Assessment of Vestibular Functions in Cochlear Implant Children

Thesis submitted in partial fulfillment of MD in Audiology

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بسم اللة الرحمن الرحيم

"قالوا سبحانك لا علم لنا الا ما علمتنا انك انت العليم الحكيم "

صدق اللة العظيم

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List of Abbreviations

Abbreviation	Synonym
ABC	Activities-specific Balance Confidence
ACC	Spinal accessory nerve
ACS	Air conducted sound
AR	Asymmetry ratio
ADT	Adaptation test
BCV	Bone conducted vibrations
BOT	Bruininks-Oseretsky Test
CDP	Computerized Dynamic Posturography
COP	Centre of Pressure
cVEMP	Cervical Vestibular Evoked Myogenic Potential

DHI	Dizziness Handicap Inventory
EMG	Electromyography
FGI	Functional Gait Index
FNS	Facial Nerve Stimulation
HTT	Head Thrust Test
HST	Head Shake Test
HSN	Head Shake nystagmus
mCTSIB	Modified Clinical Test of Sensory Interaction for Balance
msec	Millisecond
MCT	Motor Control test
MVST	Medial vestibulospinal tract
oVEMP	Ocular vestibular evoked myogenic potential
RWA	Round window approach
OLS	One leg stance
SNHL	Sensorineural hearing loss
SOT	Sensory Organization test
SCM	Sternomastoid muscle
ST	Scala tympani
uv	Microvolt
VNC	Vestibular nuclear complex
VNG	Videonystagmography
VOR	Vestibule-ocular reflex

VSR	Vestibule-spinal reflex

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Introduction

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Rationale

Introduction and Rationale

It is well known that both the cochlea and vestibule are closely related anatomically and embryologically. They share the continuous membranous labyrinth of the inner ear and function by means of almost similar receptor cells. Hence, it is reasonable to presume that many subjects with hearing impairment have concomitant vestibular abnormalities (Singh et al., 2012).

Over the last 20 years, cochlear implantation (CI) became a widely accepted procedure for severe and profound hearing loss. However, cochlear implantation is

not without risk to the nearby vestibular organs; semicircular canals and otolith organs.Thisraises the risk that existing vestibular function couldbe dramatically attenuated by the cochlearimplant (Jacot et al., 2009).

Research studies thathave examined the vestibular function following cochlear implantation focused mostly on adults and offered a wide range of conclusions (Basta et al., 2005). The percentage of occurrence of postoperativevertigo was highly variable, but at least, one third of the patients were affected (Fina et al., 2003). The variancein these studies results may result from multiple factors as; retrospective study design, lack of both pre- and postoperative testing of patients, devicestypes, surgical procedures,and testing paradigms(Buchman et al., 2004).In addition, in the CI pediatric candidates who may have significant vestibularimpairment before implantation as a result of underlyinginner ear pathology, the perceived effect of CI on vestibularfunction isnot precisely estimated.

Recently, there has been a growing awareness of vestibular dysfunction in children with hearing impairment. Published reports have shown that vestibular dysfunction is found in 20–70% of children with hearing loss of different etiologies. Vestibular dysfunction in children,especially the hearing impaired, is a diagnostic challenge for clinicians because of their limited communication abilities and the vestibular evaluation procedures are difficult to use with them (Singh et al., 2012).Meanwhile, vestibular testing is not part of the standard battery of tests before or after cochlear implant surgery (Jacot et al., 2009).

Although numerous authors havereported vestibular evaluation techniques and normsfor children, these studies have primarily focused on theapplication and adaptation of adult testsas, Videonystagmography (VNG),computerized dynamic