on the Criteria of the Heart Disease and Electrocardiogram

This survey was made by the members of the Committee on the Criteria of the Heart Disease and Electrocardiogram sponsored by the Ministry of Education in Japan. The members of the Committee who participated in this survey were as follows.

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A few reports have been conducted to describe the normal electrocardiogram of Japanese people. Their results were based on a relatively so small and limited population that, for enhancing the utility of the electrocardiogram in clinical practice, it is needed to detect abnormal electrocardiogram from the normal by delineating the range of normal variations of electrocardiographic component parts, which are based on the large samples assembled from all over Japan.

In 1959 the Committee on the Criteria of the Heart Diseases and Electrocardiogram was established under the chairman of Hideo Ueda with the support of the Ministry of Education. The objects of the committee were:

- (a) to determine the normal values of various electrocardiographic component parts for each age group in Japanese people
- (b) to study the prognosis of the patients with abnormal electrocardiographic findings

- (c) to estimate the clinical value of vectorcardiography
- (d) to determine the electrocardiographic criteria of coronary heart disease
- (e) to conduct the comparative study of electrocardiogram and pathological findings

The committee conducted a survey for 2 years, and various problems were analyzed on the basis of the data from the members of the committee. The purpose of this report is to provide the normal value of electrocardiographic component parts in Japanese people.

METHOD

Electrocardiographic records of 1,329 normal persons are assembled from institutes of the members of the committee. The persons with following conditions are excluded as abnormal.

- (a) persons with blood pressure over 140 mm.Hg in systolic and 90 mm.Hg in diastolic
- (b) patients restricted to bed
- (c) patients with diabetes mellitus
- (d) patients with tuberculosis being treated
- (e) persons with albuminuria
- (f) patients with cardiac diseases
- (g) persons with abnormal findings in chest X-ray film
- (h) patients with anemia
- (i) patients with pulmonary emphysema
- (j) patients with beriberi

The measurement of electrocardiograms, the kind of the electrocardiograph and the technique to take the electrocardiogram were entrusted to the each committee member, and tabulated results were sent to the central committee where mathematical calculations were performed. The standard deviation (SD) is calculated on some components, of which population samples show normal distribution or near it. A range of 2 SD in either direction of the mean is set as the normal range.

The electrocardiographic component parts submitted to analysis are the voltages of P, Q, R, S, T and U deflections, position of S-T segment, intervals of P-Q, durations of P, QRS and Q. Ventricular activation time is measured in lead V_1 , V_2 , V_5 and V_6 . Voltages are measured in standard leads, unipolar leads of extremity (aV_R , aV_L , aV_F) and precordium (V_{4R} , V_1 , V_2 , V_3 , V_4 , V_5 and V_6). The intervals and durations are measured in one arbitrarily selected lead of standard leads and precordial leads.

RESULTS

The age groups and the number of subjects are listed in Table I.
The age groups are divided into 2 parts by sex.

Table I. Number of Records Analyzed in Each Age Group

Age Group (yr.)								
Age	15~	20~	30~	40~	50~	60~	70~	Total
Male	61	165	119	153	135	101	48	782
Female	39	109	94	82	102	79	42	547
Total	100	274	213	235	237	180	90	1329

P Deflection

(1) Duration of P

The values of P deflection are given in Table II.

In standard and unipolar extremity leads, the mean values are from 0.09 sec. to 0.10 sec. among age groups, and there are no apparent variations with ages. In each group, the standard deviation is almost the same and the calculated normal values of P deflection range from 0.13 sec. to 0.06 sec.

In precordial leads, the mean values are from 0.08 sec. to 0.10 sec., which are a little shorter compared with those of standard leads.

(2) Voltage of P deflection (Table III)

As for the amplitude of P, there are no remarkable differences with sex and age. The greatest amplitude of P is shown in lead II, and normal limit of it ranges from 1.88 mm. to 0.19 mm. All cases are below 2.6 mm. in lead II. In lead III, lowest limit indicates below zero line in all cases, but does not exceed -0.5 mm.

P-Q Interval

P-Q interval is measured in each one lead of extremity leads and S D in each group is given in Table IV. Most cases have the mean value of 0.16 sec. and the maximum of them is 0.17 sec. in 60 year male group, and the minimum is 0.16 sec. in 20 year female group. Normal range is 0.23 sec. to 0.10 sec. and the minimum value of most cases is over 0.11 sec. The precordial leads are almost the same as the extremity leads.

QRS Interval

The QRS interval was determined in the lead which demonstrated the largest value in each extremity and precordial lead as in the duration of P. The mean values range from 0.07 sec. to 0.09 sec. The normal upper limit is 0.11 sec. There are no remarkable differences in mean values with age and sex. The mean values of QRS interval of precordial

leads are almost the same or a little longer compared with of standard leads.

Q Deflection

The duration and voltage of Q deflection are determined and averaged in standard leads, unipolar leads and precordial leads, in cases of each group in which they are measurable. Q duration is measured in 2 components, that is, Q_I which is the time from the beginning of the QRS complex to the bottom of Q deflection, and Q_{II} , which is the duration from the beginning of the QRS to the point where Q deflection crosses the base line.

(1) Voltage of Q deflection (Table VI)

In all standard leads and unipolar extremity leads, the mean values are smaller than 1 mm. except $_aV_R$. There are no remarkable differences with sex, but some tendency to decrease with age in lead II, III and $_aV_F$ and to increase in $_aV_L$ in the mean value of Q deflection.

Very few cases have small Q deflection previous to R deflection in the leads V_1 , V_2 and V_3 , which are also under calculation. The mean values of Q in leads V_5 and V_6 are very small, which range from 0.04 mm. to 1.10 mm. Maximum values do not exceed 5.2 mm. There are no remarkable difference in age and sex.

(2) Duration of Q_I (Table VII)

In standard leads and unipolar extremity leads, the mean values of Q_I duration range from 0.016 sec. to 0.006 sec. the values exceed 0.010 sec. in III and $_aV_F$ in most cases. The maximum value does not exceed 0.034 sec. in the groups over 40 year of age in all standard leads.

The mean values do not exceed 0.014 sec. in V_2 through V_6 leads, and their maximum values are below 0.03 sec. except the 60 year male group. There are no remarkable differences in age or sex.

(3) Duration of Q_{II} (Table VIII)

The mean values of Q_{II} duration range from 0.027 sec. to 0.010 sec. in standard leads and unipolar extremity leads except $_aV_R$ lead. The maximum values are in excess of 0.055 sec. in lead II, III and $_aV_F$. There are no outstanding differences between sex and ages.

Table II. Duration of P Deflection (in sec.)

Age Group									
Age		15~19		20~29		30~39		40~49	
Sex		M	F	M	F	M	F	M	F
Number of Cases		61	39	165	169	119	94	153	82
Extremity Lead	Mn., SD	0.098, 0.015	0.097, 0.014	0.093, 0.013	0.089, 0.017	0.097, 0.019	0.099, 0.017	0.095, 0.016	0.090, 0.015
	Max. ~Min.	0.13 ~0.06	0.13 ~0.06	0.13 ~0.06	0.13 ~0.04	0.17 ~0.04	0.12 ~0.04	0.15 ~0.04	0.15 ~0.04
Precordial Lead	Mn., SD	0.089, 0.016	0.093, 0.016	0.091, 0.021	0.085, 0.021	0.089, 0.022	0.088, 0.018	0.093, 0.019	0.078, 0.019
	Max. ~Min.	0.13 ~0.04	0.13 ~0.06	0.15 ~0	0.13 ~0.02	0.13 ~0.02	0.15 ~0.04	0.13 ~0.02	0.13 ~0.02

Age Group									
Age		50~59		60~69		70~			
Sex		M	F	M	F	M	F		
Number of Cases		135	102	101	79	48	42		
Extremity Lead	Mn., SD	0.093, 0.017	0.092, 0.015	0.097, 0.017	0.095, 0.017	0.099, 0.019	0.101, 0.015		
	Max. ~Min.	0.13 ~0.06	0.13 ~0.04	0.15 ~0.06	0.13 ~0.06	0.13 ~0.06	0.13 ~0.06		
Precordial Lead	Mn., SD	0.090, 0.018	0.086, 0.016	0.092, 0.018	0.088, 0.020	0.095, 0.021	0.097, 0.019		
	Max. ~Min.	0.13 ~0.04	0.13 ~0.04	0.13 ~0.04	0.13 ~0.04	0.13 ~0.04	0.13 ~0.06		

Mn. : Mean value, SD: Standard deviation, Max: Maximum value,
 Min.: Minimum value, M : Male, F : Female

Table III. Voltage of

		Age					
Age		15~19		20~29		30~39	
Sex		M	F	M	F	M	F
Number of Cases		61	39	165	109	119	94
I	Mn., SD	0.56, 0.33	0.51, 0.25	0.52, 0.25	0.60, 0.31	0.48, 0.25	0.57, 0.26
	Max.~Min.	1.7~0.6	1.1~0.0	1.1~0.0	2.0~0.0	1.4~0.0	1.4~0.0
II	Mn., SD	0.92, 0.43	0.83, 0.47	1.01, 0.47	0.80, 0.40	0.96, 0.46	0.89, 0.35
	Max.~Min.	2.0~0.0	2.0~0.0	2.6~0.0	2.0~-0.3	2.0~-0.3	1.7~0.0
III	Mn., SD	0.50, 0.45	0.44, 0.46	0.65, 0.44	0.37, 0.41	0.59, 0.47	0.39, 0.37
	Max.~Min.	1.7~-1.2	1.7~-0.3	2.0~-0.3	1.4~-0.4	1.7~-0.9	1.7~-0.6
aV_R	Mn., SD	-0.62, 0.31	-0.62, 0.27	-0.72, 0.34	-0.67, 0.30	-0.48, 0.49	-0.67, 0.25
	Max.~Min.	-1.2~-0.1	0.1~-1.2	-0.1~-2.1	-0.1~-1.5	1.7~-1.5	0.1~-1.2
aV_L	Mn., SD	0.20, 0.36	0.15, 0.28	0.16, 0.59	0.27, 0.37	0.12, 0.34	0.19, 0.40
	Max.~Min.	1.1~-0.9	1.8~-0.6	1.1~-1.1	1.4~-0.1	1.4~-0.6	0.8~-2.4
aV_F	Mn., SD	0.71, 0.44	0.66, 0.46	0.81, 0.52	0.54, 0.34	0.72, 0.51	0.71, 0.35
	Max.~Min.	2.3~-0.3	2.0~0.0	2.6~-1.4	1.7~-0.3	2.0~-1.1	1.7~-0.3
V_{4R}	Mn., SD	0.25, 0.31	0.26, 0.26	0.36, 0.31	0.20, 0.25	0.28, 0.26	0.28, 0.23
	Max.~Min.	1.1~-0.6	1.1~-0.6	1.7~-0.6	1.1~-0.6	0.8~-0.6	0.8~-0.3
V_1	Mn., SD	0.59, 0.36	0.45, 0.28	0.54, 0.37	0.4, 0.30	0.40, 0.30	0.41, 0.31
	Max.~Min.	1.4~-0.3	1.1~0.0	2.0~-0.9	1.1~-0.6	1.1~-0.9	1.1~-0.6
V_2	Mn., SD	0.68, 0.42	0.50, 0.2	0.60, 0.34	0.49, 0.32	0.44, 0.31	0.50, 0.32
	Max.~Min.	2.0~0.0	1.4~0.0	1.7~-0.3	1.4~-0.6	1.4~-0.6	1.7~-0.3
V_3	Mn., SD	0.63, 0.36	0.51, 0.28	0.61, 0.35	0.50, 0.28	0.44, 0.25	0.50, 0.28
	Max.~Min.	1.7~0.0	1.1~0.0	1.7~0.0	1.1~-0.6	1.4~0.0	1.7~0.0
V_4	Mn., SD	0.60, 0.34	0.43, 0.24	0.59, 0.33	0.42, 0.24	0.45, 0.26	0.49, 0.30
	Max.~Min.	1.7~0.0	1.1~0.0	1.7~0.0	1.1~0.6	1.4~0.0	1.7~0.0
V_5	Mn., SD	0.50, 0.37	0.40, 0.26	0.56, 0.33	0.39, 0.25	0.42, 0.24	0.74, 0.40
	Max.~Min.	1.4~0.0	1.1~0.0	2.0~0.0	1.1~-0.3	1.4~0.0	1.7~0.0
V_6	Mn., SD	0.47, 0.34	0.29, 0.24	0.50, 0.33	0.36, 0.25	0.35, 0.21	0.38, 0.26
	Max.~Min.	1.7~0.0	1.1~0.0	1.7~0.0	1.4~-0.3	1.1~0.0	1.7~0.0

Mn. : Mean value, SD: Standard deviation, Max.: Maximum value,
 Min.: Minimum value, M : Male, F: Female,

P Deflection (in mm.)

Group (yr.)							
40~49		50~59		60~69		70~	
M	F	M	F	M	F	M	F
153	82	135	102	(0)	79	48	42
0.54, 0.28 2.2~0.0	0.52, 0.24 1.1~0.0	0.48, 0.28 1.4~0.0	0.60, 0.25 1.4~0.0	0.43, 0.27 1.1~0.0	0.59, 0.31 1.7~0.0	0.43, 0.23 1.1~0.0	0.62, 0.33 1.4~0.0
1.00, 0.24 2.3~0.0	0.83, 0.37 1.7~0.0	1.00, 0.41 2.0~0.0	0.86, 0.42 2.3~0.0	1.10, 0.43 2.3~0.3	0.94, 0.48 2.3~0.0	0.97, 0.48 2.0~0.0	0.89, 0.39 2.0~0.0
0.65, 0.44 2.3~-0.8	0.45, 0.38 1.7~-0.6	0.65, 0.52 4.1~-0.6	0.46, 0.42 1.4~-0.9	0.69, 0.45 2.3~-0.6	0.42, 0.55 2.0~-1.5	0.65, 0.44 1.7~-0.3	0.40, 0.65 1.7~-2.1
0.51, 0.46 1.2~0.0	-0.65, 0.25 0.1~-1.2	-0.70, 0.60 0.8~-1.6	-0.68, 0.31 0.5~-1.5	0.67, 0.44 1.1~-1.8	-0.68, 0.42 0.8~-2.1	-0.64, 0.41 0.5~-1.5	-0.50, 0.61 1.1~-1.5
0.09, 0.38 1.1~-1.4	0.18, 0.34 1.1~-0.6	0.06, 0.39 1.1~-0.9	0.25, 0.33 1.1~-0.6	-0.05, 0.40 1.1~-1.2	0.28, 0.43 1.7~-1.2	0.10, 0.35 1.1~-0.6	0.25, 0.43 1.1~-0.6
0.81, 0.19 2.3~-0.6	0.61, 0.35 1.7~-0.3	0.79, 0.42 1.7~-0.3	0.59, 0.39 2.0~0.0	0.83, 0.43 2.6~0.2	0.62, 0.46 2.3~-0.6	0.76, 0.44 2.0~-0.3	0.59, 0.46 1.7~-1.2
0.34, 0.31 1.4~-0.3	0.30, 0.26 1.1~-0.6	0.30, 0.29 1.4~-0.6	0.34, 0.34 1.1~-0.9	0.24, 0.37 1.1~-0.9	0.13, 0.04 1.4~-1.5	0.27, 0.40 1.1~-0.6	0.29, 0.31 1.1~-0.3
0.28, 0.12 1.1~-1.5	0.39, 0.28 1.3~-0.9	0.29, 0.40 1.4~-1.2	0.43, 0.31 1.1~-0.6	0.32, 0.41 1.4~-1.4	0.25, 0.49 1.7~-1.4	0.42, 0.41 1.7~-0.6	0.20, 0.46 1.1~-1.2
0.42, 0.34 1.4~-1.4	0.47, 0.30 1.1~0.6	0.14, 0.27 1.4~-0.3	0.46, 0.26 1.1~-0.3	0.44, 0.33 1.7~-0.9	0.41, 0.30 1.4~-0.3	0.56, 0.36 1.4~0.0	0.36, 0.37 1.1~-0.9
0.52, 0.28 1.7~0.0	0.51, 0.28 2.0~0.0	0.43, 0.24 1.1~0.0	0.50, 0.25 1.1~0.0	0.49, 0.36 2.6~-0.3	0.36, 0.30 1.7~0.0	0.52, 0.30 1.7~0.0	0.51, 0.30 1.4~0.0
0.54, 0.29 1.7~0.0	0.46, 1.22 1.1~0.0	0.46, 0.23 1.1~0.0	0.51, 0.21 1.1~0.0	0.51, 0.27 1.4~0.0	0.51, 0.31 1.4~0.0	0.53, 0.27 1.1~0.0	0.49, 0.3 1.4~0.0
0.49, 0.27 1.4~0.0	0.42, 0.17 0.8~0.0	0.44, 0.24 1.4~0.0	0.44, 0.23 1.1~0.0	0.44, 0.24 1.1~0.0	0.45, 0.23 1.1~0.0	0.43, 0.26 1.1~0.0	0.48, 0.25 1.1~0.0
0.47, 0.29 1.7~0.0	0.36, 0.17 1.1~0.0	0.42, 0.24 1.1~0.0	0.41, 0.21 1.1~0.0	0.42, 0.25 1.1~0.0	0.42, 0.32 0.6~0.0	0.38, 0.25 1.7~0.0	0.46, 0.28 1.4~0.0

Table IV.

		Age					
Age		15~19		20~29		30~39	
Sex		M	F	M	F	M	F
Number of Cases		61	39	165	109	119	94
Extre- mity Lead	Mn., SD	0.163, 0.023	0.167, 0.022	0.157, 0.032	0.155, 0.025	0.162, 0.025	0.164, 0.022
	Max.~Min.	0.23~0.12	0.23~0.10	0.23~0.10	0.21~0.04	0.23~0.12	0.23~0.12
Precor- dial Lead	Mn., SD	0.167, 0.024	0.165, 0.024	0.159, 0.019	0.156, 0.021	0.166, 0.028	0.168, 0.026
	Max.~Min.	0.23~0.12	0.21~0.10	0.23~0.70	0.21~0.10	0.23~0.04	0.27~0.06

Table V.

		Age					
Age		15~19		20~29		30~39	
Sex		M	F	M	F	M	F
Number of Cases		61	39	165	109	119	94
Extre- mity Lead	Mn., SD	0.090, 0.013	0.067, 0.010	0.080, 0.015	0.074, 0.015	0.082, 0.015	0.069, 0.015
	Max.~Min.	0.150~0.06	0.09~0.05	0.13~0.04	0.14~0.04	0.11~0.04	0.12~0.04
Precor- dial Lead	Mn., SD	0.096, 0.015	0.075, 0.010	0.087, 0.014	0.084, 0.014	0.085, 0.012	0.080, 0.013
	Max.~Min.	0.19~0.06	0.09~0.05	0.16~0.03	0.14~0.04	0.11~0.05	0.12~0.05

The mean values of Q_{II} duration in lead V_4 , V_5 and V_6 do not exceed 0.03 sec. Most maximum values are within 0.044 sec. There is no remarkable difference due to age and sex.

P-Q Interval (in sec.)

Group (yr.)							
40~49		50~59		60~69		70~	
M	F	M	F	M	F	M	F
153	82	135	102	101	79	48	42
0.167, 0.026	0.159, 0.023	0.164, 0.022	0.164, 0.025	0.171, 0.031	0.165, 0.024	0.170, 0.032	0.162, 0.020
0.25~0.06	0.23~0.12	0.23~0.10	0.23~0.10	0.39~0.10	0.25~0.12	0.23~0.10	0.21~0.10
0.164, 0.024	0.156, 0.022	0.165, 0.022	0.161, 0.024	0.168, 0.031	0.162, 0.024	0.170, 0.032	0.168, 0.021
0.23~0.08	0.21~0.10	0.23~0.10	0.23~0.10	0.37~0.10	0.27~0.12	0.27~0.10	0.21~0.12

QRS Duration (in sec.)

Group (yr.)							
40~49		50~59		60~69		70~	
M	F	M	F	M	F	M	F
153	82	135	102	101	79	48	42
0.081, 0.016	0.074, 0.028	0.076, 0.012	0.075, 0.012	0.080, 0.013	0.077, 0.013	0.085, 0.019	0.079, 0.013
0.18~0.04	0.12~0.05	0.12~0.04	0.12~0.04	0.12~0.05	0.11~0.05	0.18~0.05	0.11~0.05
0.087, 0.015	0.081, 0.024	0.086, 0.012	0.081, 0.010	0.083, 0.013	0.084, 0.014	0.089, 0.017	0.082, 0.009
0.17~0.05	0.11~0.05	0.12~0.05	0.11~0.06	0.12~0.06	0.12~0.06	0.18~0.07	0.10~0.07

*R Deflection**Voltage of R Deflection* (Table IX)

The mean values of R deflections of lead I are in the narrow range indicating from 5.30 mm. to 6.55 mm. but their values in lead II, III and V_F have a tendency to decrease with ages. The mean values in lead II

are the largest among the standard leads, and range from 7.78 mm. to 15.35 mm.

The mean values of R deflection are largest in the males of 10 and 20 year age groups in all precordial leads. The voltages are mostly larger in the male group than in the female of each age group. The maximum value of normal range in V_1 is from 11.46 mm. to 4.71 mm. in the male group, and is from 8.85 mm. to 4.26 mm. in the female group. In lead V_5 , it ranges from 33.33 mm. to 27.72 mm. in the male group, and 29.09 mm. to 22.33 mm. in the female group.

S Deflection (Table X)

The mean values of S deflections do not exceed 3 mm. in all standard leads. The mean and maximum values increase a little with age in lead III and aV_F .

The value of S is largest in V_2 among the precordial leads. In lead V_2 and V_3 , the mean values are larger in male groups. There is no remarkable differences with age and sex in other leads.

S-T Segment

Because of gradual sloping of the curve from QRS to S-T segment, sometimes there are some difficulties in deciding the "J" point. The displacement of S-T segment is measured at the "J" point and at the point 0.04 sec. apart from the "J" point which is symbolized as ST-0.04 segment.

(1) "J" point (Table XI)

In lead I, mean values are almost near the zero line in all age groups and their SD is below 0.25 mm. Calculated normal limit ranges from 0.50 to -0.50 mm. These values increase in lead II, III and aV_F , in which maximum depression is about 0.8 mm. and not more than 1 mm. There are no remarkable differences with age and sex in them.

In most cases, the mean values are positive in the precordial leads. Male groups usually have more positive value than female groups, through V_1 to V_4 lead. The maximum elevation of "J" point is obtained from V_2 in most age groups and reaches to 2.9 mm. in the 20 year male group.

Maximum depression of normal limit in each precordial lead regardless of age is as follows; V_1 , -0.85 mm., V_3 , -2.14 mm., V_4 , -1.23 mm., V_5 , -0.99 mm., V_6 , -0.84 mm.

(2) *S-T 0.04 Segment* (Table XII)

S-T 0.04 segment shows almost the same tendency as described in "J" point except its values, which incline to take more positive value than "J" point.

T Deflection (Table XIII)

The mean values of lead I range from 3.2 mm. to 1.5 mm. according to ages. In almost all cases of each decade except the 70 year male group, positive T deflection is found in lead I. The lower limit of normal value ranges from 1.0 mm. to 0.0 mm. in male group, and 0.7 mm. to 0.0 mm. in female group.

In lead II, mean values range from 4.7 mm. to 2.1 mm. and the values in lead III and aV_F are smaller than in lead II. In the large number of cases, male groups show larger values than female groups, and the values decrease with age.

Voltages in precordial leads are as follows.

V_1 : The mean values of male groups are all positive. In female of 10, 20, 30, and 50 year groups, the mean value shows negative T wave. The lower limit of normal ranges of T wave is usually negative in all ages and in both sexes.

V_2 : The mean values are positive in all age groups regardless of sex. Young male groups have larger mean value. As for the lower limit of the normal range, the female groups indicate the negative value regardless of age, but in the male group of 10, 20, 40, 50 and 70 year, they have positive values.

V_3 : Mean value in V_3 is slightly larger than that in V_2 . Male groups have positive values of T deflections in both mean value and lower limit. In the female groups, mean values are all positive, but lower limit is slightly negative in almost all cases except 10 year group.

V_4 : The feature in V_4 is almost the same as that in V_3 . Even in V_4 lead, males of 30 year group and females of 30 and 50 year groups show the negative value of lower limit.

V_5 : The mean values are mostly positive in each decade, and lower limits range from 1.12 mm. to -0.34 mm., and are isoelectric in most cases.

V_6 : In V_6 the mean values of T deflections show no remarkable differences with sex, but a tendency to decrease with age. All the mean values are positive. The lower limits of normal values are all positive or isoelectric, ranging from 1.0 mm. to 0 mm.

Table VI. Voltage of

		Age					
Age		15~19		20~29		30~39	
Sex		M	F	M	F	M	F
Number of Cases		61	39	165	109	119	94
I	Mn.	0.3	0.28	0.32	0.22	0.37	0.18
	Max.~Min.	1.9~0	1.5~0	4.1~0	1.5~0	2.47~0	1.8~0
II	Mn.	0.66	0.44	0.73	0.46	0.52	0.26
	Max.~Min.	3.2~0	2.5~0	9.2~0	2.7~0	3.2~0	1.9~0
III	Mn.	0.69	0.51	0.72	0.66	0.56	0.48
	Max.~Min.	3.0~0	3.2~0	8.8~0	3.2~0	2.9~0	2.11~0
aV_R	Mn.	9.27	7.31	7.38	8.45	3.35	6.74
	Max.~Min.	2.0~0 (30)	10.1~5.5	13.5~0	14.3~2.8 (47)	12.9~0	11.5~0
aV_L	Mn.	0.28	0.26	0.33	0.20	0.15	0.29
	Max.~Min.	2.0~0	2.1~0	4.0~0	3.0~0	3.2~0	4.4~0
aV_F	Mn.	0.59	0.47	0.60	0.40	0.50	0.35
	Max.~Min.	3.8~0	2.4~0	5.8~0	2.5~0	3.0~0	3.4~0
V_{4R}	Mn.	0.03	0	0.15	0.03	0.11	0.01
	Max.~Min.	1.5~0 (31)	0	1.4~0 (117)	1.2~0 (95)	4.6~0	0.2~0 (75)
V_1	Mn.	0.03	0	0.01	0	0.01	0
	Max.~Min.	1.2~0	0	1.1~0	0	1.6~0	0
V_2	Mn.	0.04	0	0.01	0.01	0.01	0
	Max.~Min.	1.8~0	0	0.1~0	0.3~0	1.1~0	0
V_3	Mn.	0.03	0	0.01	0	0.01	0.01
	Max.~Min.	1.5~0	0	1.1~0	0	0.5~0	0.1~0
V_4	Mn.	0.35	0.16	0.31	0.13	0.4	0.01
	Max.~Min.	3.5~0	3.0~0	5.8~0	1.1~0	3.1~0	1.0~0
V_5	Mn.	1.01	0.39	0.87	0.33	0.70	0.04
	Max.~Min.	5.0~0	4.1~0	5.2~0	2.0~0	3.4~0	1.3~0
V_6	Mn.	0.95	0.56	0.92	0.45	0.58	0.39
	Max.~Min.	4.0~0	3.9~0	4.8~0	2.0~0	3.1~0	1.8~0

(): Number of cases in which measurement was made.

Q Deflection (in mm.)

Group (yr.)							
40~49		50~59		60~69		70~	
M	F	M	F	M	F	M	F
153	82	135	102	101	79	48	42
0.27 2.1~0	0.24 2.0~0	0.25 1.7~0	0.33 2.0~0	0.27 2.3~0	0.30 2.3~0	0.26 2.0~0	0.39 1.7~0
0.34 2.4~0	0.30 2.1~0	0.44 5.6~0	0.29 1.1~0	0.35 2.0~0	0.21 1.7~0	0.28 1.1~0	0.30 1.7~0
0.40 2.9~0	0.42 5.6~0	0.54 11.0~0	0.39 4.4~0	0.39 2.0~0	0.40 2.3~0	0.43 2.6~0	0.23 2.9~0
6.46 18.2~0	6.57 14.5~0.8	3.68 14.0~0	3.79 10.9~0	3.89 12.9~0	4.12 9.9~0	3.56 16.9~0	2.57 1.39~0
0.47 5.2~0	0.30 1.8~0	0.45 3.8~0	0.40 2.6~0	0.50 4.1~0	0.46 4.1~0	0.74 5.3~0	0.59 3.2~0
0.33 3.1~0	0.23 2.2~0	0.43 5.3~0	0.30 2.6~0	0.30 2.0~0	0.24 1.7~0	0.32 1.1~0	0.21 1.4~0
0.15 6.8~0	0.18 4.3~0 (77)	0.23 4.3~0 (96)	0.09 4.7~0 (84)	0.07 3.2~0 (74)	0.18 4.7~0 (56)	0.01 0.2~0 (23)	0 0
0.11 16.5~0	0 0	0.09 11.4~0	0 0	0 0	0 0.2~0	0 0	0 0.1~0
0.10 13.8~0	0.01 0.05~0	0 0	0 0.5~0	0 0.2~0	0 0	0 0.2~0	0 0.2~0
0.04 3.0~0	0.02 1.0~0	0.02 1.3~0	0.01 2.3~0	0.03 2.5~0	0.01 0.5~0	0.04 1.1~0	0.04 1.4~0
0.27 4.1~0	0.70 2.0~0	0.24 2.6~0	0.25 4.1~0	0.26 3.1~0	0.23 1.7~0	0.35 3.2~0	0.50 3.7~0
0.52 3.0~0	0.39 2.0~0	0.51 5.0~0	0.34 2.0~0	0.53 3.8~0	0.34 1.7~0	0.36 2.0~0	0.59 3.1~0
0.59 2.8~0	0.48 2.0~0	0.31 4.0~0	0.49 2.6~0	0.52 2.5~0	0.36 1.4~0	0.45 2.0~0	0.52 2.0~0

Table VII. Duration

		Age					
Age		15~19		20~29		30~39	
Sex		M	F	M	F	M	F
Number of Cases		61	39	165	109	119	94
I	Mn.	0.011	0.007	0.013	0.008	0.011	0.007
	Max.~Min.	0.022~0 (47)	0.019~0 (21)	0.024~0 (65)	0.024~0 (49)	0.049~0 (62)	0.024~0 (50)
II	Mn.	0.011	0.006	0.012	0.010	0.012	0.014
	Max.~Min.	0.024~0 (40)	0.019~0 (20)	0.024~0 (99)	0.024~0 (64)	0.054~0 (68)	0.024~0 (47)
III	Mn.	0.011	0.012	0.013	0.011	0.015	0.010
	Max.~Min.	0.024~0 (43)	0.034~0 (22)	0.074~0 (88)	0.034~0 (66)	0.054~0 (60)	0.034~0 (50)
aV_R	Mn.						
	Max.~Min.						
aV_L	Mn.	0.011	0.007	0.009	0.011	0.015	0.008
	Max.~Min.	0.024~0 (32)	0.014~0 (14)	0.024~0 (85)	0.049~0 (44)	0.074~0 (44)	0.029~0 (53)
aV_F	Mn.	0.011	0.010	0.014	0.010	0.011	0.016
	Max.~Min.	0.024~0 (36)	0.019~0 (21)	0.054~0 (81)	0.029~0 (56)	0.024~0 (15)	0.054~0 (46)
V_{4R}	Mn.	0	0.007	0.016	0.006	0	0.003
	Max.~Min.	0.01~0 (5)	0.034~0 (7)	0.034~0 (5)	0.024~0 (9)	0 (0)	0.012~0 (13)
V_I	Mn.	0.003	0.006	0.002	0	0.029	0.005
	Max.~Min.	0.014~0 (22)	0.034~0 (7)	0.014~0 (41)	0 (0)	0.039~0 (2)	0.069~0 (23)
V_2	Mn.	0.003	0.007	0.003	0	0	0
	Max.~Min.	0.014~0 (23)	0.039~0 (7)	0.014~0 (44)	0 (0)	0 (0)	0 (0)
V_3	Mn.	0.003	0	0.003	0.003	0	0
	Max.~Min.	0.012~0 (15)	0 (0)	0.014~0 (45)	0.010~0 (15)	0.010~0 (2)	0 (0)
V_4	Mn.	0.009	0.006	0.007	0.005	0.011	0.008
	Max.~Min.	0.024~0 (25)	0.019~0 (11)	0.019~0 (73)	0.019~0 (32)	0.024~0 (35)	0.024~0 (29)
V_5	Mn.	0.014	0.009	0.013	0.011	0.011	0.010
	Max.~Min.	0.029~0 (44)	0.019~0 (17)	0.029~0 (117)	0.024~0 (66)	0.024~0 (74)	0.02~0 (54)
V_6	Mn.	0.014	0.015	0.014	0.010	0.012	0.011
	Max.~Min.	0.029~0 (46)	0.024~0 (23)	0.024~0 (122)	0.029~0 (10)	0.024~0 (88)	0.02~0 (60)

(): Number of cases in which QI was measurable.

of Q_I (in sec.)

Group (yr.)							
40~49		50~59		60~69		70~	
M	F	M	F	M	F	M	F
153	82	135	102	101	79	48	42
0.006 0.025~0 (115)	0.012 0.024~0 (30)	0.011 0.024~0 (53)	0.009 1.024~0 (43)	0.011 0.024~0 (42)	0.011 0.024~0 (32)	0.010 0.024~0 (22)	0.010 0.019~0 (25)
0.015 0.044~0 (80)	0.010 0.019~0 (41)	0.011 0.034~0 (57)	0.009 0.024~0 (43)	0.012 0.024~0 (38)	0.011 0.024~0 (25)	0.012 0.024~0 (18)	0.011 0.024~0 (20)
0.014 0.03~0 (77)	0.012 0.034~0 (38)	0.013 0.034~0 (57)	0.011 1.124~0 (32)	0.011 0.027~0 (34)	0.014 0.034~0 (31)	0.012 0.029~0 (18)	0.014 0.024~0 (10)
0.013 0.04~0 (74)	0.011 0.024~0 (33)	0.014 0.034~0 (52)	0.011 0.024~0 (51)	0.014 0.044~0 (47)	0.011 0.044~0 (31)	0.019 0.034~0 (26)	0.016 0.044~0 (25)
0.003 0.020~0 (75)	0.010 0.029~0 (33)	0.013 0.029~0 (47)	0.011 0.029~0 (30)	0.011 0.024~0 (53)	0.011 0.034~0 (26)	0.012 0.024~0 (13)	0.013 0.029~0 (11)
0.010 0.03~0 (14)	0.009 0.034~0 (12)	0.007 0.014~0 (3)	0.013 0.024~0 (5)	0.014 0.019~0 (3)	0.012 0.019~0 (3)	0 0 (0)	0 0 (0)
0.001 0.03~0 (33)	0 0 (0)	0.004 0.004~0 (1)	0.014 0.024~0 (2)	0 0 (0)	0.004 0.004~0 (3)	0 0 (0)	0.014 0.014~0 (1)
0.002 0.02~0 (31)	0 0 (0)	0.004 0.004~0 (1)	0.004 0.004~0 (2)	0 0 (0)	0.004 0.004~0 (1)	0.019 0.019~0 (1)	0.009 0.009~0 (1)
0 0 (0)	0.005 0.014~0 (9)	0.011 0.014~0 (6)	0.007 0.009~0 (5)	0.011 0.014~0 (2)	0.009 0.014~0 (5)	0.014 0.019~0 (2)	0.000 0.015~0 (5)
0.002 0.015~0 (37)	0.010 0.024~0 (20)	0.010 0.024~0 (31)	0.006 0.014~0 (18)	0.011 0.019~0 (23)	0.011 0.019~0 (16)	0.012 0.024~0 (14)	0.012 0.024~0 (13)
0.011 0.025~0 (86)	0.011 0.24~0 (45)	0.011 0.124~0 (73)	0.009 0.024~0 (55)	0.011 0.034~0 (53)	0.011 0.019~0 (35)	0.012 0.024~0 (28)	0.014 0.024~0 (21)
0.011 0.025~0 (104)	0.012 0.024~0 (53)	0.015 0.29~0 (93)	0.01 0.024~0 (69)	0.011 0.024~0 (66)	0.011 0.019~0 (41)	0.013 0.024~0 (37)	0.013 0.029~0 (25)

Table VIII. Duration

		Age					
Age		15~19		20~29		30~39	
Sex		M	F	M	F	M	F
Number of Cases		61	39	165	109	119	94
I	Mn.	0.014	0.010	0.013	0.012	0.027	0.011
	Max.~Min.	0.029~0 (47)	0.024~0 (20)	0.029~0 (67)	0.024~0 (49)	0.094~0 (62)	0.029~0 (50)
II	Mn.	0.016	0.016	0.017	0.015	0.019	0.013
	Max.~Min.	0.044~0 (40)	0.024~0 (20)	0.074~0 (103)	0.034~0 (64)	0.084~0 (68)	0.034~0 (47)
III	Mn.,	0.018	0.018	0.018	0.018	0.024	0.016
	Max.~Min.	0.054~0 (43)	0.039~0 (22)	0.034~0 (92)	0.034~0 (67)	0.084~0 (59)	0.039~0 (50)
^a V _R	Mn.						
	Max.~Min.						
^a V _L	Mn.	0.017	0.012	0.014	0.015	0.027	0.013
	Max.~Min.	0.044~0 (32)	0.024~0 (14)	0.054~0 (87)	0.044~0 (43)	0.154~0 (45)	0.054~0 (52)
^a V _F	Mn.	0.017	0.015	0.019	0.015	0.020	0.010
	Max.~Min.	0.044~0 (73)	0.024~0 (20)	0.039~0 (88)	0.003~0 (56)	0.044~0 (52)	0.039~0 (47)
V _{4R}	Mn.	0	0.014	0.030	0.011	0.041	0.004
	Max.~Min.	0 (0)	0.044~0 (7)	0.060~0 (4)	0.034~0 (9)	0.064~0.020 (3)	0.024~0 (11)
V ₁	Mn.	0.003	0.009	0.005	0	0.049	0.003
	Max.~Min.	0.014~0 (22)	0.040~0 (7)	0.005~0 (1)	0 (0)	0.069~0 (2)	0.019~0 (23)
V ₂	Mn.	0.003	0.014	0.003	0	0.009	0
	Max.~Min.	0.024~0 (23)	0.054~0 (7)	0.005~0 (2)	0 (0)	0.009~0 (1)	0 (0)
V ₃	Mn.	0.004	0.004	0.007	0.003	0.011	0
	Max.~Min.	0.024~0 (15)	0.004~0 (6)	0.02~0 (3)	0.014~0 (15)	0.024~0 (2)	0 (0)
V ₄	Mn.	0.012	0.011	0.010	0.008	0.018	0.009
	Max.~Min.	0.029~0 (35)	0.019~0 (11)	0.034~0 (76)	0.029~0 (32)	0.034~0 (36)	0.034~0 (29)
V ₅	Mn.	0.018	0.012	0.017	0.014	0.018	0.012
	Max.~Min.	0.044~0 (46)	0.024~0 (18)	0.034~0 (119)	0.044~0 (55)	0.034~0 (77)	0.034~0 (55)
V ₆	Mn.	0.019	0.011	0.021	0.014	0.030	0.015
	Max.~Min.	0.044~0 (48)	0.019~0 (22)	0.034~0 (128)	0.044~0 (70)	0.034~0 (71)	0.039~0 (61)

of Q_{II} (in sec.)

Group (yr.)							
40~49		50~59		60~69		70~	
M	F	M	F	M	F	M	F
153	82	135	102	101	79	48	42
0.020, 0.204~0 (69)	0.018, 0.049~0 (30)	0.016, 0.044~0 (53)	0.014, 0.044~0 (45)	0.015, 0.029~0 (44)	0.016, 0.034~0 (33)	1.018, 0.034~0 (23)	0.015, 0.029~0 (26)
0.018, 0.304~0 (81)	0.014, 0.039~0 (41)	0.017, 0.044~0 (58)	0.013, 0.034~0 (43)	0.016, 0.029~0 (37)	0.017, 0.034~0 (25)	0.018, 0.034~0 (19)	0.017, 0.044~0 (20)
0.018, 0.204~0 (78)	0.019, 0.039~0 (38)	0.020, 0.044~0 (56)	0.019, 0.044~0 (32)	0.018, 0.054~0 (36)	0.023, 0.044~0 (31)	0.018, 0.034~0 (15)	0.022, 0.044~0 (10)
0.027, 0.060~0 (77)	0.017, 0.054~0 (34)	0.025, 0.084~0 (53)	0.017, 0.034~0 (46)	0.021, 0.054~ (46)	0.021, 0.084~0 (31)	0.029, 0.054~0 (26)	0.023, 0.074~0 (26)
0.012, 0.039~0 (77)	0.018, 0.054~0 (33)	0.020, 0.044~0 (47)	0.018, 0.044~0 (29)	0.016, 0.029~0 (36)	0.017, 0.034~0 (26)	0.017, 0.034~0 (14)	0.020, 0.044~0 (12)
0.017, 0.084~0 (15)	0.014, 0.054~0 (12)	0.010, 0.019~0 (3)	0.044~0 (5)	0.001, 0.064~0 (3)	0.022, 0.039~0 (3)	0 (0)	0 (0)
0.005, 0.044~0 (31)	0 (0)	0.007, 0.014~0 (2)	0.000, 0.039~0 (2)	0 (0)	0 (0)	0 (0)	0.010, 0.010~0 (1)
0.005, 0.044~0 (30)	0 (0)	0.004, 0.004~0 (1)	0.003, 0.009~0 (2)	0 (0)	0 (0)	0.024, 0.024~0 (1)	0.009, 0.009~0 (1)
0 (0)	0.001, 0.054~0 (3)	0.004, 0.024~0 (5)	0.007, 0.019~0 (4)	0.014, 0.019~0 (2)	0 (0)	0.019, 0.024~0 (2)	0.002, 0.024~0 (5)
0.013, 0.300~0 (35)	0.013, 0.029~0 (14)	0.014, 0.044~0 (30)	0.013, 0.024~0 (18)	0.014, 0.029~0 (24)	0.012, 0.029~0 (16)	0.018, 0.034~0 (14)	0.020, 0.034~0 (13)
0.017, 0.044~0 (87)	0.017, 0.044~0 (43)	0.016, 0.049~0 (75)	0.014, 0.044~0 (57)	0.016, 0.039~0 (54)	0.014, 0.029~0 (35)	0.018, 0.034~0 (30)	0.019, 0.039~0 (21)
0.025, 0.044~0 (108)	0.019, 0.054~0 (56)	0.018, 0.044~0 (94)	0.015, 0.034~0 (62)	0.017, 0.034~0 (66)	0.015, 0.029~0 (42)	0.018, 0.034~0 (37)	0.019, 0.039~0 (25)

Table IX. Voltage of

Age		15~19		20~29		30~39	
Sex		M	F	M	F	M	F
Number of Cases		61	39	165	109	119	94
I	Mn., SD	5.68, 2.34	5.41, 2.13	5.14, 2.67	5.56, 2.59	5.46, 2.38	5.38, 2.38
	Max.~Min.	13.0~2.0	10.0~2.2	15.3~0.26	15.3~0.43	12.9~1.0	14.2~1.0
II	Mn., SD	14.25, 4.65	11.67, 2.99	13.73, 4.69	11.64, 3.97	12.99, 3.82	15.35, 3.16
	Max.~Min.	22.1~6.0	17.5~6.5	2.38~4.2	22.7~2.0	23.9~3.0	19.1~3.33
III	Mn., SD	10.0, 2.97	7.39, 3.95	9.44, 4.86	7.44, 4.26	8.15, 4.19	5.36, 3.34
	Max.~Min.	23.1~25	15.7~0.2	22.1~0.1	21.5~0	19.9~0	15.3~0.4
aV_R	Mn., SD	0.48, 0.24	0.32, 0.73	0.49, 0.56	0.63, 0.74	0.45, 0.76	0.50, 0.72
	Max.~Min.	3.69~0.02	1.5~0	3.2~0	3.2~0	4.9~0	2.4~0
aV_L	Mn., SD	1.62, 1.17	3.06, 1.69	1.93, 2.21	1.71, 2.09	1.89, 1.48	2.21, 2.01
	Max.~Min.	6.44~0.1	6.9~0	16.2~0	13.2~0	11.9~0	9.1~0
aV_F	Mn., SD	11.80, 3.53	9.55, 3.70	11.07, 4.76	10.00, 3.88	9.57, 3.93	7.45, 4.71
	Max.~Min.	21.8~1.2	17.5~3.0	25.9~0.5	20.9~0.4	19.9~0	15.4~0.2
V_{4R}	Mn., SD	2.16, 3.26	1.43, 1.04	2.42, 1.65	1.51, 1.02	1.80, 1.05	0.98, 0.75
	Max.~Min.	6.2~0.1 (52)	3.3~0 (34)	13.6~0 (117)	18.0~0 (97)	16.9~0 (86)	3.2~0.1 (76)
V_1	Mn., SD	5.54, 2.56	3.95, 2.44	5.05, 3.19	3.53, 2.55	3.67, 2.06	2.81, 1.66
	Max.~Min.	15.5~1.6	10.8~0	15.8~0.54	10.0~0.23	10.9~0	7.5~0.2
V_2	Mn., SD	10.78, 4.16	7.32, 3.62	9.76, 4.69	7.10, 3.36	7.66, 3.95	6.48, 3.26
	Max.~Min.	15.7~3.5	18.0~0	22.4~0.8	23.7~1.0	17.9~0	12.5~1.2
V_3	Mn., SD	13.66, 5.80	9.05, 3.22	11.56, 5.73	9.83, 4.50	10.10, 5.37	4.04, 5.34
	Max.~Min.	33.3~3.1	18.5~0.2	3.70~1.17	24.6~3.5	29.9~0	26.1~0.4
V_4	Mn., SD	20.67, 7.05	13.49, 4.90	24.68, 7.53	14.60, 4.90	17.49, 7.35	14.65, 5.16
	Max.~Min.	35.8~2.3	24.8~6.8	53.2~5.0	30.6~2.87	41.9~2.0	34.0~7.1
V_5	Mn., SD	18.87, 5.31	13.51, 3.44	17.45, 5.84	13.4, 4.46	15.85~6.29	14.10, 4.48
	Max.~Min.	55.0~8.0	24.0~9.0	43.0~3.98	27.4~2.01	33.9~2.0	26.4~1.7
V_6	Mn., SD	14.31, 4.31	11.56, 3.82	13.54, 5.11	11.07, 3.56	11.81, 4.54	11.65, 3.72
	Max.~Min.	28.2~7.0	21.8~7.0	29.0~2.4	23.7~1.2	23.9~2.0	24.9~1.1

R Deflection (in mm.)

Group (yr.)

40~49		50~59		60~69		70~	
M	F	M	F	M	F	M	F
153	82	135	102	101	79	48	42
5.56, 2.70 14.6~0.3	5.71, 2.87 14.3~0	5.30, 2.36 15.9~0	6.46, 2.75 14.9~0.0	5.27, 2.98 16.9~0	6.34, 25.1 12.9~0	5.05, 2.62 16.9~1.0	6.55, 3.18 15.9~1.0
10.74, 4.20 21.0~0.2	9.91, 3.66 17.0~0	10.78, 4.11 25.9~3.0	9.17, 3.24 17.9~0.0	9.35, 3.98 18.9~1.0	7.44, 4.06 33.4~0	7.89, 3.23 15.9~2.0	7.28, 2.98 16.9~2.0
6.24, 4.20 17.5~0.3	5.16, 4.15 17.0~0.5	6.53, 4.36 21.9~0.0	4.42, 3.15 14.9~0.0	5.51, 3.16 14.9~0	3.34, 2.66 12.4~0	6.62, 3.39 12.4~0	3.18, 2.41 11.9~0.0
0.74, 0.00 11.9~0	0.19, 0.00 1.4~0	0.36, 0.17 2.4~0	0.35, 0.54 1.9~0.0	0.37, 0.24 2.4~0	0.32, 0.43 1.9~0	0.30, 0.48 1.4~0	0.43, 0.48 1.9~0.0
2.37, 2.52 14.9~0.1	2.29, 2.09 10.5~0.1	2.16, 2.42 12.9~0	3.15, 2.02 9.9~0	2.53, 2.24 8.9~0	3.29, 2.28 11.9~0	3.22, 2.28 14.9~0	3.86, 0.63 13.9~0.0
8.01, 4.25 17.2~0.4	7.47, 4.71 16.5~0.49	8.19, 4.34 22.9~0.0	6.52, 3.36 16.9~0.0	6.84, 4.81 15.9~0	4.76, 2.68 13.9~0	5.97, 3.32 13.0~0	4.74, 2.30 15.9~0.0
1.61, 0.00 8.4~0.2 (106)	5.50, 0.00 2.8~0.1 (76)	1.31, 0.74 4.9~0 (97)	1.04, 0.73 4.9~0.0 (80)	1.30, 0.96 4.9~0 (74)	1.09, 0.40 4.4~0	0.97 2.4~0	1.27, 0.85 3.9~0.0 (17)
3.17, 3.64 13.9~0.2	2.44, 1.62 6.1~0.3	3.40, 2.28 13.9~0.0	2.59, 1.67 8.9~0.0	3.22, 2.57 13.9~0	2.35, 1.89 9.9~0	2.14, 1.57 8.9~0	2.57, 1.47 8.9~0
7.0, 4.12 18.6~1.0	5.52, 3.20 17.2~0.7	7.41, 4.27 21.9~0.0	5.95, 3.62 15.9~0.0	6.32, 3.38 17.9~0	6.38, 3.87 23.9~0	5.74, 3.87 14.4~0	6.28, 3.43 13.9~0.0
9.74, 5.38 24.3~0.6	9.33, 5.66 27.0~1.3	11.13, 3.25 29.9~0.0	9.95, 5.77 35.9~0.0	10.75, 5.69 27.9~0	11.65, 4.98 21.9~0	11.58, 7.40 35.9~0	13.43, 6.10 31.9~2.0
9.31, 6.51 33.8~3.4	15.86, 5.92 26.8~5.5	17.48, 6.04 35.9~0.0	15.99, 5.72 37.9~0.0	17.50, 8.41 49.9~2.0	17.29, 5.37 37.4~2.0	19.87, 7.94 37.9~0	21.09, 7.78 39.9~6.0
16.45, 6.09 35.2~1.8	15.50, 5.0 28.5~5.6	16.2, 5.52 35.9~2.0	15.20, 5.29 35.9~0.0	16.87, 8.23 55.9~4.0	14.43, 4.88 24.4~0	16.74, 5.81 24.4~0	17.33, 6.05 35.9~6.0
13.00, 5.06 24.7~0.9	11.88, 4.97 26.1~1.7	12.20, 4.27 25.9~2.0	11.85, 4.44 23.9~0	12.25, 5.99 37.9~2.0	10.30, 4.22 23.9~0	11.28, 4.05 23.9~2.0	10.0, 3.45 17.9~4.0

Table X. Voltage of

Age		15~19		20~29		30~39	
Sex		M	F	M	F	M	F
Number of Cases		61	39	165	109	119	94
I	Mn.	1.40	0.54	1.19	0.10	0.86	0.63
	Max.~Min.	5.7~0	3.4~0	5.35~0	4.0~0	3.9~0	2.7~0
II	Mn.	2.02	0.76	1.31	0.66	1.30	0.65
	Max.~Min.	5.8~0	2.9~0	6.2~0	6.2~0	6.9~0	4.6~0
III	Mn.	1.08	0.78	0.94	0.53	1.22	0.77
	Max.~Min.	4.9~0	4.8~0	8.9~0	6.2~0	11.9~0	4.1~0
aV_R	Mn.	9.60	8.83	9.05	8.92	5.87	7.36
	Max.~Min.	14.4~0	11.2~5.6	21.7~0.17	21.0~4.0	15.9~0	11.6~3.6
aV_L	Mn.	3.27	1.82	2.98	2.12	2.39	1.43
	Max.~Min.	9.5~0	7.1~0	14.2~0	12.0~0	15.9~0	7.2~0
aV_F	Mn.	1.42	0.62	1.20	0.53	1.27	0.53
	Max.~Min.	5.84~0	2.2~0	12.0~0	3.2~0	12.9~0	2.0~0
V_{4R}	Mn.	2.99	3.3	3.99	2.73	3.47	3.35
	Max.~Min.	8.5~0 (49)	8.4~0	11.0~0	14.0~0	8.9~0	10.2~0
V_1	Mn.	10.85	9.2	9.7	9.59	9.71	8.90
	Max.~Min.	22.7~0	22.0~0	27.4~0	24.5~2.3	1.9~0	15.5~0
V_2	Mn.	18.04	15.8	20.05	14.06	15.37	13.38
	Max.~Min.	42.5~0	26.5~6.5	55.1~0	34.2~3.6	37.9~0	28.8~2.1
V_3	Mn.	13.37	8.8	12.62	7.71	10.26	7.42
	Max.~Min.	25.0~0	17.0~0	34.0~0	16.0~0	27.9~0	16.9~0
V_4	Mn.	7.22	4.5	6.46	6.42	5.54	4.00
	Max.~Min.	45.0~0	11.5~0	22.6~0	11.1~0	23.9~0	12.3~0
V_5	Mn.	2.92	2.07	2.28	1.86	2.02	1.73
	Max.~Min.	40.0~0	5.1~0	10.0~0	6.4~0	14.9~0	5.55~0
V_6	Mn.	1.32	0.62	0.99	0.54	0.85	0.51
	Max.~Min.	17.8~0	3.3~0	10.7~0	4.5~0	6.9~0	3.64~0

S Deflection (in mm.)

Group (yr.)

40~49		50~59		60~69		70~	
M	F	M	F	M	F	M	F
153	82	135	102	101	79	48	42
0.79	0.40	0.76	0.66	0.56	0.54	0.68	0.56
5.0~0	3.1~0	3.9~0	3.4~0	3.4~0	3.4~0	3.4~0	2.4~0
1.14	0.48	1.14	0.64	1.37	1.07	1.18	1.04
9.1~0	3.7~0	7.9~0	4.9~0	8.4~0	8.9~0	5.9~0.0	4.9~0
1.42	0.83	1.28	1.52	1.91	2.08	2.37	2.18
14.0~0	5.5~0	11.9~0	8.9~0	9.9~0	12.9~0	11.9~0.0	10.9~0
7.62	0.80	4.50	4.52	4.06	3.67	2.70	4.66
14.0~0.7	13.8~0.1	17.9~0	15.9~0	19.9~0	13.9~0	11.9~0	15.9~0
2.44	1.26	1.83	1.50	1.76	1.21	1.12	0.88
8.8~0	8.2~0	8.9~0	5.9~0	7.9~0	5.9~0	5.9~0.0	3.4~0
1.04	0.54	1.03	0.90	1.66	1.45	1.70	1.35
7.1~0	3.8~0	8.9~0	4.9~0	22.9~0	10.9~0	6.9~0.0	5.9~0
4.15	2.70	3.82	3.43	4.05	3.68	4.45	3.16
18.6~0	9.4~0	13.9~0	10.9~0	10.9~0	20.9~0	9.9~0.0	6.9~0
9.42	9.62	9.58	9.07	8.83	8.46	8.87	8.47
24.2~0	23.3~1.1	21.9~0	21.9~0	19.9~0	21.9~0	17.9~0	17.9~0
13.97	12.26	14.14	13.25	12.55	13.08	13.08	12.38
27.0~0	30.7~1.2	31.9~0	27.9~0	29.9~2.0	33.9~0	29.9~0.0	27.9~2.0
11.31	8.24	11.40	9.03	10.35	10.85	11.95	12.05
29.5~0	19.4~0	27.9~2.0	27.9~0	27.9~0	37.9~0	27.9~0	29.9~0
6.43	3.91	6.82	5.85	7.01	6.36	7.66	7.38
20.0~0	12.7~0	21.9~0	21.9~0	27.9~0	19.9~0	27.9~0	21.9~0
2.46	1.46	2.53	2.06	2.75	2.80	2.26	2.50
11.5~0	6.3~0	18.9~0	10.9~0	16.9~0	23.9~0	7.9~0	10.9~0
0.64	0.39	0.91	0.72	0.99	0.94	0.80	0.84
6.9~0	2.6~0.4	7.9~0	3.9~0	9.9~0	8.9~0	5.9~0	4.9~0

Table XI. S-T Segment.

Age		15~19		20~29		30~39	
Sex		M	F	M	F	M	F
Number of Cases		60	39	165	109	119	94
I	Mn., SD	0.03, 0.21	0.01, 0.21	0.01, 0.25	-0.06, 0.23	0.08, 0.17	-0.01, 0.22
	Max.~Min.	0.9~-0.8	0.7~-0.8	0.9~-1.0	0.05~-0.8	0.7~-0.8	0.9~-0.6
II	Mn., SD	0.02, 0.55	0.03, 0.45	0.13, 0.39	0.77, 0.42	0.16, 0.38	0.00, 0.23
	Max.~Min.	2.9~-1.0	2.4~-0.6	1.7~-1.0	2.1~-0.2	1.4~-1.0	0.7~-0.8
III	Mn., SD	0.05, 0.28	0.01, 0.30	0.07, 0.35	0.03, 0.40	0.15, 0.35	-0.01, 0.30
	Max.~Min.	1.1~-1.2	1.5~-0.6	1.9~-0.8	1.3~-0.8	1.9~-0.8	1.3~-1.0
^a V _R	Mn., SD	0.06, 0.41	-0.05, 0.20	0.00, 0.38	-0.05, 0.52	0.04, 0.34	0.01, 0.28
	Max.~Min.	1.3~-0.8	0.5~-0.6	2.1~-1.2	1.3~-1.4	1.1~-1.6	1.1~-1.0
^a V _L	Mn., SD	-0.02, 0.23	0.03, 0.17	0.03, 0.31	0.20, 0.35	0.04, 0.19	-0.02, 0.27
	Max.~Min.	0.9~-0.8	0.5~-0.6	1.3~-1.2	1.5~-0.6	0.9~-2.0	1.0~-1.8
^a V _F	Mn., SD	0.01, 0.35	0.03, 0.24	0.10, 0.41	0.53, 0.35	0.16, 0.35	0.00, 0.36
	Max.~Min.	1.1~-1.0	1.1~-0.6	1.8~-1.0	1.5~-0.4	2.1~-1.0	1.5~-1.0
V _{4R}	Mn., SD	0.23, 0.36	0.00, 0.23	0.02, 0.24	0.17, 0.26	0.11, 0.10	-0.02, 0.21
	Max.~Min.	1.1~-0.5 (32)	1.1~-0.6 (36)	1.1~-0.6 (114)	1.1~-0.6 (94)	0.9~-0.2 (87)	1.1~-0.6 (68)
V ₁	Mn., SD	0.28, 0.44	0.12, 0.35	0.44, 0.52	0.36, 0.29	0.38, 0.44	0.09, 0.25
	Max.~Min.	1.3~-0.8	1.7~-0.8	2.5~-1.0	1.1~-0.6	1.7~-1.6	0.9~-0.6
V ₂	Mn., SD	0.94, 0.87	0.26, 0.48	0.93, 0.89	0.47, 0.31	0.70, 0.30	0.28, 0.47
	Max.~Min.	3.3~0	1.1~-1.4	4.1~-1.0	1.3~-0.4	4.1~-1.4	2.7~-0.8
V ₃	Mn., SD	1.00, 1.57	0.47, 0.57	0.87, 0.99	0.46, 0.29	0.67, 0.61	0.18, 0.44
	Max.~Min.	2.7~-1.5	2.3~-0.8	5.5~-0.6	1.3~-0.4	2.7~-1.2	1.9~-1.0
V ₄	Mn., SD	0.51, 0.72	0.10, 0.47	0.57, 0.90	0.37, 0.23	0.59, 0.79	0.04, 0.44
	Max.~Min.	2.9~-1.0	2.3~-0.8	6.4~-1.0	1.1~-0.4	5.1~-1.6	1.7~-0.8
V ₅	Mn., SD	0.35, 0.50	0.03, 0.31	0.26, 0.57	0.34, 0.22	0.25, 0.49	0.09, 0.33
	Max.~Min.	2.3~-0.4	1.1~-0.8	3.0~-1.0	1.1~-0.2	2.9~-1.2	1.3~-0.8
V ₆	Mn., SD	0.24, 0.50	0.00, 0.14	0.24, 0.50	0.34, 0.25	0.21, 0.41	0.13, 0.37
	Max.~Min.	2.2~0.4	0.7~-0.4	5.1~-0.6	1.3~-0.2	2.5~-2.1	1.5~-1.0

“J” Point (in mm.)

Group (yr.)

40~49		50~59		60~69		70~	
M	F	M	F	M	F	M	F
153	82	135	102	101	79	48	42
0.03, 0.17 0.5~-0.8	0.03, 0.24 1.3~-0.8	0.00, 0.22 1.0~-1.2	-0.00, 0.18 0.5~-0.8	0.06, 0.22 1.1~-1.0	0.03, 0.10 0.7~-0.4	0.00, 0.27 0.9~-1.0	0.00, 0.09 0.3~-0.4
0.03, 0.36 1.1~-1.6	0.12, 0.46 2.5~-0.8	0.07, 0.33 1.7~-1.0	0.03, 0.26 1.1~-1.0	0.05, 0.41 1.5~-1.6	0.06, 0.08 1.1~-0.6	0.00, 0.27 0.7~-1.0	0.09, 0.41 1.9~-0.5
0.00, 0.41 1.1~-1.2	0.07, 0.33 1.1~-1.0	0.03, 0.28 1.0~-1.1	0.06, 0.23 0.9~-1.0	0.05, 0.38 1.1~-2.0	0.09, 0.18 1.1~-0.6	0.04, 0.17 0.5~-0.4	0.03, 0.21 0.9~-0.5
0.06, 0.29 1.0~-0.8	0.04, 0.31 1.1~-1.4	0.11, 0.28 1.1~-1.2	0.04, 0.26 0.9~-0.8	0.03, 0.29 1.9~-0.6	0.04, 0.19 0.9~-0.8	0.00, 0.23 0.7~-0.6	-0.08, 0.19 0.3~-0.7
0.06, 0.21 1.1~-1.0	0.03, 0.22 0.7~-1.2	-0.04, 0.21 0.7~-1.0	0.05, 0.13 0.7~-0.6	0.08, 0.17 1.3~-0.6	0.02, 0.14 0.3~-0.6	0.03, 0.13 0.3~-0.6	0.02, 0.05 0.2~1.0
0.07, 0.37 1.5~-1.2	0.09, 0.31 1.1~-0.6	0.07, 0.33 1.6~-1.0	0.04, 0.20 0.9~-1.0	0.07, 0.37 1.7~-1.6	0.09, 0.19 1.1~-0.6	-0.03, 0.31 1.9~-1.0	0.03, 0.30 1.3~-0.5
0.08, 0.24 1.1~-1.4 (107)	-0.02, 0.21 0.9~-0.8 (74)	0.02, 0.19 1.7~-0.8 (93)	0.07, 0.21 1.1~-1.0 (78)	0.13, 0.14 0.9~-0.4 (74)	0.09, 0.18 0.9~-2.0 (56)	0.16, 0.10 0.7~-0.4 (23)	0.08, 0.10 0.9~-0.1 (17)
0.39, 0.50 2.9~-1.4	0.09, 0.38 1.1~-1.2	0.39, 0.40 1.5~-1.2	0.18, 0.25 1.1~-0.6	0.08, 0.57 2.1~-1.0	0.19, 0.30 1.1~-1.0	0.46, 0.35 1.1~-0.5	0.32, 0.39 1.5~-0.0
0.88, 0.86 6.1~-0.6	0.32, 0.50 2.1~-1.2	0.69, 0.79 2.8~-2.6	0.40, 0.47 1.9~-1.0	0.75, 0.48 3.3~-0.5	0.51, 0.54 2.7~-1.0	0.83, 0.63 2.5~-0.5	0.62, 0.43 1.5~-0.7
0.76, 1.22 9.0~-6.8	0.11, 0.93 2.5~-6.3	0.56, 1.25 2.2~-1.5	0.30, 0.62 2.1~-2.0	0.60, 0.37 2.1~-1.2	0.22, 0.40 1.5~-1.2	0.59, 0.66 2.3~-0.8	0.43, 0.57 2.0~-0.7
0.37, 0.59 3.3~-2.4	0.01, 0.38 2.1~-1.0	0.23, 0.50 1.8~-1.4	0.04, 0.51 2.5~-1.2	0.29, 0.55 1.9~-2.0	0.03, 0.43 1.5~-1.6	0.09, 0.57 1.7~-1.6	0.06, 0.46 1.0~-1.0
0.19, 0.41 1.9~-2.2	0.09, 0.54 2.5~-1.0	0.05, 0.38 1.5~-1.1	0.02, 0.35 1.5~-1.0	0.09, 0.37 1.5~-1.0	-0.02, 0.32 1.1~-1.0	-0.02, 0.39 1.1~-1.2	0.03, 0.25 0.6~-0.9
0.14, 0.26 1.1~-1.2	0.20, 0.54 2.5~-0.6	0.10, 0.32 1.5~-1.0	0.06, 0.26 1.9~-0.6	0.09, 0.33 1.5~-1.0	0.09, 0.19 1.1~-0.6	0.15, 0.30 0.7~-1.0	0.05, 0.27 1.0~-0.7

Table XII. S-T Segment.

Age		15~19		20~29		30~39	
Sex		M	F	M	F	M	F
Number of Cases		61	39	165	109	119	94
I	Mn., SD	0.56, 0.33	0.02, 0.17	0.14, 0.22	0.06, 0.23	0.16, 0.15	0.03, 0.13
	Max.~Min.	1.7~0	0.7~-0.6	1.1~-0.6	0.8~-1.2	0.9~-0.2	0.7~-0.2
II	Mn., SD	0.92, 0.43	0.03, 0.23	0.24, 0.35	-0.02, 0.23	0.27, 0.30	0.03, 0.18
	Max.~Min.	2.0~0	0.9~-0.6	1.5~-0.6	1.1~-0.8	1.1~-0.6	0.5~-0.6
III	Mn., SD	0.50, 0.45	-0.05, 0.20	0.03, 0.33	-0.03, 0.19	0.09, 0.25	0.05, 0.17
	Max.~Min.	1.7~-1.2	0.3~-0.8	1.1~-1.0	0.7~-0.6	0.9~-0.8	0.5~-0.8
aV_R	Mn., SD	-0.62, 0.31	-0.06, 0.15	-0.16, 0.35	0.04, 0.29	-0.09, 0.25	0.02, 0.21
	Max.~Min.	-0.1~-1.2	0.3~-0.6	1.3~-1.2	1.1~-0.8	0.7~-1.2	0.9~-0.8
aV_L	Mn., SD	0.20, 0.36	0.04, 0.10	0.04, 0.26	0.07, 0.58	0.12, 0.17	0.05, 0.17
	Max.~Min.	1.1~-0.9	0.5~-0.2	1.1~-0.6	0.2~-0.6	0.7~-0.4	1.1~-0.2
aV_F	Mn., SD	0.71, 0.44	-0.03, 0.16	0.15, 0.46	0.00, 0.19	0.05, 0.25	0.01, 0.19
	Max.~Min.	2.3~-0.3	0.5~-0.6	3.7~-3.0	0.9~-0.6	0.9~-0.8	0.5~-0.8
V_{4R}	Mn., SD	0.25, 0.31	0.05, 0.15	0.17, 0.28	0.03, 0.16	0.07, 0.17	0.05, 0.12
	Max.~Min.	1.1~ $\pm$ 0.5 (50)	0.7~-0.2 (37)	1.1~-0.2 (123)	1.1~-0.2 (95)	1.6~0 (84)	0.5~-0.2 (68)
V_1	Mn., SD	0.59, 0.36	0.37, 0.50	0.14, 0.58	0.38, 0.42	0.87, 0.51	0.37, 0.36
	Max.~Min.	1.4~-0.3	1.5~0	2.5~-1.0	2.1~-0.2	2.9~0	1.3~-0.2
V_2	Mn., SD	0.68, 0.42	0.93, 0.59	2.51, 1.09	0.78, 0.60	1.77, 0.76	0.89, 0.50
	Max.~Min.	2.0~0	2.1~-0.2	5.5~-0.6	3.1~0	6.7~0	2.0~0
V_3	Mn., SD	0.63, 0.36	0.74, 0.57	1.94, 0.77	0.58, 0.50	1.57, 0.77	0.67, 0.49
	Max.~Min.	1.7~0	1.7~-0.2	5.7~0	2.1~-0.4	3.7~-0.4	2.3~-0.2
V_4	Mn., SD	0.60, 0.34	0.41, 0.32	1.09, 0.81	0.28, 0.4	0.91, 0.70	0.34, 0.48
	Max.~Min.	1.7~0	1.3~-0.2	4.5~-0.2	1.5~-0.4	3.7~-1.2	2.9~-0.4
V_5	Mn., SD	0.50, 0.37	0.19, 0.26	0.56, 0.59	0.13, 0.32	0.45, 0.45	0.22, 0.41
	Max.~Min.	1.4~0	1.1~-0.2	3.3~-0.4	1.5~-1.6	2.1~-0.4	2.5~-0.4
V_6	Mn., SD	0.47, 0.34	0.04, 0.11	0.13, 0.48	0.14, 0.30	0.25, 0.30	0.66, 0.36
	Max.~Min.	1.7~0	0.5~-0.2	2.9~-0.4	2.1~-0.4	2.7~-0.2	2.3~-0.3

S-T 0.04 Sec. (in mm.)

Group (yr.)

40~49		50~59		60~69		70~	
M	F	M	F	M	F	M	F
153	82	135	102	101	79	48	42
0.15, 0.15 1.1~-0.6	-0.01, 0.15 0.5~-0.1	0.07, 0.19 1.0~-0.5	0.05, 0.16 0.5~-0.8	0.07, 0.10 0.7~-0.4	0.06, 0.06 0.5~-0.2	0.03, 0.27 0.7~-1.0	0.00, 0.10 0.4~-0.2
0.16, 0.32 1.5~-1.4	0.05, 0.23 1.1~-0.6	0.08, 0.29 1.0~-1.0	0.06, 0.25 1.1~-0.8	0.13, 0.51 4.3~-1.0	0.09, 0.12 1.1~-0.2	0.05, 0.12 0.7~-1.0	-0.01, 0.19 0.5~-0.5
-0.01, 0.32 2.5~-1.2	0.03, 0.16 0.5~-0.8	0.00, 0.20 0.6~-0.8	0.06, 0.21 1.1~-0.6	0.07, 0.32 1.1~-2.0	0.06, 0.13 0.7~-0.4	0.03, 0.15 0.3~-0.4	0.00, 0.12 0.5~-0.3
-0.05, 0.35 1.9~-1.2	0.18, 0.16 0.5~-0.6	-0.07, 0.23 1.1~-0.9	0.08, 0.18 0.9~-0.6	-0.01, 0.28 1.9~-0.8	0.02, 0.13 0.3~-0.8	0.01, 0.17 0.5~-0.6	-0.01, 0.13 0.3~-0.5
0.12, 0.10 1.1~-0.4	0.01, 0.08 0.3~-0.6	0.05, 0.17 1.1~-0.5	0.06, 0.06 0.7~-0.2	0.09, 0.15 1.3~-0.4	0.04, 0.05 0.3~-0.4	0.05, 0.14 0.5~-0.6	0.03, 0.09 0.5~0.0
0.13, 0.28 1.5~-1.6	0.04, 0.21 0.7~-1.0	0.03, 0.23 1.0~-0.7	0.04, 0.16 0.9~-0.6	0.07, 0.30 1.9~-1.6	0.08, 0.12 0.7~-0.2	0.04, 0.19 0.5~-0.6	-0.02, 0.14 0.4~-0.5
0.25, 0.19 1.1~-0.6 (108)	0.04, 0.14 0.9~-0.4 (73)	0.12, 0.23 1.2~-0.2 (93)	0.05, 0.21 1.3~-4.2 (78)	0.17, 0.08 0.9~0 (74)	0.11, 0.13 0.7~-0.6 (56)	0.39, 0.15 0.9~0.0 (23)	0.12, 0.09 0.6~0.0 (17)
0.79, 0.56 0.9~-0.4	0.39, 0.39 1.7~0.2	0.85, 0.45 2.5~-0.1	0.37, 0.43 1.5~-1.2	0.64, 0.33 2.1~-0.2	0.40, 0.30 1.3~-0.2	0.30, 0.35 1.5~0.0	0.53, 0.48 1.9~0.0
1.60, 0.92 4.9~-2.0	1.20, 0.55 2.5~-0.6	1.61, 1.00 5.0~-1.2	0.89, 0.58 2.3~-0.4	1.20, 0.47 2.7~0	0.90, 0.55 2.5~-0.4	1.43, 0.67 3.3~0.4	0.90, 0.57 2.4~-0.5
1.59, 1.01 5.1~-2.6	0.58, 0.54 2.5~-1.0	1.50, 0.41 3.7~0.0	0.72, 0.65 2.9~-1.0	1.18, 0.30 2.9~-0.6	0.66, 0.50 2.5~-0.2	1.33, 0.75 3.3~-0.3	0.97, 0.49 2.5~-0.5
0.90, 0.72 3.5~-1.6	0.24, 0.38 1.5~-0.6	0.91, 0.77 3.8~-0.5	0.30, 0.47 2.1~-0.8	0.72, 0.45 2.1~-1.0	0.34, 0.67 2.1~-1.0	0.58, 0.70 2.3~-1.0	0.35, 0.52 2.0~-0.3
0.45, 0.56 3.3~-1.8	0.13, 0.27 1.1~-0.6	0.36, 0.36 1.5~-0.8	0.16, 0.25 2.1~-0.6	0.27, 0.36 1.3~-0.6	0.08, 0.24 1.1~-0.8	0.15, 0.45 1.3~-1.0	0.06, 0.27 1.0~-0.6
0.22, 0.28 1.5~-1.2	0.06, 0.17 0.7~-0.4	0.15, 0.30 1.3~-0.5	0.10, 0.10 4.1~-0.4	0.14, 0.28 1.1~-1.0	0.07, 0.09 0.5~-0.4	-0.02, 0.34 0.7~-3.4	0.03, 0.16 0.5~-0.4

Table XIII. Voltage of

Age		15~19		20~29		30~39	
Sex		M	F	M	F	M	F
Number of Cases		61	38	165	109	119	94
I	Mn., SD	3.21, 1.13	2.50, 0.88	2.80, 1.11	2.42, 0.98	2.42, 0.93	2.30, 0.79
	Max.~Min.	5.9~1.0	4.9~0.0	7.9~0.0	5.9~0.0	5.9~0.0	5.9~-1.0
II	Mn., SD	4.65, 1.34	2.88, 1.04	4.26, 1.56	2.98, 1.40	3.79, 1.47	2.91, 1.15
	Max.~Min.	7.9~1.0	4.9~0.0	9.9~0.0	7.9~-3.0	9.9~0.0	6.1~0.0
III	Mn., SD	1.93, 0.99	0.42, 0.95	1.78, 1.30	0.58, 1.10	1.65, 1.33	0.70, 0.76
	Max.~Min.	4.9~-1.0	3.9~-3.0	5.9~-2.0	4.9~-2.0	5.9~-2.0	2.9~-2.0
aV_R	Mn., SD	-3.68, 1.58	2.42, 0.83	-2.37, 1.38	-0.3, 0.95	-2.74, 1.46	-2.50, 0.87
	Max.~Min.	-0.1~-7.0	-9.1~-5.0	-0.1~-12.0	-0.1~-5.0	3.9~-7.6	-0.1~-5.0
aV_L	Mn., SD	1.05, 0.83	1.26, 0.83	0.89, 1.03	1.34, 1.02	0.70, 1.00	1.10, 0.72
	Max.~Min.	3.0~-1.0	3.9~-1.0	5.9~-2.0	6.9~-2.0	3.9~-2.0	3.9~-1.0
aV_F	Mn., SD	3.18, 1.28	1.73, 0.95	2.98, 1.56	1.88, 1.20	2.62, 1.46	1.86, 0.93
	Max.~Min.	5.9~0.0	4.9~-1.0	7.9~-6.0	6.9~-2.0	6.9~-4.0	4.9~-1.0
V_4R	Mn., SD	-0.26, 1.10	-0.55, 0.78	0.17, 1.25	-0.68, 0.95	0.35, 1.02	0.67, 1.07
	Max.~Min.	1.9~-4.0 (50)	1.9~-2.0 (37)	3.9~-4.0 (117)	1.9~-3.0 (96)	2.9~-3.0 (86)	11.9~-3.0 (67)
V_1	Mn., SD	1.42, 2.55	-0.15, 1.38	1.99, 1.81	-0.45, 1.65	1.77, 2.02	-0.19, 1.34
	Max.~Min.	7.9~-5.0	2.9~-4.0	6.9~-3.0	4.9~-4.0	8.9~-2.0	2.9~-3.0
V_2	Mn., SD	8.38, 3.67	3.20, 2.90	8.14, 3.65	2.96, 2.16	6.90, 3.57	3.17, 2.03
	Max.~Min.	19.9~-1.0	10.9~-3.0	23.9~0.0	8.9~-4.0	18.9~-2.0	8.9~-2.0
V_3	Mn., SD	9.92, 3.52	4.50, 2.24	8.86, 3.63	4.05, 2.16	7.58, 3.37	4.21, 2.17
	Max.~Min.	20.9~0.0	10.9~0.0	22.9~2.0	9.9~-0.0	20.9~1.0	10.9~0.0
V_4	Mn., SD	9.38, 3.75	5.15, 2.08	8.72, 3.93	4.80, 1.84	7.58, 3.89	4.87, 2.46
	Max.~Min.	16.9~1.0	10.9~0.0	24.9~1.0	10.9~0.0	40.9~1.0	13.0~0.0
V_5	Mn., SD	8.53, 3.58	4.45, 1.70	5.30, 2.82	4.25, 1.65	5.44, 2.86	4.45, 2.01
	Max.~Min.	15.9~0.0	8.9~0.0	16.9~1.0	10.9~-2.0	14.9~0.0	11.0~0.0
V_6	Mn., SD	4.96, 2.21	3.69, 1.37	4.48, 2.15	3.43, 2.41	3.80, 1.85	3.55, 1.45
	Max.~Min.	11.9~0.0	6.9~0.0	14.9~0.0	8.9~0.0	8.9~0.0	7.9~1.0

T Deflection (in mm.)

Group (yr.)

40~49		50~59		60~69		70~	
M	F	M	F	M	F	M	F
153	82	135	102	101	79	48	42
2.42, 0.95 6.9~0.0	1.87, 0.89 3.9~0.0	2.23, 0.93 5.9~0.0	2.08, 0.81 4.9~0.0	2.07, 0.96 4.9~0.0	1.83, 0.96 4.9~0.0	1.54, 1.74 2.9~-1.0	1.83, 0.78 4.9~-0.0
3.63, 1.39 7.9~0.0	2.62, 1.02 5.9~0.0	3.40, 1.44 8.9~-1.0	2.47, 1.22 5.9~-1.0	3.18, 1.45 7.9~-2.0	2.27, 1.02 7.9~0.0	2.56, 1.17 5.9~0.0	2.12, 0.87 3.9~0.0
1.45, 1.54 6.9~-3.0	0.75, 0.99 4.9~-2.0	1.40, 1.10 5.9~-2.0	0.56, 0.90 2.9~-2.0	1.46, 1.48 5.9~-3.0	0.54, 1.07 3.9~-2.0	1.33, 1.14 4.9~-1.0	0.62, 0.78 2.9~-2.0
-2.00, 2.28 4.9~-6	-1.55, 1.53 3.9~-4.0	-2.31, 1.42 4.9~-6.0	-1.88, 1.10 2.9~-5.0	-2.16, 1.43 2.9~-5.0	-1.58, 1.16 2.9~-4.0	-0.16, 1.17 1.9~-5.0	-1.12, 1.43 2.9~-4.0
0.87, 1.14 7.9~-2.0	0.85, 0.66 2.9~-2.0	0.73, 0.89 3.9~-2.0	0.96, 0.72 2.9~-1.0	0.52, 1.15 3.9~-3.0	0.27, 0.84 3.9~-2.0	0.52, 0.71 1.9~-2.0	0.90, 0.85 3.9~-2.0
2.45, 1.58 12.0~-1.0	1.72, 0.90 4.9~-0.2	2.21, 1.26 6.9~-2.0	1.47, 0.86 4.9~-1.0	2.43, 1.37 6.9~-2.0	1.41, 0.75 3.9~-1.0	1.75, 1.23 4.9~-1.0	1.23, 1.06 3.9~-4.0
-0.01, 1.26 3.9~-5.0 (108)	-0.49, 0.79 2.9~-2.0 (74)	-0.02, 0.96 3.9~-3.0 (94)	-0.42, 0.81 1.9~-2.0 (78)	-0.26, 0.99 1.9~-3.0 (74)	-0.55, 0.84 2.9~-3.0 (56)	0.00, 1.16 2.9~-2.0 (23)	-0.32, 0.57 0.9~-2.0 (17)
1.52, 4.21 10.9~-5.0	0.53, 1.28 2.9~-4.0	1.35, 2.10 7.9~-5.0	-0.13, 1.45 4.9~-4.0	1.20, 1.95 5.9~-3.0	0.08, 1.45 4.9~-3.0	1.63, 1.67 5.9~-3.0	0.29, 1.86 6.9~-4.0
6.48, 3.04 13.9~-1.0	2.78, 1.85 7.9~-2.0	6.43, 3.01 13.9~-3.0	3.35, 2.25 9.9~-3.0	5.38, 2.90 11.9~-5.0	3.08, 2.19 10.9~-2.0	5.94, 2.80 11.9~0.0	3.24, 2.42 9.9~-3.0
7.92, 3.03 16.9~0.0	3.78, 2.14 9.9~-2.0	7.95, 2.97 18.9~2.0	4.43, 2.52 12.9~-3.0	7.27, 2.98 15.9~-2.0	4.36, 2.37 11.9~-1.0	7.08, 2.98 14.9~2.0	4.62, 2.41 8.9~-1.0
7.61, 3.35 26.9~1.0	4.36, 2.14 11.9~-1.0	7.78, 2.93 15.9~-2.0	4.32, 2.74 13.9~-2.0	7.07, 3.27 17.4~-5.0	4.22, 1.99 12.9~0.0	6.19, 2.63 13.9~-4.0	4.33, 2.58 11.9~0.0
5.54, 2.43 14.9~1.0	4.03, 1.95 11.9~6	5.50, 2.43 14.9~-2.0	3.11, 1.66 9.9~0.0	5.48, 2.51 12.9~0.0	3.32, 1.77 9.9~0.0	4.42, 2.49 10.9~-2.0	3.41, 1.66 8.9~0.0
3.87, 1.75 9.9~0.0	3.12, 1.42 7.9~0.0	3.27, 1.60 8.9~-1.0	2.98, 1.33 7.9~0.0	3.96, 2.06 13.9~0.0	2.45, 1.00 4.9~0.0	2.92, 1.54 6.9~-1.0	2.34, 1.11 4.9~0.0 (38)

Table XIV. Voltage of U

Age		15~19		20~29		30~39	
Sex		M	F	M	F	M	F
Number of Cases		61	39	165	109	119	94
I	Mn.	0.08	0.04	0.06	1.07	0.04	0.03
	Max. ~ Min.	0.3~0 (36)	0.2~0 (25)	1.5~-0.1 (110)	2.0~0 (77)	0.8~-0.2 (94)	0.4~0 (72)
II	Mn.	0.16	0.10	0.19	0.14	0.13	0.09
	Max. ~ Min.	1.0~0 (47)	0.4~0 (25)	1.5~0 (127)	1.0~0 (82)	0.9~0 (103)	0.6~0 (78)
III	Mn.	0.09	0.04	0.07	0.07	0.06	0.05
	Max. ~ Min.	0.8~0 (31)	0.2~-0.1 (24)	0.6~0 (111)	0.9~0 (73)	0.4~0 (98)	0.5~0 (73)
aV_R	Mn.	-0.07	-0.05	0.02	0.02	-0.02	-0.01
	Max. ~ Min.	0~-0.5 (31)	0.1~-0.3 (22)	0.4~-1.0 (113)	0.5~-0.5 (74)	0.2~-0.5 (99)	0.2~-0.3 (66)
aV_L	Mn.	0.04	0.02	0.02	0.01	0.00	0.01
	Max. ~ Min.	0.3~0 (33)	0.1~0 (22)	0.4~0 (107)	0.3~-0.2 (67)	0.1~-0.1 (89)	0.3~0 (61)
aV_F	Mn.	0.14	0.05	0.12	0.11	0.10	0.11
	Max. ~ Min.	0.8~0 (31)	0.4~0 (26)	1.0~0 (116)	1.2~0 (76)	0.8~0 (104)	4.0~0 (70)
V_{4R}	Mn.	0.35	0.01	0.03	0.00	0.08	0.01
	Max. ~ Min.	3.0~0 (20)	0.2~-0.02 (21)	0.5~0 (65)	0.2~0 (56)	0.6~0 (67)	0.4~0 (44)
V_1	Mn.	0.40	0.10	0.35	0.21	0.28	0.10
	Max. ~ Min.	1.4~0 (43)	0.8~-0.2 (25)	2.0~-0.5 (134)	2.0~-0.2 (76)	1.0~0 (103)	1.0~-0.3 (73)
V_2	Mn.	1.07	0.41	0.96	0.69	0.66	0.50
	Max. ~ Min.	2.5~0.2 (56)	1.5~-0.2 (35)	2.8~0 (163)	2.2~0 (97)	2.1~0 (118)	1.7~0 (86)
V_3	Mn.	0.94	0.48	0.94	0.59	0.64	0.53
	Max. ~ Min.	2.5~0 (56)	1.5~0 (33)	2.8~0 (156)	2.9~0 (96)	3.5~-2.2 (114)	1.6~0 (85)
V_4	Mn.	0.73	0.29	0.65	0.36	0.49	0.25
	Max. ~ Min.	2.1~0 (51)	1.0~0 (33)	6.8~0 (144)	1.9~0 (93)	2.3~-0.3 (110)	1.2~0 (81)
V_5	Mn.	0.39	0.11	0.31	0.25	0.30	0.15
	Max. ~ Min.	2.0~0 (44)	0.7~0 (30)	2.0~0 (127)	1.5~0 (88)	7.6~-0.1 (106)	2.0~0 (79)
V_6	Mn.	0.22	0.06	0.10	0.10	0.11	0.04
	Max. ~ Min.	2.7~0 (39)	0.3~0 (27)	0.8~0 (114)	1.9~0 (81)	2.0~0 (110)	0.4~0 (72)

(): Number of cases in which U deflections were measurable.

Deflection (in mm.)

Group (yr.)							
40~49		50~59		60~69		70~	
M	F	M	F	M	F	M	F
153	82	135	102	101	79	48	42
0.05 2.1~0 (120)	0.04 0.5~0 (56)	0.02 0.2~0 (89)	0.03 0.3~0 (75)	0.03 0.4~0 (65)	0.06 1.5~0 (64)	0.03 0.3~0 (37)	0.02 0.3~ -0.3 (37)
0.18 6.2~-0.3 (128)	0.10 0.5~0 (69)	0.09 0.6~0 (98)	0.12 1.0~0 (87)	0.14 0.8~0 (76)	0.14 0.8~0 (65)	0.10 1.0~0	0.18 0.5~ -0.3 (37)
0.05 0.7~-1.1 (122)	0.04 0.5~0 (66)	0.04 0.3~0 (98)	0.05 1.0~-0.2 (74)	0.09 0.7~-0.3 (70)	0.06 0.5~0 (61)	0.04 0.3~-0.7 (39)	0.05 0.4~0 (35)
-0.01 0.4~-0.3 (122)	-0.05 0.2~-0.8 (66)	-0.03 0.2~-0.6 (91)	-0.03 0.0~-0.3 (74)	-0.04 0~-0.4 (67)	-0.03 0~-0.4 (60)	-0.03 0.2~-0.5 (37)	0.00 0.3~-0.3 (37)
0.00 0.3~-0.1 (112)	0.02 0.2~0 (64)	0.01 0.5~-0.2 (83)	0.01 0.3~0 (69)	0.00 0.3~-0.1 (64)	0.00 0.2~-0.3 (61)	0.02 0.3~0 (36)	0.01 0.3~0 (37)
0.09 0.5~0 (122)	0.04 0.4~0 (66)	0.07 0.8~0 (93)	0.05 0.5~0 (78)	0.11 1.1~0 (74)	0.08 0.4~0 (61)	0.01 0.2~-0.7 (4.0)	0.09 0.3~0 (37)
0.02 0.6~0 (84)	0.00 0.2~0 (55)	0.03 0.4~-0.1 (65)	0.01 0.4~-0.2 (58)	-0.02 0.3~-1.2 (46)	0.00 0.3~-0.2 (45)	0.01 0.2~-1.2 (15)	0
0.16 1.5~-0.2 (125)	0.07 0.9~0 (81)	0.18 1.3~-0.2 (107)	0.06 0.5~0 (75)	0.07 1.1~-0.2 (73)	0.11 1.0~0 (59)	0.20 1.0~-0.2 (38)	0.10 0.7~-0.1 (36)
0.72 10.0~0 (144)	0.47 1.5~0 (79)	0.53 1.8~0 (124)	0.43 1.8~0 (96)	0.42 1.4~0 (93)	0.39 1.3~0 (69)	0.48 1.7~0 (47)	0.41 1.1~0 (38)
0.80 6.0~0 (149)	0.44 1.7~0 (78)	0.56 1.9~0 (128)	0.43 2.0~-0.2 (96)	0.51 1.7~0 (96)	0.48 1.5~-0.6 (72)	0.55 1.8~0 (44)	0.49 1.6~0 (39)
0.49 2.5~-0.2 (140)	0.32 1.0~0 (74)	0.37 2.0~0 (122)	0.40 2.0~0 (96)	0.35 1.6~0 (95)	0.30 1.3~0 (72)	0.40 2.0~0 (41)	0.37 1.3~-0.2 (39)
0.24 1.3~0 (131)	0.16 0.9~0 (71)	0.19 1.0~0 (111)	0.25 2.0~0 (94)	0.20 1.2~0 (86)	0.19 1.0~-0.5 (69)	0.19 0.8~-0.8 (40)	0.18 1.3~-0.7 (39)
0.12 1.4~0 (123)	0.05 0.4~0 (65)	0.18 0.8~0 (95)	0.09 0.6~-0.5 (92)	0.08 1.0~0 (73)	0.07 0.6~-1.0 (69)	0.09 0.7~0 (37)	0.08 0.7~-0.8 (38)

Table XV. Ventricular Activation Time (in sec.)

		Age Group (yr.)							
Age		15~		20~		30~		40~	
Sex		M	F	M	F	M	F	M	F
Number of Cases		61	39	165	109	119	94	153	82
V ₁	Mn., SD	0.020, 0.008	0.019, 0.007	0.020, 0.006	0.019, 0.007	0.022, 0.008	0.020, 0.005	0.020, 0.007	0.020, 0.006
	Max.~Min.	0.054~0	0.049~0	0.044~ 0.005	0.049~ 0.005	0.074~0	0.039~ 0.010	0.054~ 0.005	0.034~ 0.005
V ₂	Mn., SD	0.021, 0.006	0.021, 0.007	0.023, 0.006	0.021, 0.006	0.024, 0.007	0.022, 0.006	0.023, 0.007	0.022, 0.005
	Max.~Min.	0.044~0	0.049~ 0.010	0.044~ 0.005	0.049~ 0.005	0.049~ 0.005	0.044~ 0.005	0.054~ 0.005	0.034~ 0.005
V ₅	Mn., SD	0.035, 0.010	0.030, 0.008	0.035, 0.010	0.029, 0.009	0.036, 0.009	0.030, 0.007	0.034, 0.009	0.032, 0.008
	Max.~Min.	0.064~0	0.049~ 0.010	0.054~ 0.010	0.054~ 0.010	0.064~0	0.044~ 0.010	0.054~ 0.012	0.054~ 0.010
V ₆	Mn., SD	0.036, 0.010	0.029, 0.008	0.037, 0.006	0.030, 0.009	0.037, 0.010	0.030, 0.008	0.036, 0.008	0.033, 0.008
	Max.~Min.	0.036~ 0.010	0.044~ 0.010	0.054~ 0.010	0.054~ 0.010	0.054~0	0.049~ 0.015	0.064~ 0.010	0.044~ 0.010

Age		50~		60~		70~			
Sex		M	F	M	F	M	F		
Number of Cases		135	102	101	79	48	42		
V ₁	Mn., SD	0.021, 0.006	0.018, 0.007	0.020, 0.007	0.010, 0.005	0.021, 0.008	0.019, 0.007		
	Max.~Min.	0.049~ 0.005	0.049~0	0.039~0	0.039~ 0.005	0.054~ 0.005	0.044~ 0.005		
V ₂	Mn., SD	0.024, 0.006	0.022, 0.007	0.021, 0.008	0.023, 0.008	0.024, 0.008	0.021, 0.005		
	Max.~Min.	0.044~ 0.005	0.044~ 0.005	0.044~0	0.064~ 0.005	0.054~ 0.005	0.034~ 0.010		
V ₅	Mn., SD	0.034, 0.006	0.033, 0.007	0.034, 0.009	0.033, 0.008	0.037, 0.008	0.033, 0.007		
	Max.~Min.	0.054~ 0.010	0.054~ 0.010	0.054~0	0.054~ 0.010	0.054~ 0.002	0.044~ 0.020		
V ₆	Mn., SD	0.036, 0.010	0.034, 0.007	0.035, 0.010	0.034, 0.009	0.037, 0.008	0.034, 0.007		
	Max.~Min.	0.094~0	0.054~0	0.059~0	0.054~ 0.010	0.054~ 0.020	0.054~ 0.020		

U Deflection (Table XIV)

The mean values are positive and very small in all standard leads and unipolar extremity leads which do not exceed 0.2 mm. Lead II shows the largest value among extremity leads. There are no remarkable differences with ages and sex.

In lead V_2 or V_3 , the value takes the largest among the precordial lead. In the voltage of U, there are some tendencies to decrease with age, and to be larger in the male group.

Ventricular Activation Time (VAT) (Table XV)

V_1 : The mean values and standard deviations are in a narrow range through the all age groups. The mean values range 0.022 sec. to 0.018 sec. and standard deviations indicate from 0.006 sec. to 0.008 sec. The upper limit of normal range is from 0.038 sec. to 0.031 sec. There are no remarkable differences with age and sex.

V_2 : The various values have the same tendency as in lead V_1 , except the increase of their values.

V_5 and V_6 : There are little differences between V_5 and V_6 in the values of VAT. In V_6 , the mean values range from 0.37 sec. to 0.629 sec., and the upper limits are from 0.057 sec. to 0.045 sec. There are no remarkable differences with age, but the mean values of male groups are slightly larger than that of female groups.

DISCUSSION

As recognized by many authors, there are many variables which affect the normal values of electrocardiogram.

In this report, the effects of age and sex on electrocardiogram are mainly considered. The other variables to affect the electrocardiogram, are regarded to be equalized by relatively large samples.

As for age and sex, there are some differences in the voltages of some items of electrocardiogram. The voltage of R deflections in lead II, III, aV_F and some of precordial leads decreases with age, and is larger in male groups than in female groups in the precordial leads. The same tendencies are observed in S deflection and also in T deflection. These results may suggest that when the diagnosis of ventricular hypertrophy is made from the deflections of electrocardiogram, age and sex should be considered carefully.

Significance of displacement of S-T segment should be considered in each lead, because the lowest limit in lead I is -0.05 mm., but in lead II or III, it exceeds -0.05 mm. and may reach to -0.08 mm. In precordial leads, it ranges more widely. It may be also important that there are some differences with sex in the S-T segment.

SUMMARY

The survey on the normal values of electrocardiograms of the Japanese was conducted by Committee on the Criteria of Heart Diseases and Electrocardiogram. Electrocardiographic records from 1,329 Japanese people over 15 years of age, who were considered to be clinically normal, were analyzed according to age and sex. Among the various electrocardiographic component parts, 14 items were measured in the standard leads, unipolar extremity leads and precordial leads. The mean value, maximum value and minimum value were listed according to the items, age and sex. The standard deviation was calculated in some items. The normal range of electrocardiographic items and their difference with sex and age were discussed.