5. CONCLUSIONS.

1. Periodontal disease occurred with equal frequency in both the non-diabetic and diabetic groups, only its severity varied.

2. Periodontal disease was more severe in the diabetic group. The mean Russell periodontal index was higher in the diabetics than in the non-diabetics in all age groups studied and in the total group. The significance of the difference in the scores was shown by the "t" test:
   
   In the 25-29 year age group $t = 5.00 \ (P<0.001)$
   
   In the 30-39 year age group $t = 4.56 \ (P<0.001)$
   
   In the 40-49 year age group $t = 5.98 \ (P<0.001)$

   and in the total group:
   
   $29-49 \ years \ age \ group \quad t = 7.00 \ (P<0.001)$

3. There was a significant correlation $t = 8.4501 \ (P<0.001)$, and marked relationship $r = 0.5254$ between the Russell periodontal index and diabetics.

4. Of the local aetiological factors, calculus showed the strongest correlation $t = 5.9008 \ (P<0.001)$ with a very marked relationship $r = 0.7559$ to the periodontal index in the diabetic group. The same degree of correlation existed in the non-diabetic group.
However the mean Russell periodontal scores and the mean calculus scores were higher in the diabetics.

5. As toothbrushing frequency increased from one or less to twice or more per day, the periodontal index decreased significantly ($P<0.005$) in both the diabetic and non-diabetic groups.
6. SUMMARY

1. The etiology of diabetes mellitus was discussed from an historical angle. The present day thoughts are:
   
   (a) diabetes is hereditary,
   
   (b) there is a prediabetic stage with accompanying angiopathy,
   
   (c) insulin in diabetics is often quantitatively normal, but there would appear to be insulin-inhibiting and/or insulin binding materials,
   
   (d) there is no present indication which organ is the seat of the primary gene change.

2. The pathology of diabetes was briefly discussed bringing to light the specific lesions known as diabetic angiopathy and the fact that atheromatous and arteriosclerotic lesions occur some ten years earlier and with greater severity in diabetics.

3. The treatment of diabetes is also discussed briefly and different degrees of diabetes described - very mild, mild, moderate, severe and very severe. Three different degrees of control were given according to the presence of glycosurie or not - good, fair or poor.

4. The periodontium was described, it was stated that
increased glucose levels increase mitotic activity in the epithelium and that anaerobic glycolysis is the most important manner of providing energy for keratinisation of the epithelium cells. Hyperglycaemia reduces mitotic activity in the epithelium tissue. The ground substance of the connective tissue is very important against bacterial invasion, and may have some part to play in fibre formation due to its glycoprotein content. Some hormones soon to act on the connective tissue — interfering in the synthesis of acid mucopolysaccharides which results in altered connective tissue physiology and tissue resistance. This last fact must be kept in mind when considering periodontal disease in diabetics. Glycogen would appear to be necessary in the formation of alkaline phosphates which are important enzymes in the metabolism of osteoblasts, osteocytes, cementoblasts and cementocytes. Therefore glycogen lack would affect the alveolar bone and cementum resistance and repair. The periodontal ligament being connective tissue has a ground substance which will be less resistant to bacterial invasion when there is a glycogen lack, as in diabetes — this could be a causative factor in the more severe periodontal conditions in diabetics.
5. Periodontal disease, its clinical signs and symptoms was described.

6. The Russell periodontal index and the oral hygiene index were used in an epidemiological study of 67 diabetic patients with no other medical complications, and 67 non-diabetic "healthy" patients, paired as regards age, sex and the socio-economic educational standards was carried out in Sydney. The statistical results were worked out manually and programmed for the I.B.M. computer.

The statistical results showed that periodontal disease occurred with equal frequency in both groups. The severity of periodontal disease was greater in the diabetic group. The local factors, especially calculus, were very strong aetiological factors. However, in computer selections diabetes showed a very significant correlation. ($P<0.001$) with the Russell periodontal index.

The factors which increased the severity of periodontal disease in the diabetic may be:

1. Microangiopathy - giving lowered tissue reaction to bacterial invasion and to slow removal of inflammatory products which in turn leads to increased tissue breakdown.

2. Glycogen lack leads to a lower rate of cell mitosis in
epithelium tissue, which gives a slower repair re-
action.

3. The connective ground substance is weakened by lack of
glycogen and is less resistant to bacterial invasion.

Whether the increased periodontal disease in diabetes
is due to one of these facts, a combination of two or three,
or to some other yet unknown factor in diabetes, has yet
to be determined.
Pilot Study of 64 Patients: 32 Diabetics - 32 Non-Diabetics

Mean Russell Periodontal Index

![Bar Chart]

- Mean Russell Periodontal Index in Diabetics
- Mean Russell Periodontal Index in Non-Diabetics

Scale: \( \frac{1}{5} = 1 \text{ unit} \)
Diabetic Group

Russell Periodontal Index - Debris Score

Figure II

- Mean Russell Periodontal Index in Diabetics
- Mean Debris Score in Diabetics
NON-DIABETIC GROUP

Russell Periodontal Index - Debris Score

25-29 yrs

30-39 yrs

40-49 yrs

Total Group 25-49 yrs

Figure III

Mean Russell Periodontal Index in Non-Diabetic
Mean Debris Score in Non-Diabetic
Diabetic and Non-Diabetic Groups.

Russell Periodontal Index - Debris Score

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Mean Russell Periodontal Index in Diabetics</th>
<th>Mean Debris Score in Diabetics</th>
<th>Mean Russell Periodontal Index in Non-Diabetics</th>
<th>Mean Debris Score in Non-Diabetics</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-29 yrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-39 yrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-49 yrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Diabetic Group.

Russell Periodontal Index - Calculus Score

25-29 yrs
30-39 yrs
40-44 yrs

Total Group 25-44 yrs

Scale

\( \frac{1}{2} \) = 1 unit.

Figure V

- Mean Russell Periodontal Index Score
- Mean Calculus Score
NON-DIABETIC GROUP

Russell Periodontal Index - Calculus Score

25-29 yrs
30-39 yrs
40-49 yrs
Total Group 25-49 yrs

Scale
$\frac{1}{2}$ = 1 unit

Figure VI

- Mean Russell Periodontal Index Score
- Mean Calculus Score
Diabetic and Non-Diabetic Groups.

Russell Periodontal Index - Calculus Index

- 25-29 yrs
- 30-39 yrs
- 40-49 yrs
- Total Group
- 25-49 yrs

Figure VII

- Mean Russell Periodontal Index for Diabetics
- Mean Calculus Score for Diabetics
- Mean Russell Periodontal Index for Non-Diabetics
- Mean Calculus Score for Non-Diabetics

Scale

L = 1 unit
Diabetic Group.

Russell Periodontal Index — Oral Hygiene Score

25-29 yrs

30-39 yrs

40-49 yrs

Total Group

25-49 yrs

Scale

Figure VIII

- Mean Russell Periodontal Index Score
- Mean Oral Hygiene Score
Non-Diabetic Group

Russell Periodontal Index — Hygiene Score

25-39 yrs

30-39 yrs

40-49 yrs

Total Group 25-49 yrs

Figure IX

Mean Russell Periodontal Index Score

Mean Oral Hygiene Score.
Diabetic and Non-Diabetic Groups.

Russell Periodontal Index - Oral Hygiene Score

**Figure X**

- Mean Russell Periodontal Index in Diabetics
- Mean OHI in Diabetics
- Mean Russell Periodontal Index in Non-Diabetics
- Mean OHI in Non-Diabetics
**Figure XI**

- Mean Russell Periodontal Index in Diabetes 0-7 yrs
- Mean Russell Periodontal Index in Diabetes over 5 yrs
Diabetic Treatment.

Mean Russell Periodontal Index

Mean Russell Periodontal index in diabetic patients treated with:

- Diet
- Tablets
- Under 30 u of insulin
- Over 30 u of insulin
- All treatment other than insulin
- All insulin treatment
- All treatment except over 30 u insulin
- Over 30 u insulin

Scale 1" = 2 mm

Figure XII
Diabetic Patients

Method of Diabetic Treatment—Age Groups

Russell Periodontal Index

Scale

\[ \frac{1}{2} : 1 \text{ unit} \]

**Figure XIII**

- Mean Russell Periodontal index for diet and tablet treated patients.
- Mean Russell Periodontal index for insulin treated patients.
STATE OF DIABETIC CONTROL

MEAN RUSSELL PERIODONTAL INDEX

FIGURE XIV

- MEAN RUSSELL PERIODONTAL INDEX IN "POOR" OR "FAIR" CONTROLLED DIABETICS
- MEAN RUSSELL PERIODONTAL INDEX IN "GOOD" CONTROLLED DIABETICS
Figure XV

Missing Teeth in Diabetic Groups

Missing Teeth in Non-Diabetic Groups
Number of Missing Bicuspid

Figure XVI

Missing Bicuspid in Diabetics
Missing Bicuspid in Non-Diabetics
Number of Missing Molars

**Total Group**  
25-49 yrs

**Scale**  
\( \frac{1}{2} \) = 20 Teeth

**Figure XVII**

- Missing First Molars in Diabetics
- Missing First Molars in Non-Diabetics
Sex

Mean Russell Periodontal Index (R.P.I)

Scale

Diabetic

Non-Diabetic

Figure XVIII

- Mean R.P.I in Male Diabetics
- Mean R.P.I in Male Non-Diabetics
- Mean R.P.I in Female Diabetics
- Mean R.P.I in Female Non-Diabetics

1.0

2.0
Tooth brushing frequency

Russell Periodontal Index

Scale

\[ \frac{1}{2} \text{ inch} \]

Diabetic

Non-Diabetic

Figure XIX

- Mean R.P.I. in Diabetics with 1 time Tooth Brushing
- Mean R.P.I. in Non-Diabetics in 1 time Tooth Brushing
- Mean R.P.I. in Diabetics with 2 or more Tooth Brushing
- Mean R.P.I. in Non-Diabetics in 2 or more Tooth Brushing
- Mean R.P.I. in Diabetics with 3 or more Tooth Brushing
- Mean R.P.I. in Non-Diabetics in 3 or more Tooth Brushing
Diabetic and Non-Diabetic Group
Tooth Brushing Frequency - Russell Periodontal Index

Figure XX

Mean R.P.I. in Diabetic Group
Mean R.P.I. in Non-Diabetic Group

Tooth brushing
1/less per day
2/more per day

25-29 yrs
30-34 yrs
40-49 yrs
25-49 yrs

Scale
½ unit

172
Tooth brushing frequency

- Debris Index Score

Diabetes

- Non-Diabetes

25-29 yrs 30-39 yrs 40-49 yrs 25-49 yrs

25-29 yrs 30-39 yrs 40-49 yrs 25-49 yrs

Figure XXI

Scale 1:1 unit

- Mean Debris score in Diabetes with 1/less tooth brushing per day.
- Mean Debris score in Diabetes with 2/more tooth brushing per day.
- Mean Debris score in non-Diabetes with 1/less tooth brushing per day.
- Mean Debris score in non-Diabetes with 2/more tooth brushing per day.
**Figure XXII**

Tooth brushing frequency

- Debris index score

*Scale: $\frac{1}{2}$ = 1 unit*

<table>
<thead>
<tr>
<th>Age Group</th>
<th>25-29 yrs</th>
<th>30-39 yrs</th>
<th>40-49 yrs</th>
<th>25-49 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tooth brushing 1/less per day</td>
<td>![Bar Chart]</td>
<td>![Bar Chart]</td>
<td>![Bar Chart]</td>
<td></td>
</tr>
</tbody>
</table>
Tooth brushing frequency

- Calculus Score

Figure XXIV

Scale 1' = 1 unit

Toothbrushing
1/less per day - [ MEAN CALCULUS SCORE IN DIABETICS
                  MEAN CALCULUS SCORE IN NON-DIABETICS

Toothbrushing 2/more per day - [ MEAN CALCULUS SCORE IN DIABETICS
                                  MEAN CALCULUS SCORE IN NON-DIABETICS
Time of Examination - Mean Debris Score

Diabetics

New Diabetics

[Diagram showing bar graphs for different age groups (25-29 yrs, 30-34 yrs, 40-44 yrs, Total Group) and time of examination (A.M., P.M.).]

- Mean Debris Score in Diabetics examined in the A.M.
- Mean Debris Score in Diabetics examined in the P.M.
- Mean Debris Score in Non-Diabetics examined in the A.M.
- Mean Debris Score in Non-Diabetics examined in the P.M.
Figure XXVI

- Mean Russell Periodontal index in Diabetics (Smokers)
- Mean Russell Periodontal index in Diabetics (Non-Smokers)
- Mean Russell Periodontal index in Non-Diabetics (Smokers)
- Mean Russell Periodontal index in Non-Diabetics (Non-Smokers)
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| Age | Sex | Set | Evening Frequency | Smoking | Blood Pressure | Gingival Disease | State of Dental Health | No. Missing Teeth | X-ray Examinations | Dentures | Panorex | Debris | Calculus | Upright | Score |
|-----|-----|-----|-------------------|---------|----------------|-----------------|---------------------|------------------|--------------------|----------|--------|--------|---------|---------|---------|--------|
| 25  | F   | am  | 2                 | Yes     | 25             | No              | No                  | 4++              | No                 | No                   | 233      | 133    | 366    | 272     |
| 25  | F   | am  | 2                 | Yes     | 15             | No              | No                  | 3                | No                 | No                   | 300      | 0.33   | 3.33   | 0.61     |
| 25  | F   | pm  | 2                 | Yes     | 20             | No              | No                  | 4++              | No                 | No                   | 183      | 133    | 3.66   | 0.86     |
| 25  | F   | pm  | 1                 | No      | 16             | No              | No                  | 16++             | No                 | No                   | 167      | 133    | 3.00   | 1.56     |
| 26  | M   | am  | 1                 | No      | 7              | No              | No                  | 3.33             | No                 | No                   | 3.33     | 3.50   | 6.83   | 3.47     |
| 26  | F   | am  | 1                 | Yes     | 10             | No              | No                  | 12++             | No                 | No                   | 3.33     | 4.67   | 9.00   | 3.40     |
| 26  | F   | pm  | 1                 | No      | 18             | No              | Yes                 | 20               | No                 | No                   | 2.00     | 3.33   | 5.33   | 2.67     |
| 27  | F   | pm  | 1                 | No      | 15             | No              | Yes                 | 7++              | No                 | No                   | 233      | 2.50   | 4.83   | 1.96     |
| 27  | F   | pm  | 3                 | Yes     | 18             | No              | No                  | 13++             | No                 | No                   | 2.00     | 183    | 3.83   | 2.63     |
| 28  | F   | pm  | 2                 | No      | 19             | No              | Yes                 | 3++              | No                 | No                   | 133      | 117    | 2.50   | 1.34     |
| 28  | F   | pm  | 2                 | No      | 19             | No              | Yes                 | 8               | No                 | No                   | 3.33     | 3.00   | 6.33   | 2.85     |
| 29  | F   | pm  | 1                 | No      | 15             | No              | No                  | 14++             | No                 | No                   | 183      | 167    | 5.50   | 1.83     |
| 29  | F   | pm  | 2                 | No      | 22             | No              | No                  | 6++              | No                 | No                   | 4.33     | 3.67   | 7.66   | 2.42     |

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### Reference Table XXIX

**134 observations**

**Correlation Matrix.**

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