2001年 6月
2001年 6月
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1. 검체 6개의 대상군을 선택하였으며, 14개의 대상군을 둔하였다. (18개, 54.5%) 중 1개의 대상군은 7개, 21.2%, 1개의 대상군은 1개, 3.2%로 총 19개의 대상군을 둔하였다. (14개, 58.4%), 1개의 대상군은 8개, 33.3%, 2개의 대상군은 2개, 8.3%로 총 26개의 대상군을 둔하였다. 

2. 3개의 대상군을 선택하였으며, 5.72개, 6.27개, 4.82개, 1개의 대상군은 3개, 5.35개, 3.87개, 2개, 2개의 대상군은 2개, 2.82개, 2.74개, 3.40개의 대상군을 둔하였다. 

3. 4개의 대상군을 선택하였으며, 1개의 대상군은 5.72개, 6.27개, 4.82개, 1개의 대상군은 3개, 5.35개, 3.87개, 2개의 대상군은 2개, 2개의 대상군은 2개, 2개의 대상군은 2개, 2개의 대상군은 2개의 대상군을 둔하였다.
5. (Type I) 12 (54.5%)

6. (Type II) 8 (80%)

7. DentaScan
I. 

- 1 -
DentaScan® multiplanar reformation (CT/MPR) 

17,18,19

1980
20

21,22,23
24
25,26
27,28
29
30
31,32

DentaScan

3-

(apical surgery)
II. 

1. 

Table 1. Materials used in this study according to age groups.

<table>
<thead>
<tr>
<th>Age groups</th>
<th>male</th>
<th>female</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 ~ 19</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>20 ~ 29</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30 ~ 39</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>40 ~ 49</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>50 ~ 59</td>
<td>6</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>60 ~ 69</td>
<td>5</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>70 ~ 79</td>
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<td>8</td>
<td>8</td>
</tr>
<tr>
<td>80 ~ 89</td>
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<td>1</td>
<td>1</td>
</tr>
<tr>
<td>total</td>
<td>19</td>
<td>14</td>
<td>33</td>
</tr>
</tbody>
</table>
2. 

(1) XCP

A high-resolution 3D X-ray computed tomography (CT) machine (X-70S, Yoshida Co., Tokyo, Japan) was used. The XCP machine was a 3D X-ray computed tomography (CT) machine with a high-resolution bone algorithm and a field of view (FOV) of 15 cm, 200 mA, 120 kV, and a scan time of 1 second. A reconstruction matrix of 512x512 pixels was used. CT images were reconstructed using the CT Advantage Window workstation (GE Medical System, Milwaukee, U.S.A.).

(2) CT HiSpeed Advantage

A high-resolution 3D X-ray computed tomography (CT) machine (GE Medical System, Milwaukee, U.S.A.) was used. The machine had a high-resolution bone algorithm, a field of view (FOV) of 15 cm, 200 mA, 120 kV, a scan time of 1 second, and a reconstruction matrix of 512x512 pixels. Gantry rotation was 0 degrees. The machine was equipped with a 5 mm gantry and a 5 mm reconstruction matrix. CT images were reconstructed using the CT Advantage Window workstation (GE Medical System, Milwaukee, U.S.A.).

Data were processed using a personal computer (pentium III-500, dual CPU, 512 MRAM) and the V-works™ 3.0 (CyberMed Inc., Korea) software. The processing time was 3 hours and 30 minutes (Fig. 1). The processing time is critical for the application of this technology.
V-works™ 3.0 works with the following T M 3.0 works.

- Figure 2.
Fig. 1. Captured frame images on the V-works™ 3.0 program.
Fig. 2. Schematic illustrations of lateral morphology of the maxillary sinus according to their lateral 3-D reconstructive images.

All illustrations are left sides of the specimens.

(1) Al-Calcification Solution
aluminium chloride hexahydrate (Al2Cl36H2O) 7g, 30% hydrochloric acid 8.5 mL, formic acid 5 mL, acetic acid 100 mL, distilled water 400 mL (neutralization solution) 4~7 mL, sodium sulfate 5g, 100 mL, acetic acid 3 mL.
(2) The maximum width between the buccal and the palatal alveolar plate (width) : (Fig. 3)

1. The maximum width between the buccal and the palatal alveolar plate (width) : (Fig. 3)

2. Horizontal distance between the midpoint of the palatal root and the palatal alveolar plate (P/mid) :

3. Horizontal distance between the apex of the palatal root and the palatal alveolar plate (P/a-h) :

4. Shortest distance between the apex of the palatal root and the inferior wall of maxillary sinus (P/a-s) :

5. Horizontal distance between the midpoint of the buccal root and
6. Horizontal distance between the apex of the buccal root and the buccal alveolar plate (B/a-h) :

7. Shortest distance between the apex of the buccal root and the inferior wall of maxillary sinus (B/a-s) :

8. Distance between the apex of the palatal and the buccal root (PB/a-a) :

9. Horizontal distance between the midpoint of the mesiobuccal root and the buccal alveolar plate (M/mid) :

10. Horizontal distance between the apex of the mesiobuccal root and the buccal alveolar plate (M/a-h) :

11. Shortest distance between the apex of the mesiobuccal root and the inferior wall of maxillary sinus (M/a-s) :

12. Horizontal distance between the midpoint of the distobuccal root and the buccal alveolar plate (D/mid) :

13. Horizontal distance between the apex of the distobuccal root and the buccal alveolar plate (D/a-h) :
14. Shortest distance between the apex of the distobuccal root and the inferior wall of maxillary sinus (D/a-s) :

15. Distance between the apex of the palatal and the mesiobuccal root (PM/a-a) :

16. Distance between the apex of the palatal and the distobuccal root (PD/a-a) :

17. Cortical thickness of the inferior wall of maxillary sinus to the nearest of the apex of the palatal root (P/b) :

18. Cortical thickness of the inferior wall of maxillary sinus to the nearest of the apex of the buccal root (B/b) :

19. Cortical thickness of the inferior wall of maxillary sinus to the nearest of the apex of the mesiobuccal root (M/b) :

20. Cortical thickness of the inferior wall of maxillary sinus to the nearest of the apex of the distobuccal root (D/b) :

21. Cortical thickness of the inferior wall of maxillary sinus to the nearest of the furcation area (F/b) :
Fig. 3. Illustrations showing parameter #1~#21 measured on the sectioned specimen (B: buccal, P: palatal).

For definitions, see Materials and Methods.
(3) DentaScan 画面に示した上頜付近の解剖学像をもとに、以下の5つの分類を提供しました。(Fig. 4, 5)

Fig. 4. Schematic illustrations of 5 classifications of vertical relationship between the inferior wall of maxillary sinus and the roots of the maxillary molars (B: buccal, P: palatal).

Type I:

Type II:

Type III:

Type IV:

Type V:

Fig. 5. (Fig. 5).
Fig. 5. Schematic illustrations of 3 classifications of horizontal relationship between the inferior wall of maxillary sinus and the roots of the maxillary molars (B: buccal, P: palatal).

Type 1:

Type 2:

Type 3:

(1) DentaScan
(2) DentaScan 202×300 cm² 0.1 mm

(2) DentaScan 202×300 cm² 0.1 mm

①
DentaScan 202×300 cm² 0.1 mm
(furcation area) 0 ( ), 1 ( ), 2 ( )

②
DentaScan 202×300 cm² 0.1 mm
(furcation involvement), 0 ( ), 1 ( ), 2 ( )
(apical involvement), 0 ( ), 1 ( ), 2 ( ), 3 (apical lesion) 0 ( ), 1 ( )
3. DentaScan 및 기타 도구

DentaScan 및 기타 도구의 사용 방법 및 주요 특징에 대한 설명을 제공합니다. DentaScan은 치과 진단 및 치료를 위한 강력한 도구로, 치과의의 의료진에게 꼭 필요한 인기 있는 도구입니다. 이 도구는 고급 기술을 사용하여 정밀한 치과 진단을 제공하며, 이를 통해 치과의의의 치료 계획을 더욱 정확하게 수립할 수 있습니다.

- 17 -
III. 

1. V-works TM 3.0

Table 2. Classifications of the 3-dimensional morphology of the maxillary sinus according to their lateral aspects and the inferior walls.

<table>
<thead>
<tr>
<th>Types</th>
<th>male (n=19)</th>
<th>females (n=14)</th>
<th>total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>5</td>
<td>3</td>
<td>8 (24.2%)</td>
</tr>
<tr>
<td>II</td>
<td>4</td>
<td>3</td>
<td>7 (21.2%)</td>
</tr>
<tr>
<td>III</td>
<td>2</td>
<td>3</td>
<td>5 (15.2%)</td>
</tr>
<tr>
<td>IV</td>
<td>3</td>
<td>4</td>
<td>7 (21.2%)</td>
</tr>
<tr>
<td>V</td>
<td>2</td>
<td>1</td>
<td>3 (9.1%)</td>
</tr>
<tr>
<td>VI</td>
<td>3</td>
<td>0</td>
<td>3 (9.1%)</td>
</tr>
</tbody>
</table>

Numerical is the number of samples observed.
Fig. 6. Photographs showing the lateral views of the 3-D reconstructed maxilla and maxillary sinus on the V-works™ 3.0 program.

3.0 program.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td>Type I</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Type II</td>
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<td>V</td>
<td>Type V</td>
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</tr>
<tr>
<td>VI</td>
<td>Type VI</td>
<td></td>
</tr>
</tbody>
</table>

(Table 3)
Table 3. Measurements of the maxillary sinus using the 3-dimensional reconstructive images using the V-works program.

<table>
<thead>
<tr>
<th></th>
<th>male (n=19)</th>
<th>female (n=14)</th>
<th>total (n=33)</th>
</tr>
</thead>
<tbody>
<tr>
<td>maximum A-P length (mm)</td>
<td>40.7 ± 4.5</td>
<td>37.4 ± 3.0</td>
<td>39.3 ± 4.2</td>
</tr>
<tr>
<td>maximum height (mm)</td>
<td>39.4 ± 5.8</td>
<td>34.0 ± 3.5</td>
<td>37.1 ± 5.6</td>
</tr>
<tr>
<td>maximum width (mm)</td>
<td>35.3 ± 6.9</td>
<td>28.9 ± 3.5</td>
<td>32.6 ± 6.5</td>
</tr>
<tr>
<td>volume (ml)</td>
<td>18.0 ± 6.2</td>
<td>11.1 ± 3.4</td>
<td>15.1 ± 6.2</td>
</tr>
</tbody>
</table>

unit: mean ± S.D.

2. DentaScan (Fig. 7)

33 persons were scanned using DentaScan (Fig. 7). A total of 24essel persons (73%) were scanned for DentaScan. Among them, 19 persons (58.4%) had 14 sinuses (58.4%), 8 persons (33.3%) had 2 sinuses (33.3%), and 2 persons (6.3%) had 1 or 2 sinuses (6.3%).

Further, 31 persons (93.9%) were scanned for DentaScan, of which 8 persons (25.8%) had 2 sinuses (25.8%). 2 persons (6.1%) had 1 or 2 sinuses (6.1%).
Fig. 7. DentaScan Image showing the reformatted panoramic view of 
the maxilla and maxillary sinus.
1. 11.15, 5.48, 4.48, 1.99.

2. 13.54, 11.00, 9.85, 0.89, 0.74, 0.51.
Table 4. Measurements between the maxillary posterior teeth and adjacent anatomical structures.

<table>
<thead>
<tr>
<th>No. of items</th>
<th>width</th>
<th>P/mid</th>
<th>P/a-h</th>
<th>P/a-s</th>
<th>B/mid</th>
<th>B/a-h</th>
<th>B/a-s</th>
<th>P/B/a-a</th>
<th>P/b</th>
<th>B/b</th>
<th>F/b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxillary 1st premolar</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>mean</td>
<td>11.15</td>
<td>3.79</td>
<td>8.54</td>
<td>6.27</td>
<td>1.28</td>
<td>1.99</td>
<td>5.72</td>
<td>3.57</td>
<td>0.50</td>
<td>0.44</td>
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<tr>
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<td>1.52</td>
<td>1.06</td>
<td>1.96</td>
<td>5.16</td>
<td>0.91</td>
<td>1.10</td>
<td>5.22</td>
<td>1.66</td>
<td>0.26</td>
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<td>0.47</td>
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<tr>
<td>Max</td>
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<td>5.71</td>
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<td>14.44</td>
<td>3.51</td>
<td>4.45</td>
<td>10.24</td>
<td>6.74</td>
<td>0.78</td>
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<tr>
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<td>5.58</td>
<td>0.00</td>
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<td>1.34</td>
<td>0.00</td>
<td>0.00</td>
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</table>

Maxillary 2nd premolar

<table>
<thead>
<tr>
<th>No. of items</th>
<th>width</th>
<th>P/mid</th>
<th>P/a-h</th>
<th>P/a-s</th>
<th>M/mid</th>
<th>M/a-h</th>
<th>M/a-s</th>
<th>D/mid</th>
<th>D/a-h</th>
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<th>P/D/a-a</th>
<th>P/b</th>
<th>B/b</th>
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<tbody>
<tr>
<td>Maxillary 1st molar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
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<td>3</td>
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</tr>
<tr>
<td>mean</td>
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<tr>
<td>SD</td>
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<td>1.82</td>
<td>2.81</td>
<td>4.25</td>
<td>0.83</td>
<td>1.39</td>
<td>3.43</td>
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<td>0.31</td>
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<tr>
<td>Max</td>
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<td>3.43</td>
<td>5.76</td>
<td>7.65</td>
<td>4.70</td>
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<td>1.01</td>
<td>1.13</td>
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<tr>
<td>Min</td>
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<td>0.63</td>
<td>1.64</td>
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<td>0.00</td>
<td>0.46</td>
<td>0.50</td>
<td>0.46</td>
<td>0.50</td>
<td>0.46</td>
<td>0.50</td>
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</table>

Maxillary 2nd molar

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<tr>
<th>No. of items</th>
<th>width</th>
<th>P/mid</th>
<th>P/a-h</th>
<th>P/a-s</th>
<th>M/mid</th>
<th>M/a-h</th>
<th>M/a-s</th>
<th>D/mid</th>
<th>D/a-h</th>
<th>D/a-s</th>
<th>P/M/a-a</th>
<th>P/D/a-a</th>
<th>P/b</th>
<th>B/b</th>
<th>F/b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxillary 1st molar</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
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<td>12</td>
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<td>18</td>
<td>22</td>
</tr>
<tr>
<td>mean</td>
<td>14.81</td>
<td>2.52</td>
<td>5.27</td>
<td>3.87</td>
<td>1.82</td>
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<td>3.53</td>
<td>9.04</td>
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</tr>
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<td>1.90</td>
<td>2.91</td>
<td>0.96</td>
<td>1.50</td>
<td>2.82</td>
<td>0.85</td>
<td>1.82</td>
<td>2.88</td>
<td>1.14</td>
<td>1.76</td>
<td>0.31</td>
<td>0.28</td>
<td>0.36</td>
</tr>
<tr>
<td>Max</td>
<td>17.01</td>
<td>4.40</td>
<td>9.57</td>
<td>9.37</td>
<td>3.84</td>
<td>6.93</td>
<td>11.14</td>
<td>2.92</td>
<td>8.12</td>
<td>9.45</td>
<td>11.09</td>
<td>11.57</td>
<td>1.31</td>
<td>0.91</td>
<td>1.25</td>
</tr>
<tr>
<td>Min</td>
<td>12.47</td>
<td>0.90</td>
<td>2.75</td>
<td>0.00</td>
<td>0.39</td>
<td>0.86</td>
<td>0.00</td>
<td>0.23</td>
<td>0.71</td>
<td>0.00</td>
<td>6.99</td>
<td>4.07</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Maxillary 2nd molar

<table>
<thead>
<tr>
<th>No. of items</th>
<th>width</th>
<th>P/mid</th>
<th>P/a-h</th>
<th>P/a-s</th>
<th>M/mid</th>
<th>M/a-h</th>
<th>M/a-s</th>
<th>D/mid</th>
<th>D/a-h</th>
<th>D/a-s</th>
<th>P/M/a-a</th>
<th>P/D/a-a</th>
<th>P/b</th>
<th>B/b</th>
<th>F/b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxillary 1st molar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>17</td>
<td>21</td>
<td>21</td>
<td>21</td>
<td>15</td>
<td>16</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>16</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>17</td>
<td>21</td>
</tr>
<tr>
<td>mean</td>
<td>15.19</td>
<td>2.56</td>
<td>4.44</td>
<td>3.40</td>
<td>3.01</td>
<td>5.48</td>
<td>2.82</td>
<td>2.76</td>
<td>4.48</td>
<td>2.74</td>
<td>5.36</td>
<td>6.40</td>
<td>0.46</td>
<td>0.40</td>
<td>0.37</td>
</tr>
<tr>
<td>SD</td>
<td>1.54</td>
<td>0.77</td>
<td>1.64</td>
<td>3.06</td>
<td>1.07</td>
<td>1.66</td>
<td>3.08</td>
<td>0.78</td>
<td>1.29</td>
<td>3.23</td>
<td>2.11</td>
<td>2.43</td>
<td>0.20</td>
<td>0.25</td>
<td>0.29</td>
</tr>
<tr>
<td>Max</td>
<td>17.35</td>
<td>4.25</td>
<td>8.69</td>
<td>9.85</td>
<td>4.73</td>
<td>7.76</td>
<td>10.84</td>
<td>4.64</td>
<td>7.26</td>
<td>11.00</td>
<td>9.23</td>
<td>9.79</td>
<td>0.74</td>
<td>0.89</td>
<td>0.98</td>
</tr>
<tr>
<td>Min</td>
<td>11.40</td>
<td>1.20</td>
<td>1.70</td>
<td>0.00</td>
<td>1.00</td>
<td>1.24</td>
<td>0.00</td>
<td>1.69</td>
<td>2.58</td>
<td>0.00</td>
<td>2.70</td>
<td>3.37</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

n : numbers of the samples, SD : standard deviation, Max : Maximum, Min : Minimum

1. width : The maximum width between the buccal and the palatal alveolar plate
2. P/mid : Horizontal distance between the midpoint of the palatal root and the palatal alveolar plate
3. P/a-h : Horizontal distance between the apex of the palatal root and the palatal alveolar plate
4. \( P/a-s \): Shortest distance between the apex of the palatal root and the inferior wall of maxillary sinus
5. \( B/mid \): Horizontal distance between the midpoint of the buccal root and the buccal alveolar plate
6. \( B/a-h \): Horizontal distance between the apex of the buccal root and the buccal alveolar plate
7. \( B/a-s \): Shortest distance between the apex of the buccal root and the inferior wall of maxillary sinus
8. \( P/B/a-a \): Distance between the apex of the palatal and the buccal root
9. \( M/mid \): Horizontal distance between the midpoint of the mesiobuccal root and the buccal alveolar plate
10. \( M/a-h \): Horizontal distance between the apex of the mesiobuccal root and the buccal alveolar plate
11. \( M/a-s \): Shortest distance between the apex of the mesiobuccal root and the inferior wall of maxillary sinus
12. \( D/mid \): Horizontal distance between the midpoint of the distobuccal root and the buccal alveolar plate
13. \( D/a-h \): Horizontal distance between the apex of the distobuccal root and the buccal alveolar plate
14. \( D/a-s \): Shortest distance between the apex of the distobuccal root and the inferior wall of maxillary sinus
15. \( P/M/a-a \): Distance between the apex of the palatal and the mesiobuccal root
16. \( P/D/a-a \): Distance between the apex of the palatal and the distobuccal root
17. \( P/b \): Cortical thickness of the inferior wall of maxillary sinus to the nearest of the apex of the palatal root
18. \( B/b \): Cortical thickness of the inferior wall of maxillary sinus to the nearest of the apex of the buccal root
19. \( M/b \): Cortical thickness of the inferior wall of maxillary sinus to the nearest of the apex of the mesiobuccal root
20. \( D/b \): Cortical thickness of the inferior wall of maxillary sinus to the nearest of the apex of the distobuccal root
21. \( F/b \): Cortical thickness of the inferior wall of maxillary sinus to the nearest of the furcation area
Table 5. Incidences and classifications of vertical relationship between the inferior wall of maxillary sinus and the roots of the maxillary molars.

<table>
<thead>
<tr>
<th>Classifications</th>
<th>Maxillary 1st molar</th>
<th>Maxillary 2nd molar</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>12 (54.5%)</td>
<td>11 (52.4%)</td>
</tr>
<tr>
<td>II</td>
<td>4 (18.3%)</td>
<td>6 (28.6%)</td>
</tr>
<tr>
<td>III</td>
<td>1 (4.5%)</td>
<td>3 (14.2%)</td>
</tr>
<tr>
<td>IV</td>
<td>3 (13.6%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>V</td>
<td>2 (9.1%)</td>
<td>1 (4.8%)</td>
</tr>
</tbody>
</table>

Numerical is the number of samples observed.
Fig. 8. Classifications of vertical relationship between the inferior wall of maxillary sinus and the roots of the maxillary molars (B: buccal, P: palatal).
Table 6. Incidences and classifications of horizontal relationship between the inferior wall of maxillary sinus and the roots of the maxillary molars.

<table>
<thead>
<tr>
<th>Classifications</th>
<th>Maxillary 1st molar</th>
<th>Maxillary 2nd molar</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 (20.0%)</td>
<td>2 (20.0%)</td>
</tr>
<tr>
<td>2</td>
<td>8 (80.0%)</td>
<td>8 (80.0%)</td>
</tr>
<tr>
<td>3</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
</tr>
</tbody>
</table>

Numerical is the number of samples observed.
Fig. 9. Classifications of horizontal relationship between the inferior wall of maxillary sinus and the roots of the maxillary molars (B: buccal, P: palatal).
5.  

DentaScan 

(Fig. 10), DentaScan (furcation area) (furcation involvement) 88.4%, DentaScan 95.4% 100%, DentaScan (furcation area) (furcation involvement) (apical lesion) (apical involvement) (Table 7, 8). DentaScan (98.6%).

DentaScan (Table 8, Fig. 11).
Fig. 10. Photographs of sectioned specimens (upper panel) and DentaScan reformatted cross-sectional images (lower panel) on the same areas. Left panel is shown the furcation involvement of the maxillary 1st molar area, at the middle panel, periapical lesion is observed under the root rest of the maxillary molar. Right panel is shown the apical involvement of the maxillary 2nd molar.
Table 7. Comparisons in the degree of accuracy of the findings of the dental inflammatory pathoses of the periodontal and apical regions of maxillary teeth on the intraoral radiographs and DentaScan reformatted cross-sectional images.

<table>
<thead>
<tr>
<th>Maxillary tooth</th>
<th>root</th>
<th>Furcation involvement</th>
<th>Apical lesion</th>
<th>Apical involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Intraoral DentaScan</td>
<td>Intraoral DentaScan</td>
<td>Intraoral DentaScan</td>
</tr>
<tr>
<td>1st premolar</td>
<td>palatal</td>
<td>8/8 (100.0)</td>
<td>8/8 (100.0)</td>
<td>10/10 (100.0)</td>
</tr>
<tr>
<td></td>
<td>buccal</td>
<td>21/21 (100.0)</td>
<td>21/21 (100.0)</td>
<td>19/22 (86.4)</td>
</tr>
<tr>
<td>2nd premolar</td>
<td>palatal</td>
<td>4/4 (100.0)</td>
<td>4/4 (100.0)</td>
<td>4/4 (100.0)</td>
</tr>
<tr>
<td></td>
<td>buccal</td>
<td>20/20 (100.0)</td>
<td>20/20 (100.0)</td>
<td>18/20 (90.0)</td>
</tr>
<tr>
<td>1st molar</td>
<td>palatal</td>
<td>21/22 (95.5)</td>
<td>22/22 (100.0)</td>
<td>21/22 (95.5)</td>
</tr>
<tr>
<td></td>
<td>mesio-buccal</td>
<td>21/22 (95.5)</td>
<td>20/22 (90.9)</td>
<td>19/22 (86.4)</td>
</tr>
<tr>
<td></td>
<td>disto-buccal</td>
<td>22/22 (100.0)</td>
<td>20/22 (90.9)</td>
<td>20/22 (90.9)</td>
</tr>
<tr>
<td>2nd molar</td>
<td>palatal</td>
<td>21/21 (100.0)</td>
<td>21/21 (100.0)</td>
<td>21/21 (100.0)</td>
</tr>
<tr>
<td></td>
<td>mesio-buccal</td>
<td>17/21 (80.9)</td>
<td>21/21 (100.0)</td>
<td>21/21 (100.0)</td>
</tr>
<tr>
<td></td>
<td>disto-buccal</td>
<td>18/19 (94.7)</td>
<td>19/19 (100.0)</td>
<td>19/20 (95.0)</td>
</tr>
<tr>
<td>Total (%)</td>
<td>88.4</td>
<td>95.4</td>
<td>98.1</td>
<td>94.4</td>
</tr>
</tbody>
</table>

Intraoral: intraoral radiography.

Number of the samples in which finding was corresponded with the specimen / total number observed.

Numerical in parentheses is the incidence (%) of the samples observed.
Table 8. Comparisons in the degree of accuracy of relationships between the apices of maxillary teeth and inferior wall of maxillary sinuses on the intraoral radiographs and DentaScan images.

<table>
<thead>
<tr>
<th>Maxillary tooth</th>
<th>root</th>
<th>Relationship between apex and inferior wall of maxillary sinus</th>
<th>Intraoral radiography</th>
<th>DentaScan image</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Maxillary sinus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st molar</td>
<td>palatal</td>
<td>18/22 (81.8)</td>
<td>21/22 (95.5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>mesio-buccal</td>
<td>20/22 (90.9)</td>
<td>21/22 (95.5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>disto-buccal</td>
<td>20/22 (90.9)</td>
<td>21/22 (95.5)</td>
<td></td>
</tr>
<tr>
<td>2nd molar</td>
<td>palatal</td>
<td>21/21 (100)</td>
<td>21/21 (100)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>mesio-buccal</td>
<td>19/21 (90.5)</td>
<td>20/21 (95.2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>disto-buccal</td>
<td>19/21 (90.5)</td>
<td>21/21 (100)</td>
<td></td>
</tr>
<tr>
<td>Total (%)</td>
<td></td>
<td>90.6</td>
<td>97.3</td>
<td></td>
</tr>
</tbody>
</table>

Number of the samples in which finding was corresponded with the specimen / total number observed.

Numerical in parentheses are incidences (%) of the samples observed.
Fig. 11. Photographs of intraoral (left panel), DentaScan reformatted cross-sectioned radiography (middle panel) and cross-sectioned specimen (right panel) on the left maxillary 1st molar area. As shown in photographs, palatal root of 1st molar is shown the apical protrusion over the sinus inferior wall.
IV. 泀　

1970年、1980年、2000年。3 وأ، 3 وأ

multiplanar imaging）workstation

V-works™ 3.0 CT volume rendering

V-works™ 3.0 workstation 3 و 3 وأ

6 و (I و 24.2% و II و 21.2% و 50% و)
V - works™

3.0 ±×·¯³ªÀÌ¿¬±¸¿¡¼­ ¢øÇÑ 3 ±×ÁÎ±â¼úµÇ¾î ÀÔ³ª
³²³à°£ÀǰèÃøÄ¡Â÷À̰¡¶Ñ·ÇÇϰԳªÅ¸³µ´Ù (Table 3). ±×Â÷À̴»ó¾Çµ¿ºÎÇÇÇ׸ñ¿¡¼­°¡ÀåÅ©±â°¡¾ÕµÚ 32°, ° 25°, ° 35
³×·¯³ªÀÌ ±×¸®°íÁ¦ 1 ¼Ò±¸Ä¡ºÎÀ§ ×Å©±â°¡¾ÕÀ¹«¸®°¡µû¸¦°ÍÀ¸·Î»ý°¢ÇÑ´Ù.

±×·¯³ªº»¿¬±¸¿¡¼­»ó¾Çµ¿¾Õ °æ°è´ÂÁ»´õ¾Õ 1 ¼Ò±¸Ä¡ºÎÀ§¿¡³õ¿©Àִٴ»ç½ÇÀ»È®ÀÎÇÒ¼öÀÖ¾ú´Ù.

ÁïÇѱ¹ÀÎÀÇ»ó¾Çµ¿ÀºÀϺ»Àο¡ºñÇØ¾Õ°æ°è´ÂÁ»´õµÚÂÊ¿¡³õ¿©Àִٴ»ç½ÇÀ»È®ÀÎÇÒ¼öÀÖ¾ú´Ù.
DentaScan

- 36 -
Table 9

1. 1, 2, 3 (P/ a, PD/ a-a, M/ a-h, D/ a-h)
2. 1, 2, 3, 4 (P/ b, M/ a-s, D/ a-s, F/ b)

(1) 1, 2, 3, 4 (P/ a, PD/ a-a, M/ a-h, D/ a-h)

(p < .05).
Table 9. Correlations between the items of measurements.

<table>
<thead>
<tr>
<th>Items of analysis</th>
<th>n</th>
<th>Correlation coefficient</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxillary 1st premolar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B/a-h □ PB/a-a</td>
<td>12</td>
<td>-0.703</td>
<td>0.011</td>
</tr>
<tr>
<td>Maxillary 1st molar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P/a-s □ P/b</td>
<td>21</td>
<td>0.487</td>
<td>0.025</td>
</tr>
<tr>
<td>PD/a-a □ width</td>
<td>18</td>
<td>0.527</td>
<td>0.024</td>
</tr>
<tr>
<td>M/a-h □ M/a-s</td>
<td>17</td>
<td>-0.526</td>
<td>0.029</td>
</tr>
<tr>
<td>M/a-h □ PM/a-a</td>
<td>11</td>
<td>-0.639</td>
<td>0.034</td>
</tr>
<tr>
<td>D/a-h □ D/a-s</td>
<td>19</td>
<td>-0.507</td>
<td>0.026</td>
</tr>
<tr>
<td>Maxillary 2nd molar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PD/a-a □ width</td>
<td>13</td>
<td>0.813</td>
<td>0.001</td>
</tr>
<tr>
<td>P/a-s □ F/b</td>
<td>21</td>
<td>-0.456</td>
<td>0.037</td>
</tr>
<tr>
<td>M/a-s □ F/b</td>
<td>17</td>
<td>-0.495</td>
<td>0.042</td>
</tr>
<tr>
<td>D/a-h □ D/a-s</td>
<td>16</td>
<td>-0.577</td>
<td>0.019</td>
</tr>
<tr>
<td>P/a-h □ PM/a-a</td>
<td>13</td>
<td>-0.658</td>
<td>0.014</td>
</tr>
<tr>
<td>P/a-h □ PD/a-a</td>
<td>16</td>
<td>-0.684</td>
<td>0.003</td>
</tr>
<tr>
<td>M/a-h □ PM/a-a</td>
<td>12</td>
<td>-0.594</td>
<td>0.042</td>
</tr>
</tbody>
</table>
DentaScan

(furcation involvement)

93%

DentaScan

96.7%
involved (94.4%) DentaScan (94.9%).

Fuhrmann 4, 100% DentaScan DentaScan
100%, 100% DentaScan
100%, 100%

further involvement DentaScan

DentaScan

(98.1%) DentaScan

(98.6%) DentaScan

(blurring effect)

DentaScan

24 100% DentaScan DentaScan
24 100% DentaScan
24 100% DentaScan

- 41 -
DentaS can 97.3%、DentaScan 90.6%、DentaScan 6°、DentaScan 21°、DentaScan 4°、DentaScan 6°、DentaScan 21°、DentaScan 4°、DentaScan 6°、DentaScan 21°、DentaScan 4°。
V. クラス

1. 6名の学生 (18名, 54.5%) が DentaScan を使用しました。DentaScan の使用は 10名の学生を含みました。DentaScan の使用率は 18.0% です。

2. 39.3名, 37.1名, 32.6名が DentaScan を使用しました。DentaScan の使用率は 11.1% です。

3. 2名の学生 (18名, 54.5%) が DentaScan の使用を検討しました。

4. DentaScan の使用を検討する学生の数は 2名です。
5. The patients were divided into two groups: Type I (54.5%) and Type II (52.4%).

6. The patients were further divided into two groups: Type I (80%) and Type II (80%).

7. DentaScan and DentaScan were used for scanning, respectively.


8. : Orthopantomograph, 9:19-23, 1979


10. Eberhardt GA, Torabinejad M, Christiansen EL: A computed tomographic study of the distances between the maxillary sinus floor and

- 45 -


13. ±èÇü½Ä: OrthopantomogramÀ»ÀÌ¿ëÇÑ»ó¾Çµ¿ÀÇÇüÅ¿¡°üÇÑ¿¬±¸.´ëÇѱ¸°­¾Ç¾È¸é¹æ»ç¼±ÇÐȸÁö, 13:107-114, 1983


30. °û÷±â´ö, °û¼­: ÇϾǰñ¸Å½ÄºÎÀ§°èÃøÀ»À§Çѳª¼±Çü´ÜÃþÃÔ¿µ¼úÀǽŷÚµµ.´ëÇѱ¸°­¾Ç¾È¸é¹æ»ç¼±ÇÐȸÁö, 27:27-46, 1997

31. °û÷±â´ö: ³Åº¹Ä¡È®ÀÎÀ»À§ÇÑ3 Â÷¿øÀü»êÈ­´ÜÃþÃÔ¿µÀÇÀÌ¿ë, 36:526-528, 1998

32. °û÷±â´ö, °ûê, °ûë, °ûê : 3Åº¹Ä¡È®ÀÎÀ»À§ÇÑÇѱ¹ÀξƷ¡ÅλÀÀÇüÁúÀηùÇÐÀû¿¬±¸; 3Åº¹Ä¡È®À»À§Á¤È®µµÆò°¡.´ëÇÑüÁúÀηùÇÐȸÁö, 12:13-22, 1999

33. °û÷±â´ö: ³Åº¹Ä¡È®ÀÎÀ»À§ÇÑ1¶, ³Åº¹Áæ², 2¶, ³Åº¹Á¤È®µµÆò°¡ ÀξƷ¡ÅλÀÀÇüÁúÀηùÇÐÀû¿¬±¸, 1990, pp209-214


37. °û÷±â´ö, °ûë : ³Åº¹Ä¡È®ÀÎÀ»À§ÇÑÇѱ¹ÀξƷ¡ÅλÀÀÇüÁúÀηùÇÐÀû¿¬±¸.´ëÇѱ¸°­¾Ç¾È¸é¹æ»ç¼±ÇÐȸÁö, 11:14-49, 1981

38. °û÷±â´ö, °ûê : ³Åº¹Ä¡È®ÀÎÀ»À§ÇÑÇѱ¹ÀξƷ¡ÅλÀÀÇüÁúÀηùÇÐÀû¿¬±¸.´ëÇṠüÁ¤È®µµÆò°¡ Á¤È®µµÆò°¡, 25:39-47, 1995

- 48 -
Abstract

Topographical anatomy and radiographic evaluations of the maxillary sinus and surrounding structures

Hae-Rym Yoon D.D.S., M.S.D

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The anatomical description and the relationship between the root apex and the inferior wall of sinus are critical in diagnoses and surgeries of the sinus pathoses, and in dental implantation. So, identification of the proximity between the root apex and the inferior wall of sinus and the clarification of cortical thickness of inferior wall of sinus are indicated the topography of spreading dental infection into the maxillary sinus. Therefore, anatomical knowledge of the topography between the root apex and the inferior wall maxillary sinus are important in the diagnosis and treatment planning of the dental implantation, endodontic procedures, and orthodontic treatment.

The purposes of this study were 1) to clarify the morphological and clinical characteristics of the maxillary sinus, especially the inferior wall of sinus in Korean, 2) to identify the relationship between the inferior wall of maxillary sinus and the roots of maxillary teeth, and 3) to evaluate the degree of accuracy of DentaScan reformatted images of the maxillary sinus.

33 sides of maxillae of the hemi-sectioned Korean heads were used in this study. Periapical radiographs, computed tomography and DentaScan reformatted
cross-sectional images were taken for the radiographic evaluation of the maxillary teeth and inferior wall of maxillary sinus. From the CT images, 3-dimentional reconstructive images of maxillary sinuses were made using the V-works\textsuperscript{T\textcopyright} 3.0 program. All specimens were decalcificated and then were sectioned coronally. On the sectioned specimen, 21 metric items were measured using the image analyzing system.

The results were as follows:

1. In 6 categories of maxillary sinus according to their lateral aspects and shapes of the inferior walls, flat (54.5\%) and round (21.2\%) inferior wall of maxillary sinus were prominent. In 58.4\%, the anterior limit of maxillary sinus was located in the 1st premolar area and the posterior limit was in the 3rd molar and maxillary tuberosity area (93.9\%). The lowest level of the maxillary sinus was in the 1st molar and 2nd molar area.

2. From the 3-dimensional reconstructive images of maxillary sinus, the maximum A-P length of sinus was $39.3 \pm 4.2\, \text{mm}$, the maximum height was $37.1 \pm 5.6\, \text{mm}$, and the maximum width was $32.6 \pm 6.5\, \text{mm}$. And the average volume of sinus was $15.1 \pm 6.2\, \text{mm}^3$. All measurements were larger in male than female.

3. The distance between the each root apex and the inferior wall of maxillary sinus was the shortest in the 2nd molar area and the longest in the 1st premolar area.

4. The thickness of the cortical plate of the inferior wall of maxillary sinus was thinnest in the 1st premolar area, whereas, the thickest in the 2nd premolar area.

5. The vertical relationship between the inferior wall and the roots of the maxillary molars was classified into 5 types. Type I (the inferior wall of sinus was located above the level connecting the buccal and lingual root apices) was
predominant (54.5% in the 1st molar area, 52.4% in the 2nd molar area).

6. The horizontal relationship between the inferior wall of sinus and root apex were classified into 3 types. Type 2 (the alveolar recess of the inferior wall of sinus was located between the buccal and lingual roots) was predominant (80% in the 1st and 2nd molar area).

7. Compared the degree of accuracy and findings of dental and periapical pathoses on the intraoral radiographs and DentaScan reformatted images with the cross-sectioned specimens, the DentaScan reformatted cross-sectional images were more accurate and more effective than the intraoral radiography with a viewpoint of the detection of dental and periapical pathoses.

Summarizing all these results, this study demonstrated that all the measurements of maxillary sinus were larger in males than females. Also morphological measurements of maxillary sinus and surrounding structures have provided the useful measurement data in clinical procedures. Comparing the results of specimens with intraoral radiographies and DentaScan reformatted images, the dental and periodontal pathoses and topographical structures were more clearly observed in the DentaScan reformatted images, providing the possibility of more applications of reformatted images to clinical dentistry.

**Key Words**: maxillary sinus, inferior wall of maxillary sinus, maxillary teeth, DentaScan reformatted image