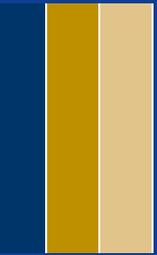


Rajen Gupta

Phacoemulsification Cataract Surgery



 Springer

Phacoemulsification Cataract Surgery

Rajen Gupta

Phacoemulsification Cataract Surgery

With the editorial assistance
of Dr Martin Beed FRCA FFICM DM

 Springer

Rajen Gupta
Newcastle Eye Centre
Royal Victoria Infirmary
Newcastle upon Tyne
United Kingdom

ISBN 978-3-319-59923-6 ISBN 978-3-319-59924-3 (eBook)
DOI 10.1007/978-3-319-59924-3

Library of Congress Control Number: 2017947309

© Springer International Publishing AG 2017

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

Good, Better, Best.
Never will I rest,
until my good Phaco is better and
my better Phaco is deemed my best.
Adapted from T. Duncan

Learning how to safely perform phacoemulsification is one of the key surgical techniques for an ophthalmologist. Training on how to master the art of removing a cataract independently in an efficient, slick manner with a low overall complication rate and produce good visual outcomes takes practice. Initial cataract training can be hindered by a combination of factors including the lack of surgical opportunities, a change in required technique, setback induced by perceived poor technique or surgical complications. Training may be stressful not only for the trainee but also for the trainer, theatre staff and the patient during the novice training stage.

This book is not intended to describe cataract assessment, biometry evaluation or machine settings, nor the complications that may occur during surgery. It does not attempt and is not meant to be a complete guide on managing the plethora of different types of cataract encountered surgically or the different techniques used for such cases. Instead, this book is primarily aimed at the novice surgeon and as a companion teaching guide for the supervising ophthalmologist.

A Manual for Cataract Phacoemulsification Surgery Training was adapted from a series of handouts developed over many years of supervising the novice surgeon new to surgery and surgeons struggling to make progress. Common technique issues were identified and each chapter written to fill the void in cataract surgery understanding. Although comprehensive, the overall emphasis is to explain cataract surgery steps in a simple fashion, with clear terminology rather than an encyclopaedic attempt to cover every technique.

The specific technique during a procedure will remain the responsibility of the trainer; however the chapters serve as examples of how a trainer's own particular technique could be broken down into bite-sized surgical learning points.

The framework and order of chapters will serve as a curriculum guide for training for the complete novice. For the surgeon who has some experience, but still

lacks confidence in certain parts of the procedure, the chapters will serve to explain the fundamentals to aid understanding. As skills are developed, the techniques suggested can be adapted and refined. Most of all however, I hope the book will serve as a useful ad memoir to teaching and learning phacoemulsification surgery in an enjoyable fashion.

Newcastle upon Tyne, UK
2017

Rajen Gupta

Acknowledgements

I am grateful to all of my trainers during my career who have helped me develop my skills. Many of the phacoemulsification techniques I use and teach today were passed verbally to me and I fully acknowledge that the original source of the technique may not be referred to.

I am indebted to all my consultant colleagues at the Newcastle Eye Centre (NEC) for their helpful comments and to the theatre staff at the NEC for helping acquire the side profile corneal images and draping preparation images in Chaps. 14 and 15. The images in Chap. 7 were all taken with the assistance of Sally Gupta.

My friend Martin Beed deserves a huge acknowledgement. Without his initial encouragement and proofreading of all the chapters, this book undoubtedly would have remained a series of handouts.

Finally, I need to say thank you to my wife Sally and my children Tara and Roshan. I have only been able to compile all the images and chapters with your support.

Abbreviations

AC	Anterior chamber
BSS	Balanced salt solution
CCC	Continuous curvilinear capsulorhexis
IA	Irrigation aspiration
IOL	Intraocular lens implant
LH	Leading haptic
Phaco	Phacoemulsification
Rhexis	Capsulorhexis
SLM	Soft lens material
TH	Trailing haptic

Contents

1	Understanding the Phacoemulsification Surgical Learning Process	1
1.1	Theatre Training Time	3
1.2	Training Progress	3
1.3	Understanding Modular Training	5
1.4	Modular Training	7
	References	12
2	Irrigation/Aspiration	13
2.1	Irrigation/Aspiration Fundamentals	14
2.2	Terminology	14
2.2.1	Orientation	14
2.2.2	The ‘Safe Zone’	14
2.2.3	Soft Lens Material	14
2.2.4	The Soft Lens Material Capsule Interface	16
2.3	Aspiration Control	16
2.3.1	Terms That Are Useful for Aspiration of SLM Include	17
2.4	The Irrigation/Aspiration Instrument	18
2.5	Irrigation/Aspiration Movement Terminology	19
2.5.1	“Wind-on-a-Stick”	19
2.5.2	Lateral Movement	20
2.5.3	Combination of Lateral and “Wind-on-a-Stick” Movement	20
2.6	Removal of Viscoelastic	21
2.7	Irrigation/Aspiration Movement Training	22
2.8	Aspirating Under the Lens (Port-Up, with Tip Under Edge of Lens Implant)	26
2.9	Removing Tiny Air Bubbles at the End of Surgery	28
2.10	Stromal Hydration at the End of Surgery	28
2.11	Intra Cameral Antibiotic at the End of Surgery	29
2.12	Summary	31
3	Intraocular Lens Insertion	33
3.1	Terminology	33
3.1.1	Phakia	33

3.1.2	Pseudophakia	33
3.1.3	Haptic Terminology	34
3.2	Lens Implant Orientation	35
3.3	Step-by-Step Technique	35
3.3.1	Step 1	36
3.3.2	Step 2	37
3.3.3	Step 3	38
3.3.4	Step 4	38
3.3.5	Step 5	39
3.4	Dialling the Lens Into the Capsule Bag	39
3.5	Summary	44
4	Soft Lens Material Removal.	45
4.1	Irrigation/Aspiration Fundamentals	45
4.1.1	Aspiration of Soft Lens Material	45
4.2	Aspiration Zone Terminology	46
4.3	Step by Step SLM Zone Instruction.	47
4.3.1	Zone 1	47
4.3.2	Zone 2	50
4.3.3	Zone 3	53
4.3.4	Sub-Incisional Zones 4 and 5.	54
4.3.5	Correct Irrigation/Aspiration Probe Tip Position.	54
4.3.6	Aspiration “Fishing”	55
4.3.7	Sub-Incisional Zone 4 and 5 Soft Lens Material Peeling	56
4.4	Removal of Lens Epithelial Remnants.	58
4.5	Summary	61
5	Manual Capsulorhexis	63
5.1	Fundamentals of Capsulorhexis	64
5.1.1	Anatomical Orientation	64
5.1.2	Viscoelastic Fill	64
5.1.3	Creation of Capsule Flap	65
5.1.4	Capsule Stab.	67
5.1.5	Capsule Flap Creation	69
5.2	Creation of Continuous Curvilinear Capsulorhexis.	73
5.2.1	Capsulorhexis Flap Terminology	73
5.2.2	Shearing or Ripping.	73
5.2.3	Where to Grasp the Flap	75
5.2.4	Rhexis Propagation	76
5.2.5	6 o’Clock Cardinal Point	77
5.2.6	3 o’Clock Cardinal Point	77
5.2.7	12 o’Clock Sub-Incisional Cardinal Point.	78
5.2.8	Completion of the Rhexis Past 9 o’Clock Cardinal Point	80

5.3	Additional Surgical Advice for Capsulorhexis	81
5.3.1	Ensuring a Circular Rhexis	81
5.3.2	Repositioning the Flap to Ensuring the Redundant Capsule is Moved Out of the Way	82
5.3.3	Maintaining a Flat Rhexis Flap	82
5.3.4	Capsule Crease: A Clinical Sign Worth Knowing	83
5.4	Summary	85
	References.	85
6	Hydrodissection.	87
6.1	Fundamental Principles and Clinical Signs	88
6.1.1	Create Space: The Viscoelastic Burp.	88
6.1.2	Adequate Posterior Wave Propagation: Lens Prolapse.	89
6.1.3	Adequate Posterior Wave Propagation: Lens Depression.	89
6.1.4	Where Should Fluid be Injected for Maximum Effect?.	90
6.1.5	How to Inject	91
6.2	Summary	95
	References.	95
7	How to Palm an Instrument.	97
7.1	Palming an Instrument Step-By-Step Instruction	97
7.1.1	Step 1	98
7.1.2	Step 2	99
7.1.3	Step 3	99
7.2	Palming Reversal	100
7.2.1	Reverse Step 1	100
7.2.2	Reverse Step 2	100
7.2.3	Reverse Step 3	101
7.3	Summary	102
8	Phacoemulsification: Small Fragments.	103
8.1	Terminology.	104
8.1.1	The Phaco Probe	104
8.1.2	Lens Fragment Anatomy	106
8.1.3	Lens Fragment Capture	106
8.1.4	The Safe Zone	106
8.2	Foot Pedal Control.	107
8.3	Insertion of the Phaco Probe	108
8.3.1	Step 1	108
8.3.2	Step 2	109
8.3.3	Step 3	109
8.3.4	Step 4	110
8.3.5	Step 5	110
8.3.6	Step 6	110

8.4	Second Instrument Insertion into the Eye	111
8.5	Fundamental Concepts for Phacoemulsification of Fragments	112
8.5.1	Fragment Engagement	112
8.5.2	Fragment Wobble	113
8.6	Phacoemulsification Control	115
8.7	Important Movements for Fragment Removal	115
8.7.1	Phaco Tip Movement	115
8.8	Within-the-Bag Fragment Rotation	116
8.9	Summary	120
	Reference	120
9	Debulking of Lens Fragments	121
9.1	Skills to Be Gained	121
9.2	Debulking of Lens Fragment: Step by Step Instruction	122
9.2.1	Step 1	122
9.2.2	Step 2	122
9.2.3	Step 3	122
9.2.4	Step 4	122
9.2.5	Steps 5 and 6	124
9.2.6	Step 7	125
9.2.7	Step 8	125
9.3	Summary	127
10	Make-a-Space Technique	129
10.1	Fundamentals: The Lens Fragment	129
10.2	Make-a-Space Principles	129
10.2.1	Initial Fragment Choice	129
10.2.2	Fragment Extraction from the Capsule Bag: Unlocking Fragments	130
10.2.3	Fragment Extraction from the Capsule Bag: Unlocking Fragments and Moving the Target-Fragment into a Created Lateral Space Before Pulling into a Central Location	131
10.2.4	Fragment Extraction from the Capsule Bag: Freeing a Fragment Shoulder	132
10.2.5	Improving the Available Space for Target: Fragment Phacoemulsification	132
10.3	The Next Fragment	133
10.3.1	Potential Position 1	134
10.3.2	Potential Position 2	134
10.3.3	Potential Position 3	135

10.3.4	Potential Position 4	135
10.4	The Final Two Fragments	136
10.5	Summary	137
11	Phacoemulsification: Grooving and Cracking	139
11.1	Fundamentals	141
11.1.1	Phaco Probe	141
11.1.2	Insertion of Phaco Into the Anterior Chamber	143
11.1.3	Palming of Forceps	147
11.1.4	Pseudo-Groove	147
11.2	The Phacoemulsification Triad	147
11.3	The <i>Grooving</i> Mantra	148
11.3.1	Phaco on. <i>Groove</i> . Phaco off and Return Silently	148
11.4	The Phaco Starting Position	149
11.4.1	Grooving	150
11.4.2	<i>Groove</i> Depth	150
11.4.3	Deepening the Initial Trench	152
11.4.4	Subsequent Grooving	154
11.4.5	Cracking	156
11.5	Major Rotation	160
11.5.1	Major Rotation Post Cracking	160
11.5.2	Major Rotation Without Previous Cracking	160
11.6	Summary	163
	Reference	163
12	Phacoemulsification: An Easy Stop, Chop and Crack Technique	165
12.1	Fundamentals	166
12.2	Step-by-Step Approach	167
12.3	Step-by-Step Training	167
12.3.1	Pre-Cracking Training	167
12.3.2	Initial Chop Attempt After the Initial Trench is Formed	167
12.3.3	Divide Each Heminucleus into Two Quadrants Using Chop Technique	169
12.3.4	Divide Each Heminucleus into Three Pieces Using Chop Technique	169
12.4	Common Difficulties	170
12.4.1	Difficulty 1: Fear of Burying Phaco Tip into Nucleus	170
12.4.2	Difficulty 2: Incomplete Nucleus Cleavage is Observed	170
12.4.3	Difficulty 3: The Fragment Does Not Remain Steady Whilst Trying to Insert the Chopper	170

12.4.4 Difficulty 4: Lens Nucleus Separation does Not Create a Clean Split but Leaves a Residual Tongue of Lens Material Jutting Out from One of the Fragments 171

12.5 Summary 173

References..... 173

13 The Paracentesis Incision 175

13.1 The Paracentesis..... 175

13.2 Instrumentation 176

13.3 Stabilisation of the Eye 177

13.4 Step-by-Step Paracentesis Creation..... 178

13.5 Summary 181

14 The Main Corneal Incision 183

14.1 Fundamentals 183

14.1.1 Corneal Orientation 183

14.1.2 The Keratome..... 184

14.2 Keratome Movements 184

14.2.1 Tip Up/Heel Down Verses Tip Down/Heel Up 184

14.2.2 Keratome ‘Snake-Like’ Movement 186

14.3 Obtaining an Adequate View 187

14.4 The Clear Cornea Incision..... 189

14.5 The Clear Corneal Main Incision..... 191

14.5.1 First Step 191

14.5.2 Second Step-Part A 193

14.5.3 Second Step-Part B 194

14.5.4 Third Step..... 195

14.5.5 Widening the Main Incision..... 196

14.5.6 Removing the Keratome 197

14.6 Summary 199

15 Essential Preparation: Draping, Safety and Surgeon Comfort 201

15.1 Skin Preparation..... 201

15.2 Draping 204

15.3 Draping: Application Using Additional Implements to Retract the Lids 207

15.4 The Oily Tear Film..... 208

15.5 Safety and Surgeon Comfort 208

15.6 Summary 210

References..... 210

Glossary 211

Index..... 217

Understanding the Phacoemulsification Surgical Learning Process

1

Cataract phacoemulsification training poses a unique challenge of learning a delicate, complex task in which only one person can operate at any given time. The majority of patient's remain awake during surgery and training usually has to proceed in a setting of service provision [1].

Not only is an understanding of how the process of phacoemulsification surgery will be taught is important for the novice surgeon, it is equally important for the experienced surgeon embarking on a phacoemulsification teaching role to determine how to teach the novice surgeon. Given the plethora of techniques possible for every stage of the cataract procedure, the Trainer may no longer perform surgical steps in a basic fashion. Instead advanced skills, developed over years of practice will be applied to complete their own cases. Though important to ensure acquisition of a broad repertoire of skills by the end of training, the novice surgeon needs to be taught basic, fundamental phacoemulsification skills initially. The novice surgeon may fail to perform advanced intraocular movements if their confidence or skill level has not developed sufficiently, consequently it may not be appropriate to mimic such techniques. Surgical steps should not be 'challenging' but rather remain well within the Trainee's competency and comfort level. The book aims to provide a framework for phacoemulsification training: concepts are introduced over the course of the book and a training program for the Trainer to follow. Important concepts will be repeated in successive chapters to reiterate the concept for the Trainee.

The Trainer and novice surgeon need to be aware of preconceived assumptions that may influence training progress (Tables 1.1 and 1.2. Such assumptions are easily overlooked and both Trainer and Trainee need to agree on a surgical development plan before training commences.

The Trainer and novice surgeon should clarify terminology that will be used during training, as misunderstanding instructions can lead to operating being stressful. This can be avoided by developing a common language for instruction. Suggested terminology will be covered in each chapter.