**Otology**

**Alternative treatment for otitis media with effusion: eustachian tube rehabilitation**

*Un trattamento alternativo dell’ottite media effusiva: la riabilitazione tubarica*

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**SUMMARY**

In this study, we evaluated the effectiveness of eustachian tube rehabilitation (ETR) as treatment for otitis media with effusion (OME). Thirty-five children with persistent OME were enrolled. Patients were divided into three groups: group I (isolated OME); group II (OME and atypical swallowing); group III (OME, habitual mouth breathing and atypical swallowing). All children underwent ETR. Otomicroscopy and tympanograms were performed before treatment, and at one and three months following ETR. Considering the overall patient population after ETR (one and three months later), the prevalence of type A tympanogram increased significantly compared to before therapy (p < 0.005), while the prevalence of type B tympanogram decreased significantly (p < 0.005). We found significant differences between pre- and both post-therapy control in groups I and II. However, children in group III experienced significant improvement of middle ear conditions only three months after the end of therapy (p < 0.005). On the basis of the physiopathologic knowledge of OME and the underlying principles of ETR, we conclude that ETR can be considered a useful therapy in management of OME.

**KEY WORDS:** Otitis media with effusion • Eustachian tube • Eustachian tube rehabilitation • Swallowing • Habitual mouth breathing

**RIASSUNTO**

Scopo di questo studio è stato quello di valutare i risultati della terapia riabilitativa tubarica in pazienti affetti da otite media secretiva (OME). Sono stati trattati 35 bambini affetti da OME suddivisi in 3 gruppi: gruppo I (OME isolata); gruppo II (OME e deglutizione atipica); gruppo III (OME, respirazione orale abituale e deglutizione atipica). Prima della terapia ed a distanza di 1 mese e 3 mesi dalla fine del trattamento, tutti i casi sono stati sottoposti ad otomicrotoscopia timpanometrica. Fra tutti i pazienti, sia a distanza di un mese che di tre mesi dalla fine del trattamento, la prevalenza del timpanogramma tipo A aumentava significativamente (p < 0,005) mentre si riduceva in modo statisticamente significativo quella del timpanogramma tipo B. I pazienti del gruppo I e II mostravano un significativo miglioramento sia al primo controllo che a distanza di tre mesi mentre i bambini del gruppo III solo tre mesi dopo la terapia (p < 0,005). Sulla base delle conoscenze fisiopatologiche dell’OME e dei principi di rieducazione tubarica, possiamo sostenere che la riabilitazione tubarica potrebbe essere considerata un trattamento utile ed efficace per la terapia delle otiti medie secretive.

**PAROLE CHIAVE:** Otite media effusiva • Tuba di Eustachio • Riabilitazione tubarica • Deglutizione • Respirazione orale abituale

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**Introduction**

Otitis media with effusion (OME) can be defined as a non-purulent effusion of the middle ear that may be either mucoid or serous, without sign and symptoms of acute infection. Although the lack of acute symptoms makes the prevalence of OME difficult to assess, epidemiologic studies estimate that at least 80% of preschool children have one or more episodes of OME, and that the point prevalence of OME on screening tests is about 20%. OME may resolve spontaneously within 3 months, but about 30% to 40% of children have recurrent OME, and 5% to 10% of episodes last 1 year or longer. Moreover, middle ear diseases occurring later in life, such as chronic otitis media and cholesteatoma, can be attributable to OME in childhood. Many events are advocated in the pathogenesis of OME: inflammation, adenoid hypertrophy, atypical swallowing, craniofacial growth abnormalities caused by nasal obstruction, and a reduction of local and/or systemic immune response associated with inadequate ET function. Owing to the large variability of the spontaneous course of OME, it is common policy to observe the child and postpone treatment until the condition has been persisted for at least 3 months. Medical therapies, including antihistamines, decongestants, antimicrobials and corticosteroids, are not recommended because of the short-term and relatively small magnitude in benefits. Surgical treatment is recommended when OME lasts 4 months or longer and causes persistent hearing loss. Furthermore, a surgical
approach is advocated in the presence of structural damage to the tympanic membrane and in children at risk for speech, language or learning problems. Tympanostomy tube insertion is the preferred initial surgical procedure, while adenoidecotomy plus myringotomy, with or without tube insertion, is recommended only when a child needs to repeat surgery for OME 13.

“Eustachian tube rehabilitation” (ETR) was developed in France 20 years ago 14-16. This is a treatment designed to help ET opening by using a combination of methods including improved nasal hygiene and breathing, muscle strengthening exercises and auto-insufflation. Young children are prone to OME because their Eustachian tubes are short, floppy, horizontal and functionally poor 17. In addition, some negative behaviors may play an important role in the development of OME. Sniffing causes negative pressure in the middle ear which leads to retraction of the tympanic membrane 18. Naso-diaphragmatic breathing exercises should be performed to achieve synchrony between nasal and diaphragmatic breathing, while trough nasal valve exercises help children acquire awareness of nostril dilatation. The ET is normally closed at rest. During swallowing and yawning, the ET physiologically opens because of the activity of tensor and levator veli palatini muscles. Swallowing and yawning exercises increase the chances of tubal opening. The goal of ETR is to allow the activity of the velopharyngeal sphincter. This is obtained by play activities in which movements of the tongue, soft palate and jaws, isolated or associated, are performed. Valsava and Misurya manoeuvres constitute components of ETR. Nevertheless, these passive auto-insufflation manoeuvres have only transient effects when used alone. Finally, as a part of therapy, the regular use of chewing gum should be encouraged. Indeed, chewing activates jaw movements, increases salivary flow, the rate of swallowing and the rate of activations of paratubal muscles and tubal opening 19 20.

Although rehabilitation exercises and their underlying principles have been described in detail 14-16, few studies have been conducted to clarify the efficacy in ETR 21 22. The aim of this study is to evaluate the effectiveness of ETR as treatment for persistent OME in children.

Materials and methods

We studied 35 children, 15 males and 20 females, aged between 6 and 11 years [mean = 7.53 years; standard deviation (SD) ± 2.89]. The clinical protocol was approved by institutional review board committee of the Università Cattolica and informed consent was obtained from parents of patients. The inclusion criteria were: mono- or bilateral OME persistent for at least 3 months at the moment of the enrolment, as verified by type B tympanogram and otomicroscopy analysis; previous adenoidecotomy, medical and Politzer’s treatments without resolution of OME; absence of nasal obstruction, as supported by anterior basal rhinomanometry (Ryno Zig® Equipment – Menfis Biomedica, Italy), and acute inflammation of nasal-rhino-pharyngeal district. Finally, audiometric tests were performed in all cases before and after treatment, but for the purposes of this study these data were not considered. All children were submitted to evaluation by a speech pathologist. Assessment of oral habits showed that in 13/35 patients (37.14%) OME was isolated, while in 22/35 patients (62.86%) OME was associated with atypical swallowing and/or habitual mouth breathing. The latter was a dysfunctional habit in the absence of obstructive pathologies of the nasopharynx. According to the absence or the different coexistence of oral dysfunctions, children were divided into three groups: group I – 13/35 children with isolated OME; group II – 7/35 children with OME and atypical swallowing; group III – 15/35 children with OME, habitual mouth breathing and atypical swallowing.

After evaluation, the speech pathologist performed ETR to restore or improve the ventilatory function of the ET by a hygienic approach and by training specific voluntary motor activities and correcting deviant mouth habits. Children performed specific tubaric rehabilitation based on lingual, velar and mandibular exercises, nasal respiratory exercises monolateral or bilateral, swallowing exercises and Valsalva’s and Misurya’s manoeuvres. The total number of therapy sessions was 12; mean duration of therapy was 3 months. The first eight sessions of ETR were given twice a week, while the last four were planned at a distance of 15 days. Each session lasted 30 minutes. Parents were involved in treatment; they were asked to repeat daily the exercises with their child and to control adherence to hygiene advice.

The results of ETR tympanometry were monitored before, and at one and three months after the end of treatment. During the behavioural treatment and for the following three months, none of the patients received medical therapy. Finally, all patients were instructed to perform the exercises daily for at least one month after the end of treatment.

Statistical analyses were performed with the software package SPSS (version 10.0 for Windows®-SPSS Inc., Chicago, IL, USA). The chi-square test was used for categorical variables. Statistical significance was set at p < 0.005.

Results

Tympanogram analysis before ETR showed a type C in 17 ears (24.28%) and a type B in 53 ears (75.71%). One month after the end of treatment, type A, C and B tympanograms were detected in 32 (45.71%), 20 (28.57%) and 18 (25.71%) ears, respectively. Three months later we observed type A in 32 (45.71%) ears, while types C and B were found in 23 (32.86%) and in 15 (21.43%) ears,
respectively. One month after ETR 13 (76.47%) type C and 19 (35.84%) type B switched to a type A, while 16 (30.18%) type B converted to a type C. Three months after ETR, an additional 3 ears switched from a type B to a type C tympanograms.

After ETR (one and three months later), the prevalence of type A tympanogram was significantly higher than before therapy (p < 0.005), while the prevalence of type B tympanogram was significantly lower (p < 0.005). Furthermore, prevalence of type C tympanograms was decreased (or increased) without statistical difference before and after ETR (one and three months after) (p > 0.005). Finally, no statistically significant differences were found in tympanometric findings between the two follow-up evaluations (p > 0.005) (Table I).

Figures 1, 2 and 3 show the tympanometric results in the three groups of patients before ETR and at the two post-therapy assessments. In groups I and II, comparison between pre-therapy tympanometric findings and both post-treatment evaluations showed a statistically significant increase of the number of type A tympanograms and a statistically significant decrease of the number of type B tympanograms (p < 0.005). Moreover, no significant differences were found between early and late post-treatment follow-up (p > 0.005) (Figs. 1, 2). In group III, comparison between pre-therapy and early post-treatment and the two post-treatment evaluations showed no statistically significant differences in tympanometric findings (p > 0.005). In this group, a significantly higher number of type A tympanograms (p < 0.005) and a significantly lower number of type B tympanograms (p < 0.005) was observed only three months after the end of ETR (Fig. 3).

Table I. Tympanometric results of the overall group of ears (70/70) before ETR (pre) and at each post-treatment assessment (post 1 = one month after ETR; post 2 = three months after ETR).

<table>
<thead>
<tr>
<th>Tympanogram</th>
<th>Pre No. of ears (%)</th>
<th>Post 1 No. of ears (%)</th>
<th>Post 2 No. of ears (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type A</td>
<td>0 (0%)</td>
<td>32 (45.71%) *</td>
<td>32 (45.71%) *</td>
</tr>
<tr>
<td>Type C</td>
<td>17 (24.28%)</td>
<td>20 (28.57%)</td>
<td>23 (32.86%)</td>
</tr>
<tr>
<td>Type B</td>
<td>53 (75.71%)</td>
<td>18 (25.71%) *</td>
<td>15 (21.43%) *</td>
</tr>
</tbody>
</table>

* = p < 0.005 Pre vs Post 1
* = p < 0.005 Pre vs Post 2

Fig. 1. Tympanometric results of group I (26/70 ears) before ETR (pre) and at each post-treatment assessment (post 1 = one month after ETR; post 2 = three months after ETR).

Fig. 2. Tympanometric results of group II (14/70 ears) before ETR (pre) and at each post-treatment assessment (post 1 = one month after ETR; post 2 = three months after ETR).

Fig. 3. Tympanometric results of group III (30/70 ears) before ETR (pre) and at each post-treatment assessment (post 1 = one month after ETR; post 2 = three months after ETR).
Discussion

In this study, we treated 35 children with mono- or bilateral persistent OME with a functional approach. The overall results showed a significant improvement of middle ear conditions, as reflected by the tympanometric findings, one month after the end of the ETR. Additionally, the last follow-up visit demonstrated the stability of these results. Evaluating the results in three groups, we found that children with isolated OME and children with OME associated with atypical swallowing (groups I and II) had similar outcomes. However, children with OME associated with habitual mouth breathing and atypical swallowing (group III) experienced a significant improvement of middle ear ventilation only three months after the end of ETR.

Mouth breathing has been found significantly associated with the prevalence of OME. In mouth breathers, the altered position of the tongue and oral mucosa dryness contribute to qualitative and quantitative abnormalities in swallowing. Because the ET opens with every swallow, habitual mouth breathing negatively interferes with the ventilatory and pressure equilibration functions of the ET. Various experimental studies conducted on animal models have shown a strict correlation between nasal obstruction, craniofacial growth, OME and ET muscular dysfunction. Orofacial functional and structural changes related to oral breath might explain the late improvement of middle ear conditions that we observed in children with habitual mouth breathing.

OME is a matter of discussion between otolaryngologists and paediatricians for significant practice variations in management. Indeed, none of the drugs used for OME treatment has been demonstrated to be effective. On the other hand, tympanostomy tubes seem to be associated with complications in at least 80% of operated ears such as purulent otorhrea, myringosclerosis, segmental atrophy, atrophic scars, retraction pockets, membrane perforation and granulation tissue. Nevertheless, the indication to insert tubes is still controversial. Many reviews conclude that there is only a small benefit of conventional ventilation tubes. Indeed, tympanostomy tubes are inserted to ameliorate middle ear ventilation, but have no effects on ET dysfunction.

Considering the physiopathologic knowledge of OME and the underlying principles of ETR, this functional approach seems to be a valid alternative to invasive treatments for OME. Nevertheless, ETR has received little attention in clinical practice and in the literature. In a clinical study with four non-randomized groups of children with OME, Deggouj et al. reported a recovery rate of 40% with ETR, 28% with medication and 60% when ETR was associated with medication, while no improvement was observed in the group of children who did not receive any treatment. In a prospective, randomized, pilot study in a small number of subjects, Kouwen et al. reported only marginally significant recovery in children who underwent functional treatment compared to the watchful waiting group.

The reasons for the limited interest in ETR warrant discussion. ETR is a long-term treatment that requires time in learning and carrying out exercises, good compliance of children and daily training. Because of the long time required for therapy, one risk is that patients may lose motivation. Based on our experience, we believe that involvement of children using playing activities and active participation of parents to treatment are two essential factors for the success of ETR.

Conclusions

ETR may be a useful treatment tool in the management of OME and may improve middle ear ventilation, avoiding the need for surgery and exposure to surgical complications. However, the effectiveness of this therapy deserves to be investigated in broader trials, evaluating outcomes obtained in patients treated with ETR and those obtained with more conventional treatments and watchful waiting.

References


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