

D

Contribution of middle ear dynamic characteristics to hearing aid performance

Thesis

Submitted in partial fulfillment for the Master degree in
Audiology

By

Hanan Mohammed Ghoneim
(M. B., B. Ch.)



617.89
H . M

Supervised
By



Dr. Nadia M. Kamal
Professor of Audiology
Head of Audiology Unit
Department of Otolaryngology
Ain Shams University

Dr. Iman M.S. EL. Danasoury
Lecturer of Audiology
Ain Shams University

Faculty of Medicine
Ain Shams University
1996

Handwritten signatures and initials:
1. Signature of Dr. Nadia M. Kamal
2. Signature of Dr. Iman M.S. EL. Danasoury
3. Initials 'EM' and '12/96'

the 1990s, the number of people in the world who are under 15 years of age is expected to increase from 1.1 billion to 1.5 billion.

As the world's population grows, the demand for food and other resources will increase. This will put pressure on the environment and on the world's food supply. It is important that we find ways to meet this demand without harming the environment.

One way to do this is to use sustainable agriculture. This is a type of farming that uses natural resources in a way that does not harm them. It uses less fertilizer and pesticides than conventional farming, and it helps to improve the soil.

Another way to do this is to use sustainable forestry. This is a type of logging that uses trees in a way that does not harm the forest. It uses less machinery than conventional logging, and it helps to protect the forest's ecosystem.

There are many other ways to use resources sustainably. We need to find ways to meet our needs without harming the environment. This is the only way to ensure a better future for all of us.

One of the most important things we can do is to reduce our consumption. We need to stop using so many resources that we cannot replace them. We need to start using less energy, less water, and less material.

We also need to recycle more. Recycling helps to reduce the amount of waste we produce, and it helps to conserve resources. We need to make sure that we are recycling as much as we can.

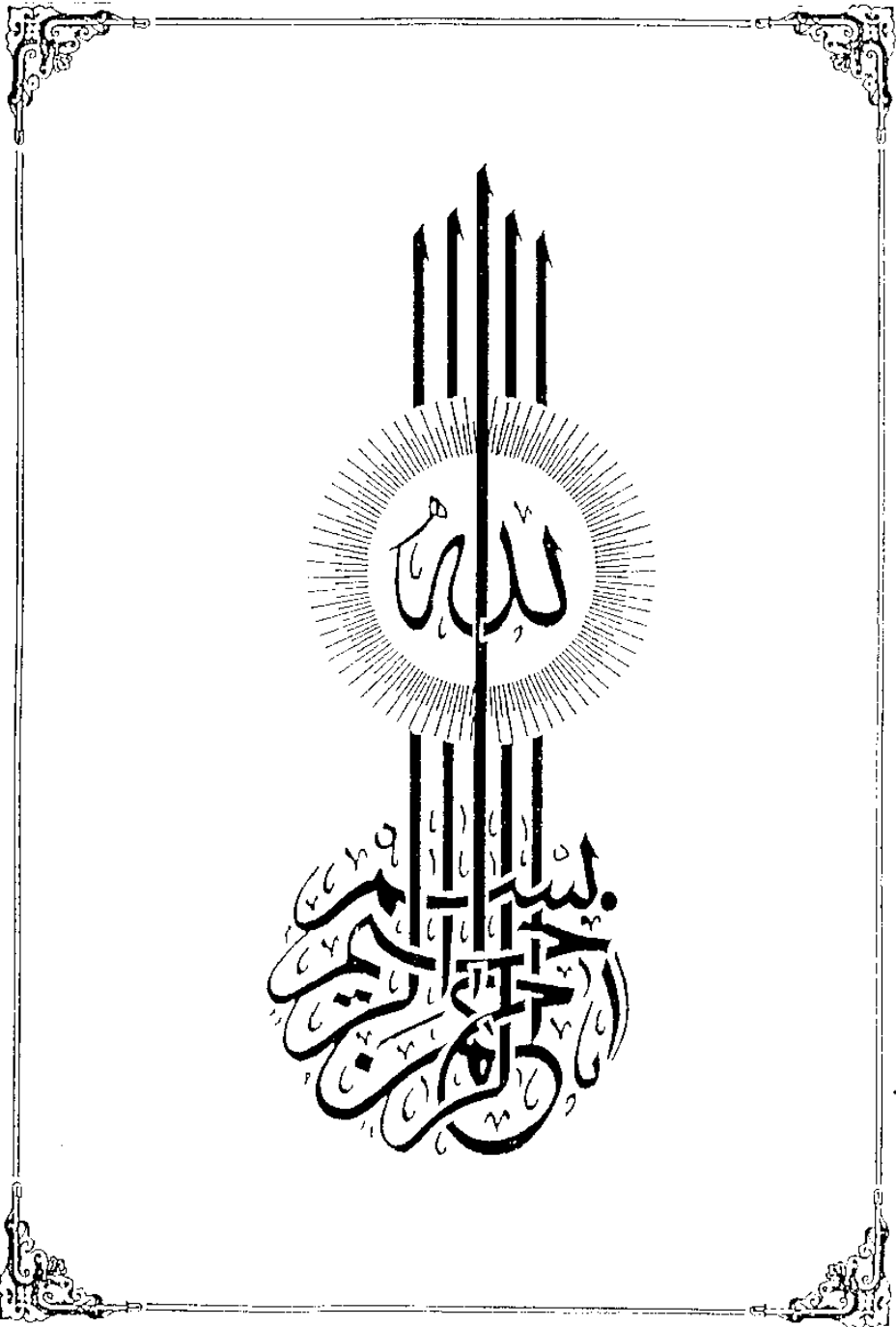
Finally, we need to protect the environment. We need to make sure that we are not harming the land, the water, or the air. We need to take steps to protect the natural world that we all depend on.

There are many things we can do to make a difference. We need to work together to find solutions to the problems we face. We need to make sure that we are using resources in a way that is sustainable for the future.

It is our responsibility to make sure that we are leaving the world a better place than we found it. We need to make sure that we are using resources in a way that does not harm the environment. We need to make sure that we are leaving a better future for all of us.

There are many things we can do to make a difference. We need to work together to find solutions to the problems we face. We need to make sure that we are using resources in a way that is sustainable for the future.

It is our responsibility to make sure that we are leaving the world a better place than we found it. We need to make sure that we are using resources in a way that does not harm the environment. We need to make sure that we are leaving a better future for all of us.



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Acknowledgment

I wish to express my greatest appreciation to Prof. Dr. Nadia Kamal for her precious guidance and support, without her help this work would never be accomplished.

Certainly I will never forget the generous support and fabulous remarks of Dr. Iman Sadek I wish that I can thank her for everything.

I wish to thank my parents and my husband for their sincere love and unlimited support.

No word can express my happiness for being at the same time with Prof. Dr. Salah Soliman godfather of Egyptian Audiology.

the 1990s, the number of people in the UK who are employed in the public sector has increased by 1.5 million, from 2.5 million in 1980 to 4 million in 1995. The public sector has become an important employer of people with mental health problems.

There is a growing awareness of the need to improve the mental health of people in the public sector. The Department of Health (1996) has published a report on the mental health of public sector employees, which highlights the need for a comprehensive approach to the issue.

The report identifies a number of key areas for action, including the need to improve the mental health of public sector employees, to provide support for people with mental health problems, and to ensure that the public sector is a safe and healthy place to work.

The report also identifies a number of key areas for research, including the need to develop a better understanding of the mental health of public sector employees, to develop effective interventions, and to evaluate the impact of interventions.

The report concludes that the mental health of public sector employees is a complex issue, which requires a comprehensive approach. The report also identifies a number of key areas for action, including the need to improve the mental health of public sector employees, to provide support for people with mental health problems, and to ensure that the public sector is a safe and healthy place to work.

The report also identifies a number of key areas for research, including the need to develop a better understanding of the mental health of public sector employees, to develop effective interventions, and to evaluate the impact of interventions.

The report concludes that the mental health of public sector employees is a complex issue, which requires a comprehensive approach. The report also identifies a number of key areas for action, including the need to improve the mental health of public sector employees, to provide support for people with mental health problems, and to ensure that the public sector is a safe and healthy place to work.

The report also identifies a number of key areas for research, including the need to develop a better understanding of the mental health of public sector employees, to develop effective interventions, and to evaluate the impact of interventions.

The report concludes that the mental health of public sector employees is a complex issue, which requires a comprehensive approach. The report also identifies a number of key areas for action, including the need to improve the mental health of public sector employees, to provide support for people with mental health problems, and to ensure that the public sector is a safe and healthy place to work.

The report also identifies a number of key areas for research, including the need to develop a better understanding of the mental health of public sector employees, to develop effective interventions, and to evaluate the impact of interventions.

The report concludes that the mental health of public sector employees is a complex issue, which requires a comprehensive approach. The report also identifies a number of key areas for action, including the need to improve the mental health of public sector employees, to provide support for people with mental health problems, and to ensure that the public sector is a safe and healthy place to work.

The report also identifies a number of key areas for research, including the need to develop a better understanding of the mental health of public sector employees, to develop effective interventions, and to evaluate the impact of interventions.

The report concludes that the mental health of public sector employees is a complex issue, which requires a comprehensive approach. The report also identifies a number of key areas for action, including the need to improve the mental health of public sector employees, to provide support for people with mental health problems, and to ensure that the public sector is a safe and healthy place to work.

Contents

-Introduction and rationale	1
-Review of literature:	
*Role of external and middle ear in sound transmission	3
*Hearing aid fitting	29
-Aims of the work	54
-Materials and method	55
-Results	60
-Discussion	85
-Conclusions	92
-Recommendations	93
-Summary	94
-References	97
-Arabic Summary	

the 1990s, the number of people in the UK who are employed in the public sector has increased by 1.5 million, from 2.5 million in 1980 to 4 million in 1995. The public sector has become a major employer in the UK, and its growth has been a major factor in the overall growth of the economy.

The public sector has also become a major employer of women. In 1980, women made up 40% of the public sector workforce, and by 1995, this figure had risen to 50%. This increase in the number of women in the public sector has been a major factor in the overall increase in the number of women in the workforce.

The public sector has also become a major employer of young people. In 1980, young people made up 10% of the public sector workforce, and by 1995, this figure had risen to 20%. This increase in the number of young people in the public sector has been a major factor in the overall increase in the number of young people in the workforce.

The public sector has also become a major employer of people with disabilities. In 1980, people with disabilities made up 5% of the public sector workforce, and by 1995, this figure had risen to 10%. This increase in the number of people with disabilities in the public sector has been a major factor in the overall increase in the number of people with disabilities in the workforce.

The public sector has also become a major employer of people from ethnic minorities. In 1980, people from ethnic minorities made up 5% of the public sector workforce, and by 1995, this figure had risen to 10%. This increase in the number of people from ethnic minorities in the public sector has been a major factor in the overall increase in the number of people from ethnic minorities in the workforce.

The public sector has also become a major employer of people who are over 50 years old. In 1980, people over 50 years old made up 10% of the public sector workforce, and by 1995, this figure had risen to 20%. This increase in the number of people over 50 years old in the public sector has been a major factor in the overall increase in the number of people over 50 years old in the workforce.

The public sector has also become a major employer of people who are under 25 years old. In 1980, people under 25 years old made up 5% of the public sector workforce, and by 1995, this figure had risen to 10%. This increase in the number of people under 25 years old in the public sector has been a major factor in the overall increase in the number of people under 25 years old in the workforce.

The public sector has also become a major employer of people who are over 65 years old. In 1980, people over 65 years old made up 5% of the public sector workforce, and by 1995, this figure had risen to 10%. This increase in the number of people over 65 years old in the public sector has been a major factor in the overall increase in the number of people over 65 years old in the workforce.

The public sector has also become a major employer of people who are under 18 years old. In 1980, people under 18 years old made up 5% of the public sector workforce, and by 1995, this figure had risen to 10%. This increase in the number of people under 18 years old in the public sector has been a major factor in the overall increase in the number of people under 18 years old in the workforce.

The public sector has also become a major employer of people who are over 75 years old. In 1980, people over 75 years old made up 5% of the public sector workforce, and by 1995, this figure had risen to 10%. This increase in the number of people over 75 years old in the public sector has been a major factor in the overall increase in the number of people over 75 years old in the workforce.

The public sector has also become a major employer of people who are under 15 years old. In 1980, people under 15 years old made up 5% of the public sector workforce, and by 1995, this figure had risen to 10%. This increase in the number of people under 15 years old in the public sector has been a major factor in the overall increase in the number of people under 15 years old in the workforce.

The public sector has also become a major employer of people who are over 85 years old. In 1980, people over 85 years old made up 5% of the public sector workforce, and by 1995, this figure had risen to 10%. This increase in the number of people over 85 years old in the public sector has been a major factor in the overall increase in the number of people over 85 years old in the workforce.

List of tables

Table (1): Mean, standard deviation and range of pure tone thresholds in group I.....	60
Table (2): Mean, standard deviation and range of air-bone-gap in group I.....	61
Table (3): Mean, standard deviation and range of pure tone thresholds in group II.....	61
Table (4): Mean and standard deviation of word discrimination scores in both groups.....	63
Table (5): Classification of subjects with CHL according to etiology.....	64
Table (6): Classification of subjects with SNHL according to etiology.....	65
Table (7): Mean, standard deviation and range of middle ear resonant frequency in both groups.....	68
Table (8): Mean, standard deviation and range of external canal resonant frequency in both groups.....	68
Table (9): Mean and standard deviation of functional gain in group I.....	69
Table (10): Mean and standard deviation of insertion gain in group I.....	69
Table (11): Mean and standard deviation of functional gain in group II.....	72
Table (12): Mean and standard deviation of insertion gain in group II.....	72
Table (13): ANOVA test for functional gain and insertion gain in group I.....	75
Table (14): ANOVA test for functional gain and insertion gain in group II.....	76
Table (15): Effect of middle ear resonant frequency on functional gain in group I.....	78
Table (16): Effect of middle ear resonant frequency on insertion gain in group I.....	78

Table (17): Effect of external canal resonant frequency on functional gain in group I.....	80
Table (18): Effect of external canal resonant frequency on insertion gain in group I.....	81
Table (19): Effect of middle ear resonant frequency on functional gain in group II.....	82
Table (20): Effect of middle ear resonant frequency on insertion gain in group II.....	83
Table (21): Effect of external canal resonant frequency on functional gain in group II.....	84
Table (22): Effect of external canal resonant frequency on insertion gain in group II.....	84

the 1990s, the number of people in the UK who are employed in the public sector has increased by 1.5 million, from 2.5 million in 1980 to 4 million in 1995. The public sector has become a major employer in the UK, and its growth has been a major factor in the overall growth of the economy.

The public sector has also become a major provider of social services, and its growth has been a major factor in the overall growth of the economy. The public sector has become a major provider of social services, and its growth has been a major factor in the overall growth of the economy. The public sector has become a major provider of social services, and its growth has been a major factor in the overall growth of the economy.

The public sector has become a major provider of social services, and its growth has been a major factor in the overall growth of the economy. The public sector has become a major provider of social services, and its growth has been a major factor in the overall growth of the economy. The public sector has become a major provider of social services, and its growth has been a major factor in the overall growth of the economy.

The public sector has become a major provider of social services, and its growth has been a major factor in the overall growth of the economy. The public sector has become a major provider of social services, and its growth has been a major factor in the overall growth of the economy. The public sector has become a major provider of social services, and its growth has been a major factor in the overall growth of the economy.

The public sector has become a major provider of social services, and its growth has been a major factor in the overall growth of the economy. The public sector has become a major provider of social services, and its growth has been a major factor in the overall growth of the economy. The public sector has become a major provider of social services, and its growth has been a major factor in the overall growth of the economy.

The public sector has become a major provider of social services, and its growth has been a major factor in the overall growth of the economy. The public sector has become a major provider of social services, and its growth has been a major factor in the overall growth of the economy. The public sector has become a major provider of social services, and its growth has been a major factor in the overall growth of the economy.