Critical Review:
Current Management Strategies of Children with Minimal and Mild Bilateral Hearing Loss

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This critical review examines the current practices in case management of children with minimal and mild bilateral hearing loss. Study designs include: survey and observational uncontrolled cohort study designs. Overall, there is no universal case management strategy used for children with mild bilateral hearing loss and management strategies have been documented to change over time. There is a trend for children with mild to moderate hearing loss to be identified later and the gap between identification and treatment is larger for this group than for children with moderate to severe hearing losses. Greater severity of loss in the better ear is predicative of the recommendation for amplification.

Introduction

Minimal hearing loss is a term used to encompass many configurations of hearing loss which are present but are not classified as moderate or more severe based on the traditional elevated pure-tone average in the better hearing ear. The three configurations typically grouped under this term are: unilateral hearing loss, bilateral mild hearing loss and high-frequency hearing loss. Children with transient hearing loss related to otitis media are also sometimes included in the term. There exists so little research on these groups they are often combined into one large group and described as "minimal" because the degree of loss appears to be less severe in comparison to other hearing losses.

Children with minimal and mild bilateral hearing loss are a group which receive considerably less attention than those children with more severe types of hearing loss. Some children with minimal and mild bilateral hearing loss do not require support to develop age-appropriate speech and language and succeed academically without special attention. Historically, these types of hearing loss raised little concern (Tharpe, 2008). However, it is now well documented that children with minimal and mild bilateral hearing loss experience difficulties beyond that of their normal hearing peers (Bess, Dodd-Murphy & Parker, 1998).

The documented listening needs of children with minimal and bilateral hearing loss are greater than those of their normal hearing peers (Crandell, 1993). Further, a greater proportion of children with minimal and mild bilateral hearing loss have difficulty in school: they are more likely to have behavioural issues and are at increased risk for academic failure (Bess, Dodd-Murphy & Parker, 1998). There is currently no way to predict which children will experience difficulties, and this makes intervention recommendations unclear. Case management varies from taking a wait-and-see approach to providing communication therapy, hearing instrments, and the use of FM systems. The most common recommendation is to make decisions for this group of children on a case by case basis (e.g. Flexer, 1995; McKay, Gravel & Tharpe, 2008).

Objectives

Since there are no clear case management strategies for this group of children, this critical review focuses on the current case management of children with minimal and mild bilateral hearing loss. The secondary objective is to propose future research for case management of children with minimal and mild bilateral hearing loss which would provide the necessary information needed to make evidence-based recommendations.

Methods

Search Strategy

Computerized databases, including PubMed, and CINHAL, SCOPUS and Google Scholar were searched using the following search strategy: ((minimal hearing loss) OR (mild bilateral hearing loss)) AND ((amplification) OR (FM) OR (intervention)). The search was restricted to articles in English. Reference lists in the obtained articles were also searched for other relevant articles.

Selection Criteria

Studies selected for inclusion in this critical review were required to report on the current case management of children with minimal or mild bilateral hearing loss. No limits were used to define minimal or mild bilateral hearing loss. Limits were set on the age of participants - all needing to be less than 18 years of age. Studies were included that reported on intervention in the form of

amplification, FM system and communication development services.

Data Collection

Results of the literature search yielded five articles consistent with the selection criteria: survey, observational uncontrolled cohort study designs were found.

The intent of this critical review was to evaluate all current literature available regarding case management of children with mild bilateral hearing impairment however also included studies which reported aggregate data when specific data for mild bilateral hearing loss was not available. Due to the paucity of current research at this time, non-peer reviewed publications were also included.

Results/Discussion

Survey Study #1

Harrison and Roush (1996) conducted a national survey study in the United States to gather information on identification and intervention services for children with hearing loss. Letters were mailed to 279 professionals in 50 states who provided early intervention services to children with hearing loss and of these 35 requested surveys to distribute to clients. 1500 questionnaires were sent to professionals and 401 surveys were returned to the authors between September 1993 and February 1994. Of these only 331 were used in analysis; 70 were not used due to illegible, incomplete responses or unknown hearing status. Parents of children aged less than one year to 5 years completed the mail survey. Severity of hearing loss ranged from mild to severe. Respondents were from 35 different states. The questionnaire requested information about the approximate age of suspicion, diagnosis, hearing aid fitting and initiation of early intervention services. Intervention services were not described but it is assumed that "early intervention" refers to communication development intervention.

Descriptive statistics were used to describe the results. 74.9% of the children were described as having a severe or profound hearing loss and 25.1% as mild or moderate. The results were analyzed separately depending on if risk factors for hearing loss were present or not. Results indicated that for children with mild to moderate hearing loss with no risk factors, median age of diagnosis was 22 months and hearing aid and communication intervention were initiated at a median age of 28 months. These results are later than those reported for the severe to profound children for diagnosis (median 13 months) and fitting of hearing aids and intervention (median 16 months). The trends of longer interval to intervention for children with mild to moderate hearing loss were also present in the group with known risk factors (diagnosis: median 12 months all severities, hearing aid fitting: 22 mild to moderate vs. 15 sever to profound, communication intervention: 18 mild to moderate vs. 16 sever to profound.)

This study was peer-reviewed. Weaknesses of the study included the lack of representation of geographic region despite researchers' attempts to sample the whole country. It was unclear if all surveys were distributed to families and the data may contain errors because information could not be checked against clinical records. No statistical analysis was done to determine if the median age differences were significant between the mild to moderate and severe to profound groups. The use of FM systems as an intervention was not reported on in this study.

Survey Study #2

Davis, Reeve, Hind, and Bamford (2001) reported on a survey study conducted in the United Kingdom which looked at the impact of mild and unilateral hearing loss in children. The focus of the study was on Quality of Life measures but information regarding case management was also gathered. Of 150 questionnaires sent to families of children with a mild bilateral or unilateral hearing loss, 66 were returned. Data represented conductive and sensorineural hearing losses and roughly a third of children were reported to have other disabilities. Information on the questionnaires was compared to audiological data. There was additional audiological data available for 87 children and this was combined with the chart and survey information from the other participants. Descriptive statistics were used to describe the results.

Most of the children in the study were aided (80%) however the authors noted great regional variations in the clinical management of cases. Children with greater unilateral losses were most often aided. Age of identification was not commented on for children with mild bilateral hearing loss and age of referral for children with unilateral losses was between 4-6 years of age. Both mild bilateral and unilateral losses were only fit with amplification in 50% of cases by age 5;0 years and 80% by 8;3 years. The use of the prescribed aids was broken down into unilateral or mild bilateral hearing loss groups. Of the unilateral loss group, 50% reported "never" wearing the aid, 26% "all the time" and 4% "only for school". 44% of children with mild bilateral hearing loss were reported to wear aids "all the time" and 3% "only for school" and almost 25% "never".

The summary of this study was published as a chapter in the proceedings of a well-respected conference but was not peer-reviewed and the methodology was not described in depth. The authors are known for their work and an earlier poster presentation of the same study was likely peer reviewed. Based on this information, the evidence could be considered peer-reviewed. The use of FM and language intervention was not commented on. There was a comment on regional variation in case management and it was unclear exactly which regions were represented in the data included.

Cohort Study #1

Dalzell, Orlando, MacDonald, Berg, Bradley, Cacace, et al. (2000) report on the age of identification, fitting and early intervention for children in the New York universal newborn hearing screening program.

Median age of identification was reported to be "similar between the [mild to moderate and severe to profound] groups". At risk and no risk factor babies were all identified at around the same age but there was a greater delay in fitting hearing aids when the child was in the at-risk group or had a mild hearing loss. The authors report that 46% of infants were diagnosed with a "very mild" or unilateral hearing loss and were not fit with amplification. Age of enrolment in early intervention programs was similar regardless of severity of hearing loss.

This study was peer-reviewed. This study does not report on the specific numbers of children broken down by level of hearing loss and important information regarding delays in amplification and enrolment in communication intervention may have been hidden by grouping hearing losses of mild and moderate severity together.

Cohort Study #2

Yoshinaga-Itano, DeConde Johnson, Carpenter, & Stredler Brown, (2008), reviewed the available literature on outcomes of children with mild bilateral and unilateral hearing loss and reported on a 2002-2003 cohort of children enrolled in the Colorado school system. This report differed from others in that data was included for only those students with an "Educationally Significant Hearing Loss" (ESHL). To have an ESHL a student must meet audiometric and disability criteria. Disability criteria include: poor word recognition, speech, language or reading delay, significant differences between verbal and non-verbal performance and behaviour problems.

2.26% of children in the state of Colorado met the criteria for hearing loss but only 0.66% met criteria for an ESHL. Of the children with an ESHL, 35.5% were eligible for special education and related services. Children with mild bilateral, unilateral, high-frequency or otitis media related hearing loss accounted for about 49% of children with an ESHL and 22% of this group received special education and related services.

The use of ESHL makes this report difficult to compare to other studies and it does not report on the use of amplification or FM systems. ESHL may be a useful term because it combines both audiological factors and factors related to poor academic performance. The methodology of how statistics were gathered was lacking. It mentions only that one educational audiologist was responsible for the whole state but does not mention any demographics of the schools included (e.g. public, private). Useful from this study was some information on the number of children who were receiving special education or related services although these services could have been better defined.

Cohort Study #3

Fitzpatrick, Durieux-Smith, and Whittingham, (2010) conducted a retrospective chart review of all cases of mild bilateral or unilateral hearing loss at a Canadian pediatric centre between 1990 and 2006. This study compared children identified before and after the implementation of a universal newborn hearing screening program. Children who fit the National Workshop (2005) definition of mild bilateral or unilateral hearing loss were considered for the study. If the etiology of the hearing loss was known to be acquired, the child's information was excluded from use in the study. Charts were reviewed and a data sheet was filled out with information regarding characteristics of the child, their hearing loss, recommendations and uptake of interventions. Amplification was described as hearing aids and FM systems. Descriptive statistics were used to describe most of the results. The student's t test was used when comparing normally distributed continuous characteristics and outcomes. For non-parametric variables Mann Whitney U test was used. Categorical characteristics were evaluated between groups using Chi-square test or Fisher's exacts test when appropriate.

In the study period 670 children were identified as having a permanent congenital or assumed congenital hearing loss of which 291 met criteria for inclusion in the study. Of the 291, medical charts were available for 255 cases. Those not included differed significantly from the study group in that they were older and followed for a shorter period than the study group. The study group consisted of 178 mild bilateral, 31 high-frequency bilateral and 46 unilateral configurations. Of children with high-frequency bilateral hearing loss, 24

progressed to moderate hearing loss in the better ear. One child in the unilateral group progressed to a moderate bilateral hearing loss. The Median age of identification was 51.1 months for the mild bilateral group, 56.9 months for the high-frequency bilateral group and 60.4 months for the unilateral group. The authors reported that there was an average of 5 months between the first assessment appointment and confirmation of diagnosis. 91.4% of children received a recommendation for amplification – 54.1% within 3 months of confirmation of hearing loss and 37.3% after 3 months. No amplification recommendation was made for 22 children.

Patterns of recommendations for amplification differed for the bilateral and unilateral groups. 60.1% of children with mild bilateral hearing loss had an initial recommendation and only 26.1% of children with a unilateral loss. Change of recommendation occurred for 21 children, 9 of whom received a recommendation for discontinued use.

This study provides the most robust evidence for case management of this group. This study confirms the uncertainty reported in so many articles on whether to prescribe hearing aids and when. The largest limitation of this study was its retrospective design; past exposure information like duration and amount of use of amplification and other intervention services could not be gathered or reasons why these interventions were delayed or not used. Also, this study sought to report only on children with an acquired loss and although measures were taken to control for this, in some cases it will never be clear the age at which the onset of hearing loss occurred.

Conclusion

The criteria used by different authors to define the audiometric cut-off for inclusion for each configuration is not consistent across studies and therefore makes comparison of results difficult. However, there does appear to be great variation in the case management of children with minimal and mild bilateral hearing loss. A trend toward a longer gap between diagnosis and initiation of intervention in the form of amplification and communication development appears to be greater in this group than for children with more severe hearing losses. This gap deserves further investigation. Studies which explore reasons for delays (due to clinician uncertainly and/or parental uncertainty in how best to proceed) are needed. Reasons for the trends in different recommendations based on configuration of hearing loss seen in the Fitzpatrick, Durieux-Smith, and Whittingham study (2010) might be illuminated by such work.

To reduce the uncertainty when making recommendations for children with minimal and mild bilateral hearing loss, research on outcomes based on child characteristics and intervention types at different ages are needed. Ideally, these would be randomized control studies.

Also each of the groups included in the term “minimal hearing loss” may vary considerably and more research into specifics for each configuration is needed.

Clinical Implications

Clinicians should be aware that there is more often a delay between diagnosis and initiation of intervention for children with minimal and mild bilateral hearing loss. Early intervention has proven to provide the best outcomes for children with hearing loss and specifically children with mild bilateral hearing loss (Yoshinaga-Itano, et al. 2008). While there is still uncertainly regarding the best age at which to fit personal hearing aids and/or an FM system, early intervention may provide a benefit over a wait-and-see approach.

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