I. Introduction
Hearing improvement after canal wall down(CWD) tympanomastoidectomy is another major goal of surgery after eradication of disease, especially in cases with intact stapes. The surgery in case of intact stapes head in CWD patient is divided into two major group; classical tympanoplasty type III (Wollstein’s classification; graft material is laid down onto stapes head directly) and tympanoplasty type III, subtype (Farrior’s classification; strut like autologous cartilage or PORP is inserted between stapes head and graft material). The distance from the tympanic annulus to the head of stapes is 3.0 – 4.5 mm in normal adult. The distance between the line which is made from the facial ridge to anterior tympanic annulus is less than 1.5 mm. The grafted fascia will be placed close to stapes head and graft material. The objective of this study is to compare the postoperative results of hearing gain and middle ear condition according to the types of ossiculoplasty described above.

II. Material and Methods
Of patients who received CWD tympanomastoidectomy from January 1992 to June 2004, 90 who had been followed up for more than 1 year after surgery were selected. We found 30 cases of classical tympanoplasty type III, 38 short columellization tympanoplasty cases, and 22 partial osicular replacement prosthesis (PORP, Xomed, Jacksonville, USA) tympanoplasty cases. Age and sex distribution, success rate of hearing improvement (excellent results(0-10 ABG), good results(11-20 ABG), no improvement(21-30 ABG), poor result(above 31 ABG)), mean of postoperative air-bone gap (ABG; checked postoperative 3 month and 1 year respectively), rate of middle ear adhesion were analyzed according to the type of surgery.

III. Results
1. Comparison of postoperative hearing results at postop. 3 months and 12 months

<table>
<thead>
<tr>
<th>Postop. ABG</th>
<th>Postop. 3 mo</th>
<th>Postop. 12 mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10 dB</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>11-20 dB</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>21-30 dB</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>31 dB</td>
<td>8</td>
<td>6</td>
</tr>
</tbody>
</table>

Number of cases : 27 37 21 19 31 17

Abnormality : 25.7% 37.1% 21.2% 35.5% 66.7%

2. Preoperative and postoperative means of air-bone gaps.

ABG : air-bone gap  T3 : classical tympanoplasty type III, SC : short columellization tympanoplasty, PORP : partial osicular replacement prosthesis tympanoplasty

IV. Discussion
Many articles review that there is no actual differences in the hearing improvement after canal wall down mastoidectomy or closed mastoidectomy. Many kinds of ossiculoplasty after CWD mastoidectomy are applied according to middle ear conditions. When ABG after CWD is within 20 dB, we can consider the operation is successful. 33-64% in CWD patients is successful regardless of ossiculoplasty.

The surgery in case of intact stapes head in CWD patient is divided into two major group, classical tympanoplasty type III (Wollstein’s classification; graft material is laid down onto stapes head directly) and tympanoplasty type III, subtype (Farrior’s classification; strut like autologous cartilage or PORP is inserted between stapes head and graft material). 3 types of surgery were done in this study and the success rate after postoperative 3 months and 12 months was 51.4% and 64.7% and best in PORP group, 51.4% and 35.5%, second in short columellization group, 40.0%, 21.1%, last in classical type III tympanoplasty (p=0.0117, ANOVA with Duncan’s multiple range test)

The rate of adhesion is 23.1%, 4.5% in classical type III tympanoplasty and strut used group, respectively (p=0.0451, Fisher’s exact test) The struts is considered useful in prevention of middle ear adhesion. The silastic sheet was effective in prevention of adhesion in this study but the statistics showed no differences.

Surgeon must consider various factors in ossiculoplasty especially in case of cholesteatoma surgery such as middle ear condition, amount of bleeding, the possibility of 2nd stage operation and Eustachian tube function. The use of strut such as PORP is preferable in CWD operation with intact stapes.

V. Conclusion
In cases of with intact stapes in CWD tympanoplasty, we conclude that tympanoplasty using strut is more useful for hearing improvement and prevention of middle ear adhesion than classical tympanoplasty type III : for the statural material, we found PORP more effective than autologous materials.

VII. Reference
17. Usefulness of Strut in Ossiculoplasty during Canal Wall Down Tympanomastoidectomy.