

Contents

- 1 Introduction 1**
 - 1.1 A Brief Introduction to the Vestibular System. 2
 - 1.2 Visual-Vestibular Interactions 6
 - 1.3 Adaptation 6
 - 1.4 Motion Sickness. 7
 - 1.5 Historical Perspective 8
- 2 The Role of the Otoliths 13**
 - 2.1 Which Functions Do the Otoliths Fulfil? 13
 - 2.2 Early Spaceflight-Related Studies of Otolith Responses. 16
 - 2.3 Recent Postflight Testing of Otolith Function 17
 - 2.3.1 Utricle Function Tests 18
 - 2.3.2 Saccule Function Test 19
 - 2.4 Related Experimental Findings 19
 - 2.4.1 Subjective Vertical 19
 - 2.4.2 Utriculo-Ocular Reflex. 21
 - 2.4.3 Saccule Function Test 21
 - 2.4.4 Discussion of the Findings. 22
 - 2.5 Summary 23
- Appendix. 23
 - Unilateral Centrifugation 23
 - Subjective Visual Vertical 24
 - Utriculo-Ocular Response 25
 - Cervical Evoked Myogenic Potentials (cVEMPs) 27
- 3 The Three-Dimensional Vestibulo-Ocular Reflex During Prolonged Microgravity 29**
 - 3.1 Introduction 29
 - 3.1.1 Test Procedure 31

3.2	Spaceflight Findings.	32
3.2.1	Horizontal VOR	33
3.2.2	Vertical VOR	33
3.2.3	Torsional VOR	34
3.3	Summary	35
4	Listing’s Plane and the 3D-VOR in Microgravity	37
4.1	Introduction	37
4.2	Parabolic Flight Study	39
4.3	Spaceflight Study	40
4.4	Summary	46
	Appendix.	47
	Determination of Listing’s Plane Coordinates	47
	Determination of Minimal Gain Vector Coordinates	49
5	Technology Developments and Transfer	51
5.1	Eye Movement Measurement Technology.	51
5.2	The DLR Eye Tracking Device	52
5.2.1	Front-End Image Processing	54
5.2.2	Online Acquisition and Measurement	55
5.2.3	Offline Image Evaluation.	55
5.2.4	Convention for Describing 3D Eye Position	56
5.2.5	Offline 3D Tracking.	56
5.2.6	Determination of 3D Eye Position.	57
5.3	Laser Eye Surgery	57
5.4	Clinical Diagnostic Testing	58
6	Clinical Applications and Related Projects	59
6.1	Unilateral Otolith Dysfunction	60
6.2	Subjective Visual Vertical as a Clinical Test	60
6.3	Testing Utricular Function by Means of On-Axis Rotation.	61
6.4	Head Pitch Affects Eye Torsion.	61
6.5	Migrainous Vertigo.	62
6.6	Benign Paroxysmal Positioning Nystagmus (BPPN)	63
6.7	Galvanic Stimulation of the Vestibular Labyrinth	64
6.8	Vestibulo-Ocular Monitoring of Comatose Patients as Predictor of Outcome After Severe Brain Injury	64
6.9	Vestibulo-Autonomic Regulation of Muscle Structure	65
	References.	67

<http://www.springer.com/978-3-319-59932-8>

Vestibulo-Oculomotor Research in Space

Clarke, A.H.

2017, XIV, 74 p. 52 illus., 34 illus. in color., Softcover

ISBN: 978-3-319-59932-8