Diagnosis and Treatment of Oblique Muscle Disorders



K. P. Boergen

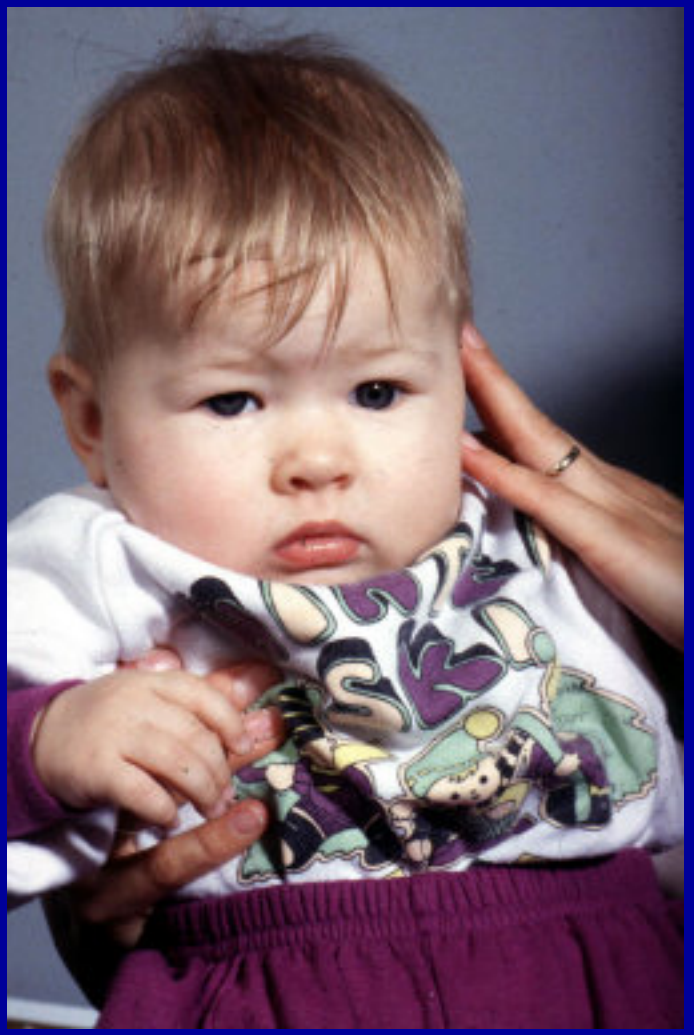
IAȘI, 2020

Congenital oblique muscle disorders

- Strab. sursoadductorius
- Strab. deorsoadductorius
- Brown´s Syndrome
- Combined dysfunctions of oblique muscles

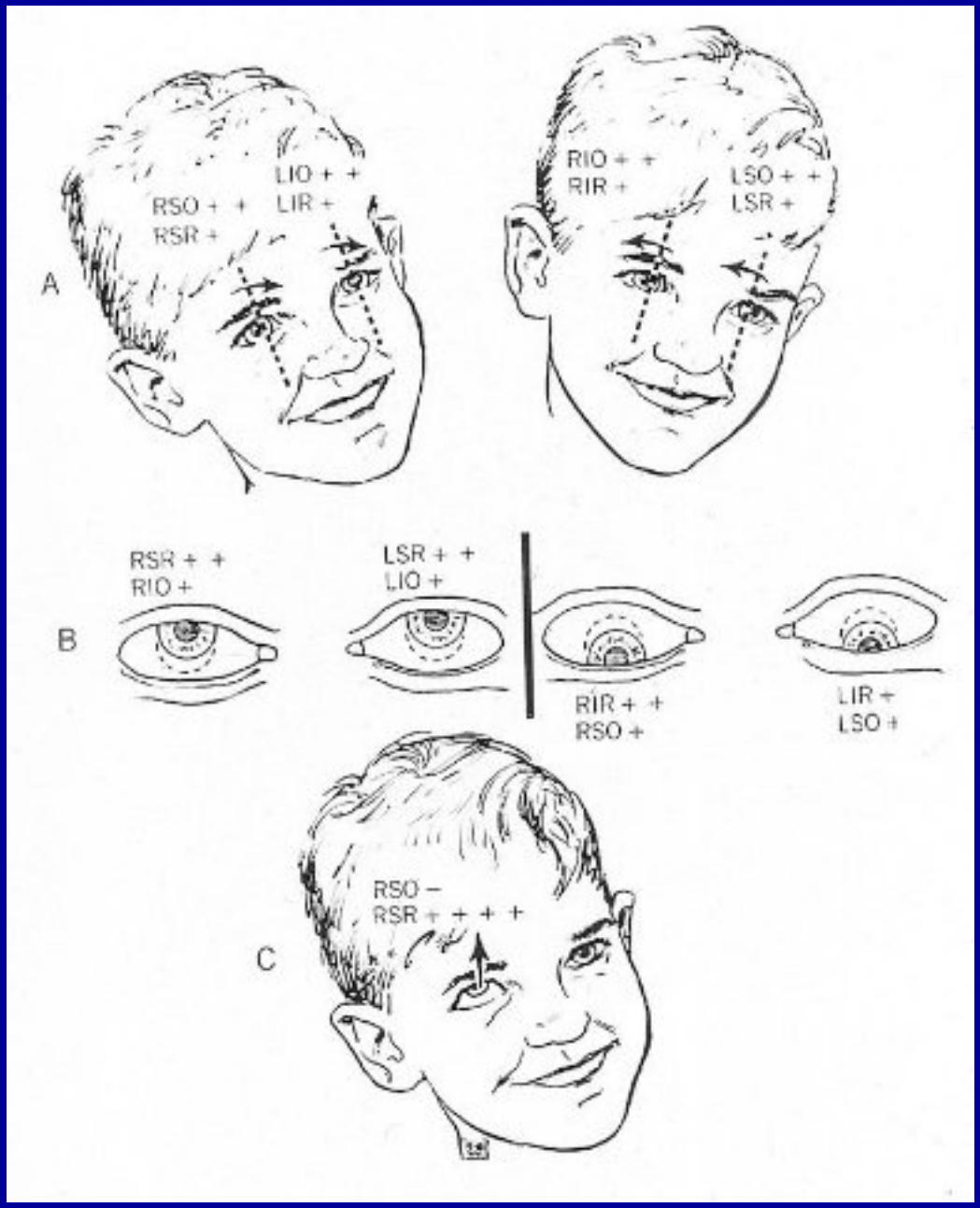
Strabismus sursoadductorius: clinical characteristics

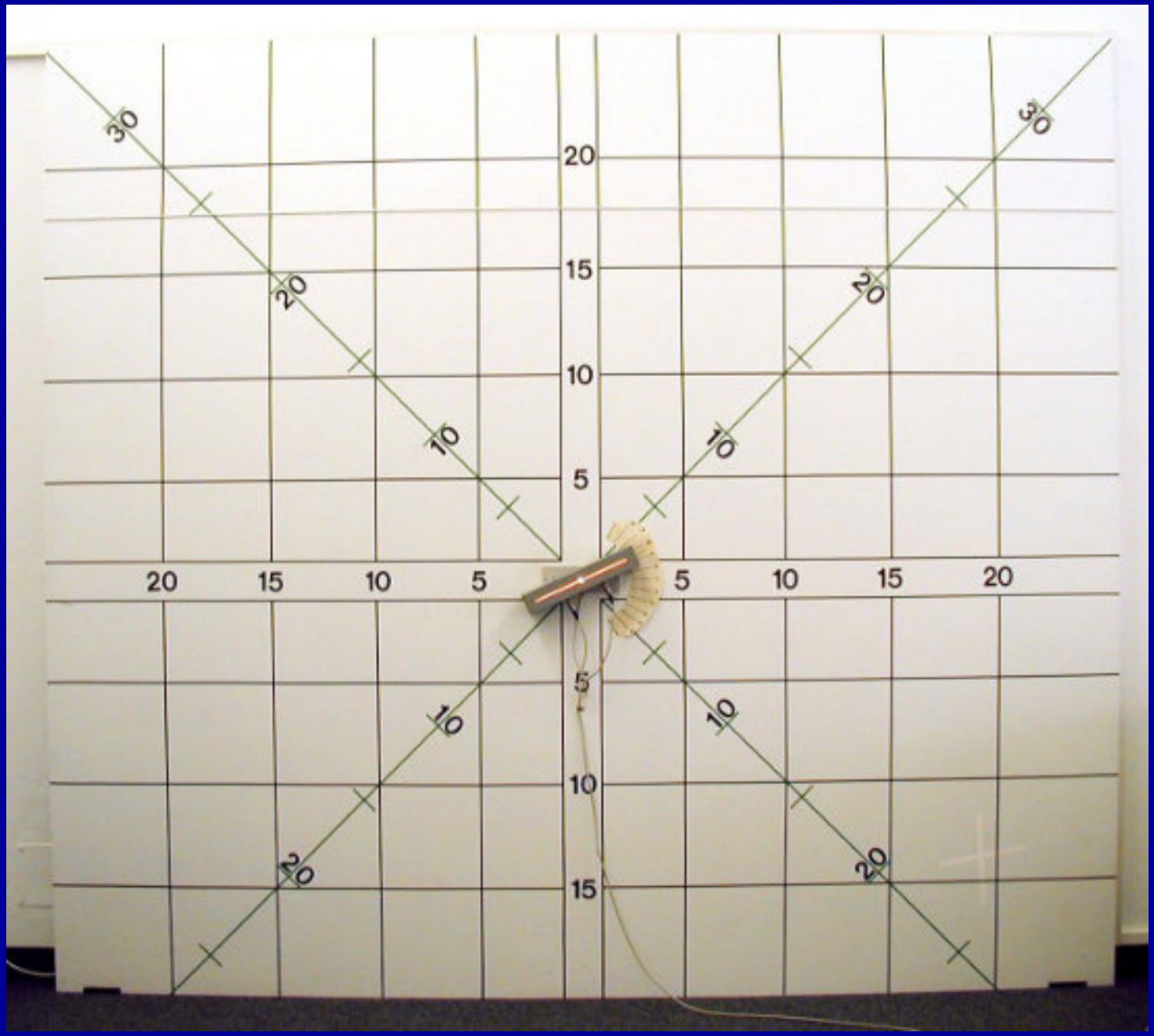
- abnormal head position (photo !)
- intermittent onset
- comitant VD in adduction
- V-symptom
- comitant excyclotropia/-phoria
- BHTT positive in pp, up- and down-gaze
- vertical fusional amplitudes



Strabismus sursoadductorius: Diagnosis

- history
- head position
- vertical, horizontal and cyclo-rotational deviation in different gaze directions (tangent screen)
- BHTT in different gaze directions
- fusional amplitudes
- field of binocular single vision (BSV) using a light bar


A
LIO + +
LIR +
RSO + +
RSR +
RIO + +
RIR +
LSO + +
LSR +
B
RSR + +
RIO +
LSR + +
LIO +
RIR + +
RSO +
LIR +
LSO +
C
RSO −
RSR + + + +


30
20
10
20
15
10
5
20
15
10
5
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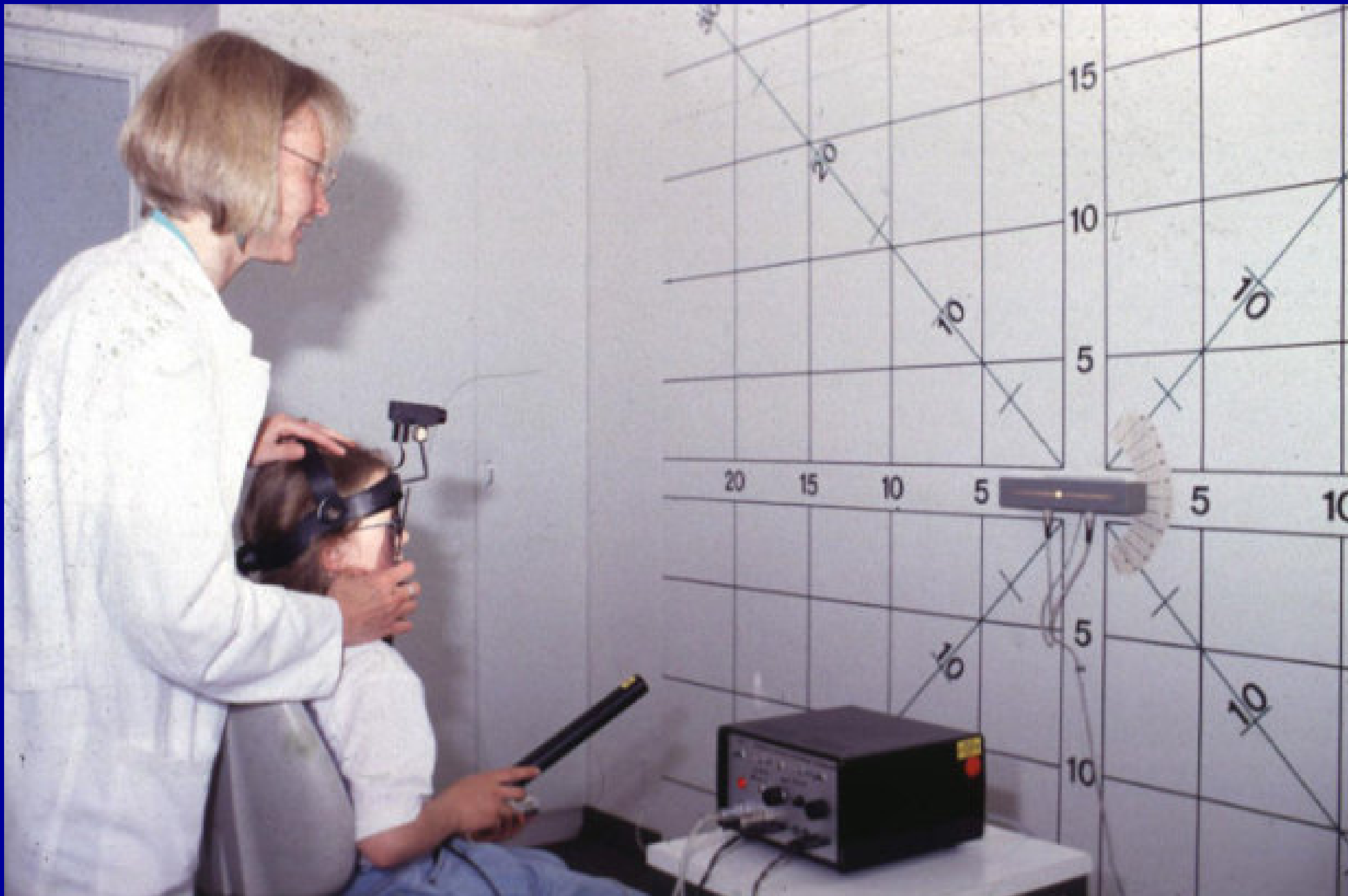
10
15
20


15
20
10
10
10
5
20 15 10 5
5
10
5
10
10
10

Unilateral strab. sursoadductorius (right eye):

Pat.: H.R. born: 21.1.46

HD	VD
CD	

Exam: 16.10.91

RE fix.

-5	+20	-4	+15	-2	+12
1 Ex		4 Ex		7 Ex	
-2	+18	-3	+17	-1	+11
1 Ex		3 Ex		6 Ex	
-1	+18	-1	+12	-0	+8
0		3 Ex		5 Ex	

left gaze

LE fix.

-6	+15	-3	+10	-2	+7
2 Ex		2 Ex		2 Ex	
-4	+16	-2	+11	-1	+9
2 Ex		3 Ex		7 Ex	
0	+15	0	+10	-1	+7
2 Ex		3 Ex		3 Ex	

right gaze

BHTT:

left		right	
-1	+9	+3	
+22		6 Ex	
7 Ex			

left		right	
-1	+6	+2	
+18		2 Ex	
2 Ex			

Strabismus sursoadductorius: differential diagnosis

- trochlear palsy
- DVD
- superior rectus underfunction

DD: Strab. sursoadd. - trochlear palsy

	strab. sursoadd.	trochlear palsy
- history (photo)	head tilt ⊕	negative
- onset	intermittend	sudden
- vertical deviation	comitant in adduction	maximum in downgaze
- cyclotropia	small, comitant	maximum in downgaze
- sursoadduction	marked	negative
- vertical fusion	"pathologic"	normal
- BHT	not gaze dependent	maximum in downgaze

Strabismus sursoadductorius: therapy

surgery on the oblique muscle

- change of tension

  weakening of i.o. (recession)

  strengthening of s.o. (tuck)

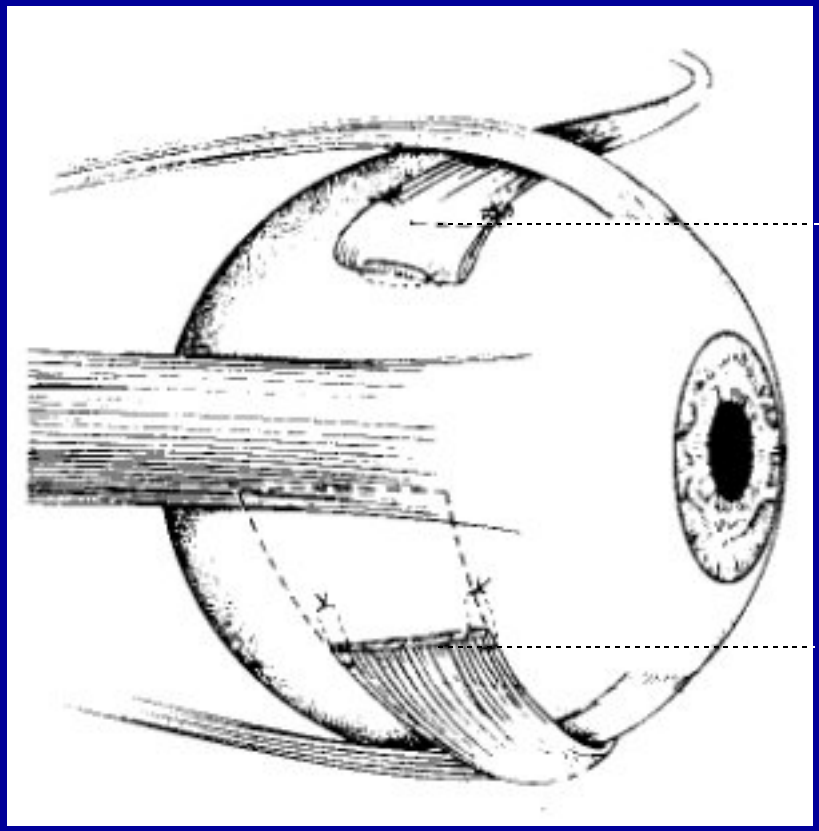
- change of eye position

  combined operation
  (i.o. and s.o.)

surgery on rectus muscles

- weakening of i.r. of the non-involved eye

Combined Oblique Muscle Surgery



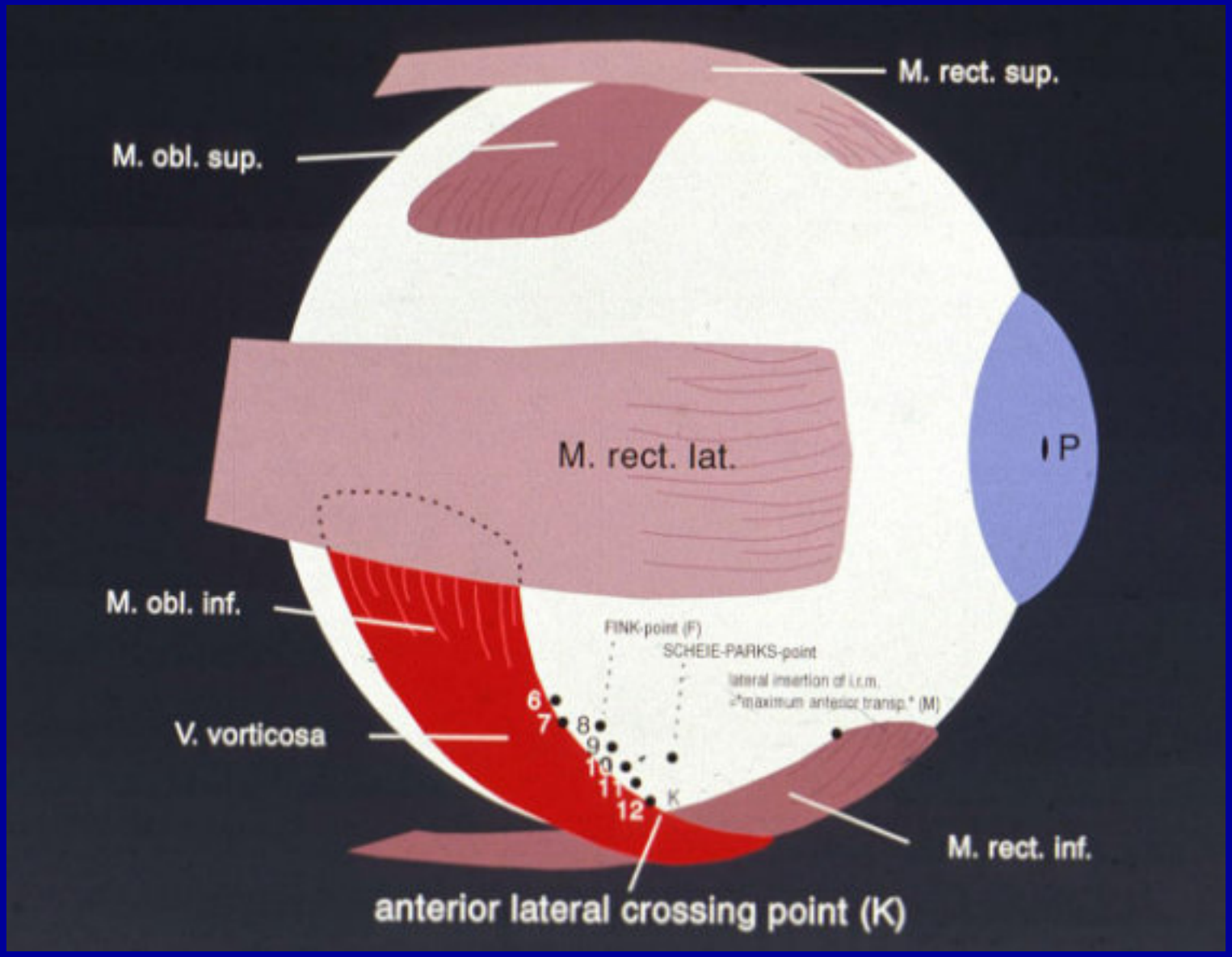
Obl. sup. Faltung

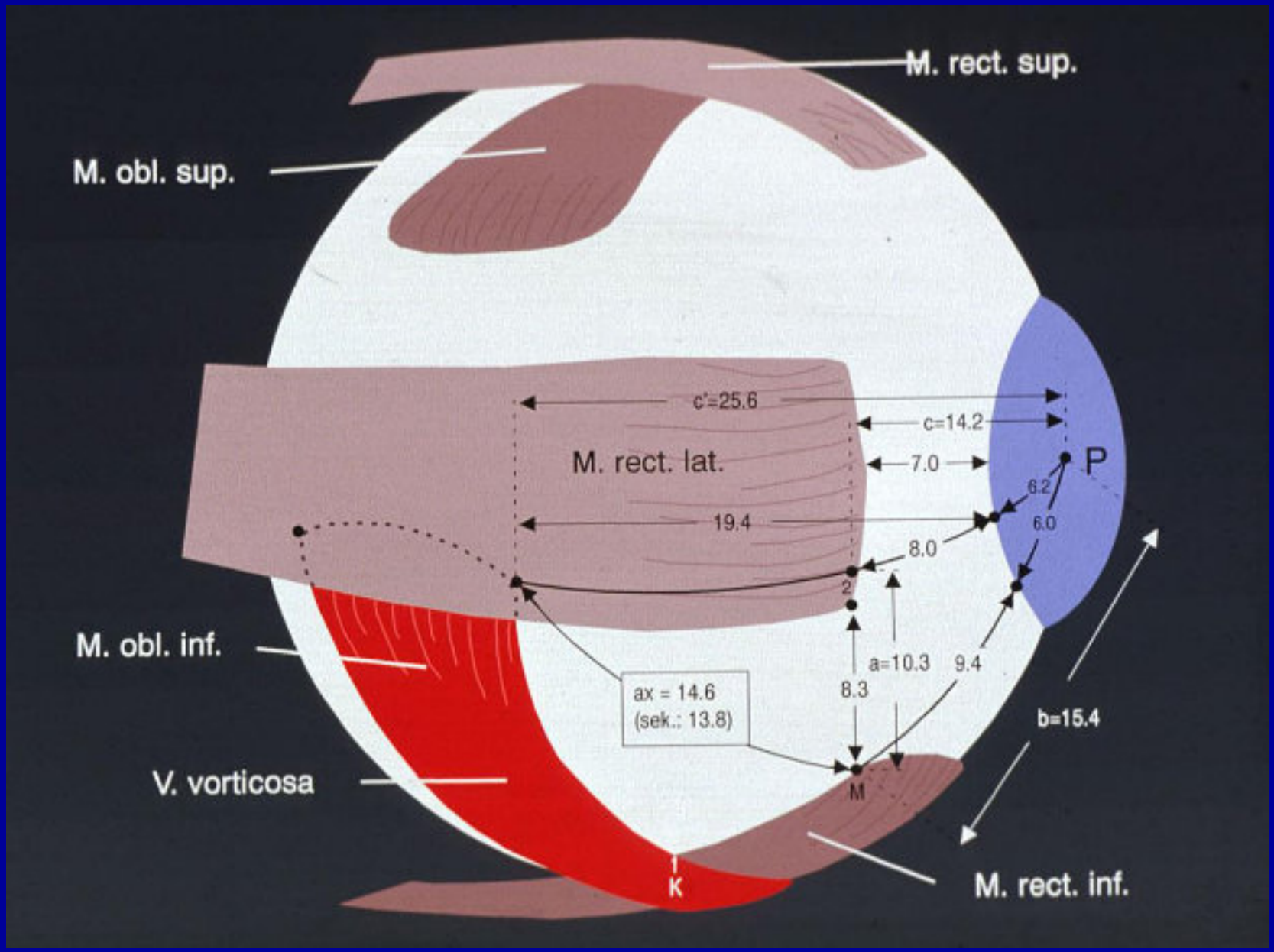
Obl. inf. Rücklagerung

aus Kaufmann (1983)

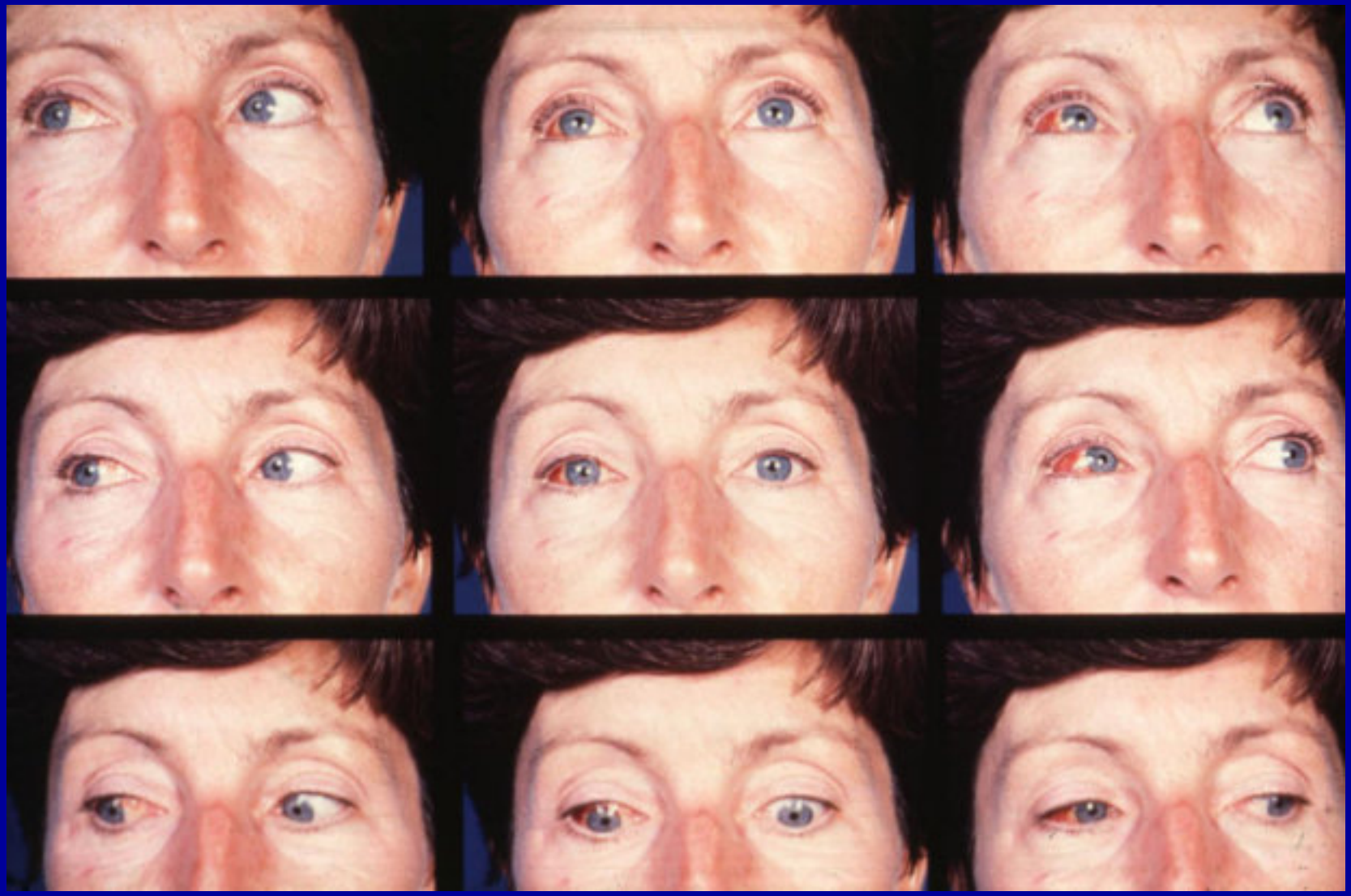
Strabismus sursoadductorius: own surgical approach

- graded recession of the i.o.
  (8, 10 mm and maximum)
- superior oblique tuck
- (recession of the i.r.)


M. rect. sup.
M. obl. sup.
M. rect. lat.
IP
M. obl. inf.
FINK-point (F)
SCHEIE-PARKS-point
lateral insertion of i.r.m.
=maximum anterior transp.* (M)
V. vorticosa
6
7
8
9
10
11
12
K
M. rect. inf.
anterior lateral crossing point (K)


M. rect. sup.
M. obl. sup.
M. rect. lat.
c'=25.6
c=14.2
7.0
P
6.2
6.0
19.4
8.0
2
M. obl. inf.
a=10.3
9.4
8.3
ax = 14.6
(sek.: 13.8)
b=15.4
V. vorticosa
M
K
M. rect. inf.


cbm



Total number of patients (pre-op. n = 28)
Median (degree)

VD

Add.

14	7	3
15	7,5	2,75
14	5	4

HD

	-1	
	1	
	2	

CT

Abd.

4	5	5
3	4	5
4	3,5	5

BHT:

left tilt — right tilt

1	3	2	14
2		8	

Angle of squint: postop. - preop. (n = 25)
Median (degrees)

Add. VD		
11	6	3,5
9	5	1
6	2	2

HD		
	-1	
	0	
	0	

CT		Abd.
6	6	5,5
4	4	4
3	2	4

BHT:

left tilt			right tilt
0	4	0	3
4,5		3	

Comparison of long term (2 months) and short term (3 days) results
Median (degree) (n = 11)

VD

Add.

+3,5	+0,5	+1,5
-0,2	-1,5	+1
0	+0,2	0

HD

	0	
	+0,5	
	0	

CT

Abd.

+3	+3	+2,5
0	0	+1
0	0	+1

BHT:

left tilt			right tilt
-1	+2	0	0
+2,5		+1	

Conclusions

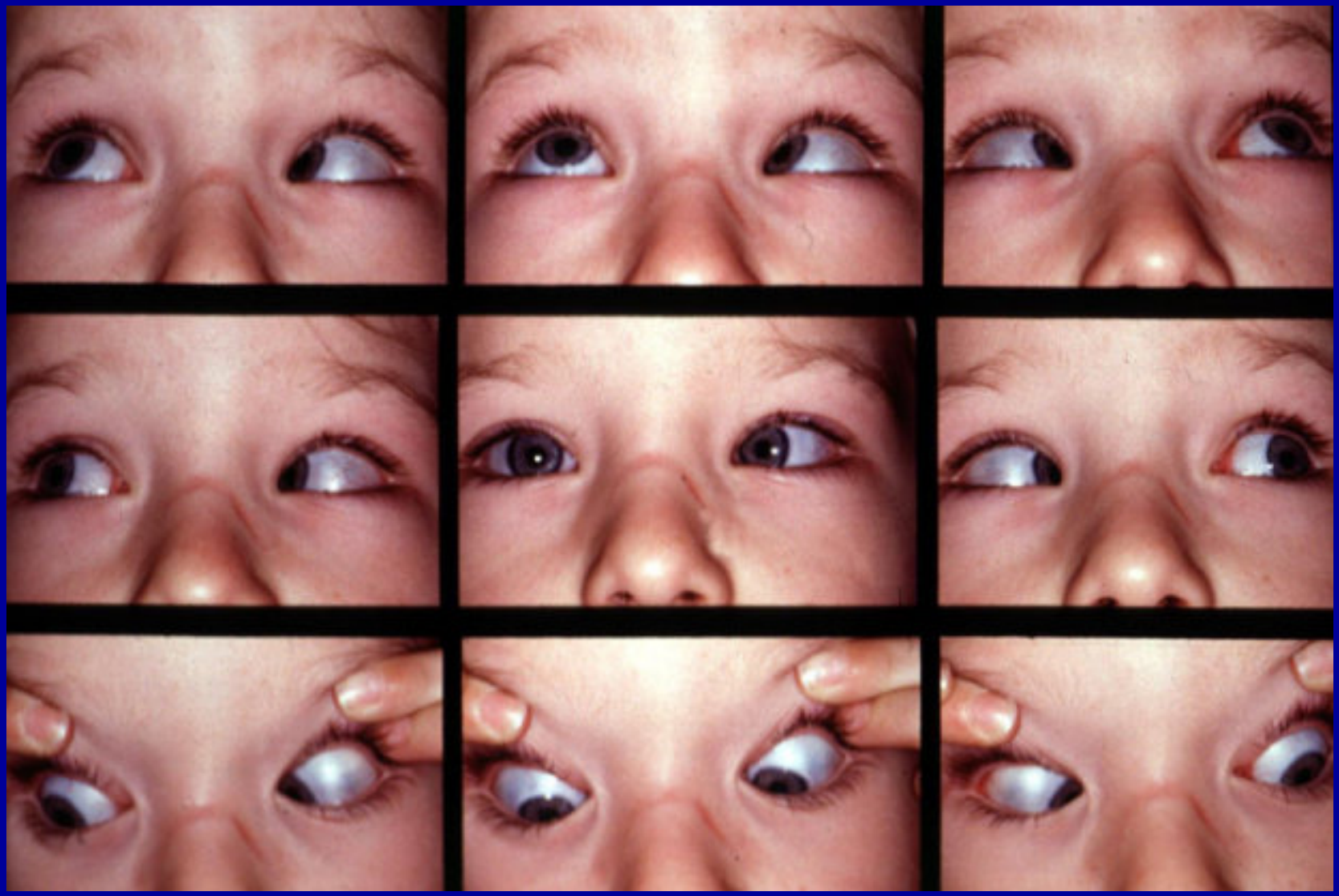
1. Anterior transposition of i.o. is effective
2. No permanent underfunction of i.o.
3. No Brown's syndrome
4. Adaptation of effect

Congenital oblique muscle disorders

- Strab. sursoadductorius
- Strab. deorsoadductorius
- Brown´s Syndrome
- Combined dysfunctions of oblique muscles

Strabismus deorsoadductorius: Clinical characteristics

- abnormal head position (photo !)
- intermittent onset
- underfunction of the i.o.
- overfunction of the s.o.
- A-symptom
- BHTT positive
- incyclotropia



Unilateral strab. deorsoadductorius (right eye):

Pat.: W.S. born: 3.6.64

HD	VD
CD	

Exam: 21.2.91

RE fix.

-6	-2	-11	-4	-11	-7
2 In		3 In		8 In	
-7	-4	-13	-5	-13	-6
2 In		3 In		5 In	
-6	-7	-13	-7	-13	-7
5 In		8 In		8 In	

left gaze

LE fix.

-10	-4	-12	-7	-11	-8
2 In		2 In		4 In	
-6	-6	-15	-8	-11	-7
3 In		7 In		4 In	
-8	-12	-13	-11	-12	-8
6 In		8 In		9 In	

right gaze

BHTT:

left		right	
-11	-11	-10	-2
4 In		3 In	

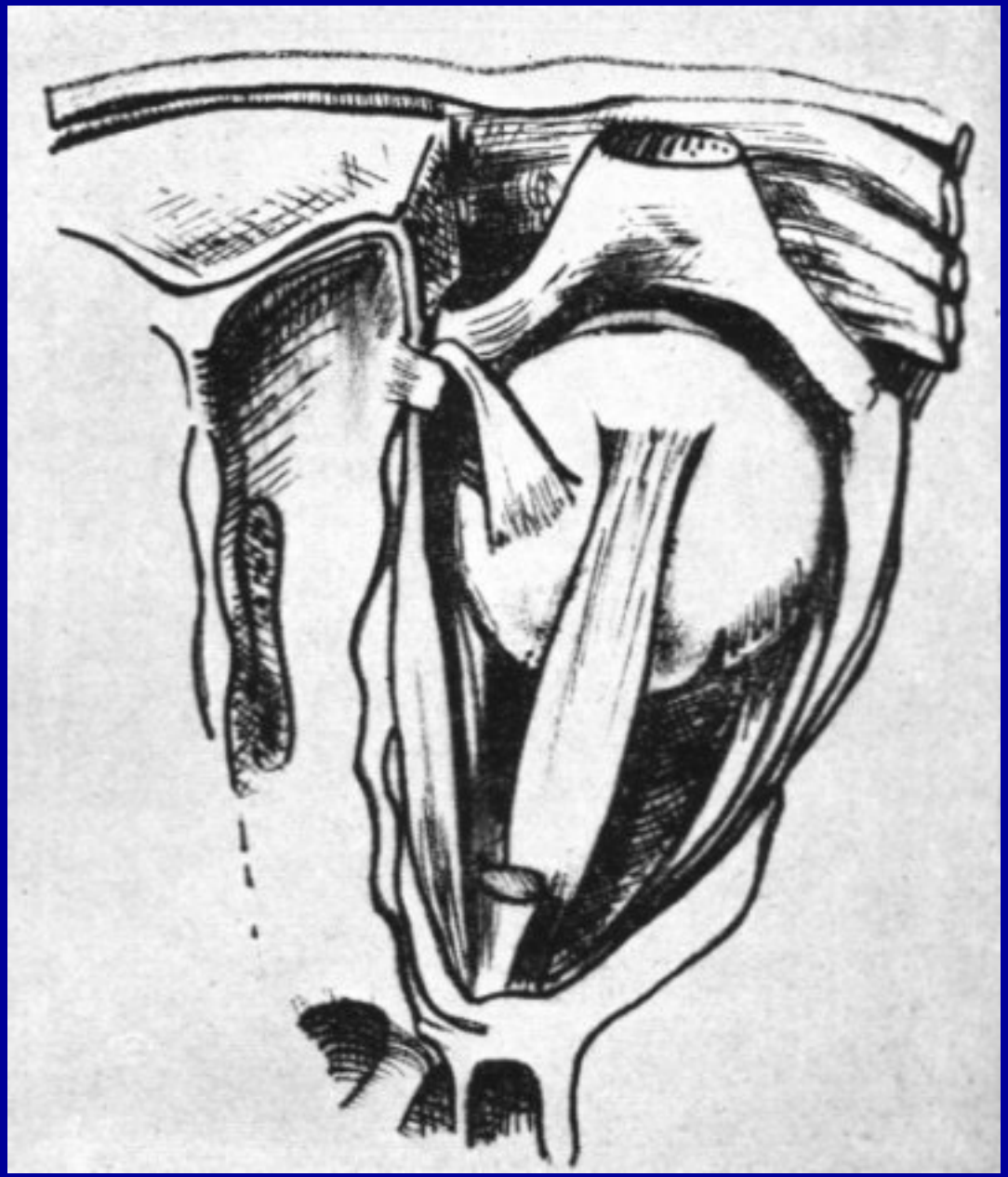
left		right	
-13	-13	-13	-3
7 In		3 In	

Strabismus deorsoadductorius: differential diagnosis

- Brown´s syndrome

Strabismus deorsoadductorius: therapy

- s.o. recession



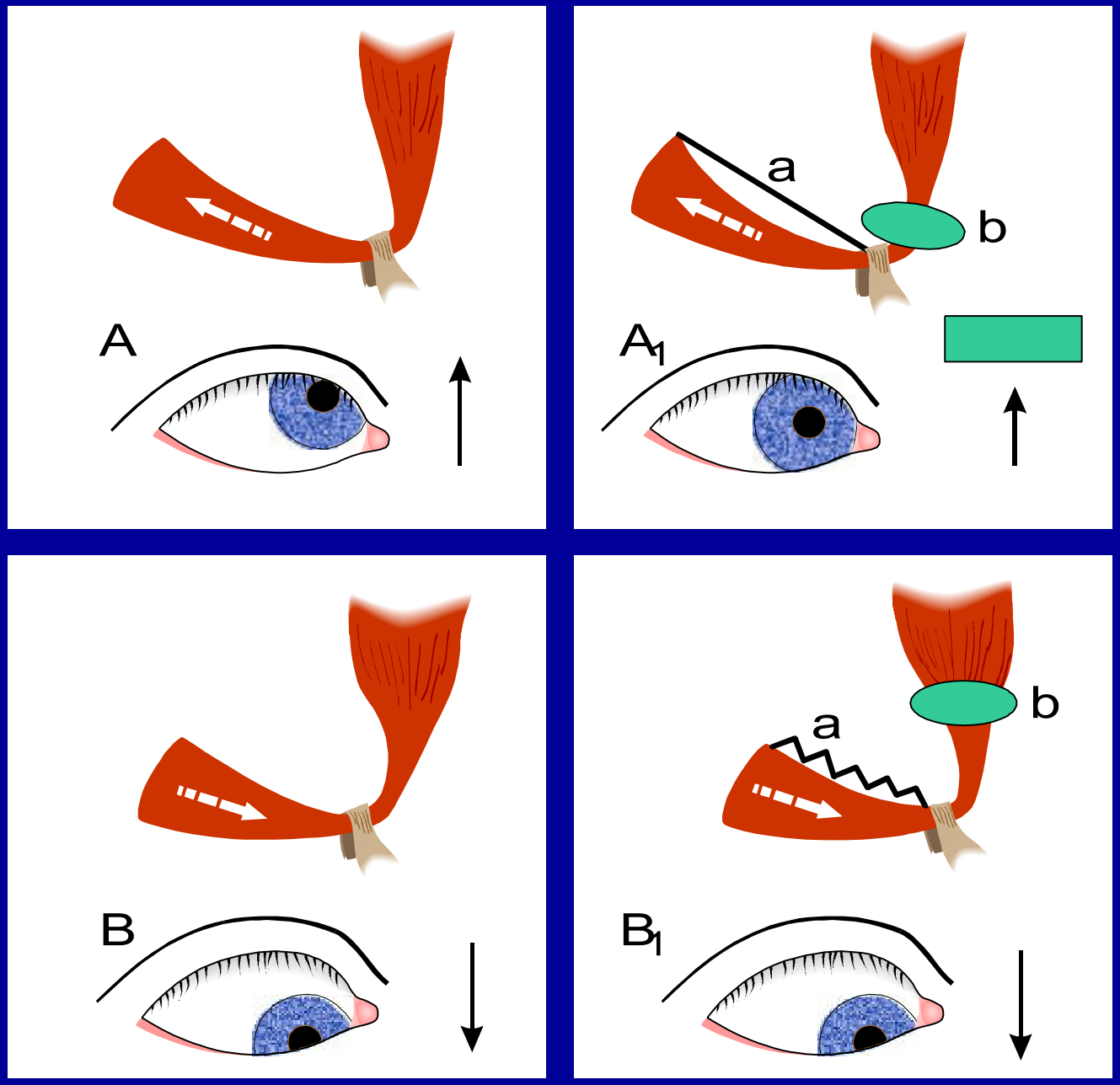

cbm

Congenital oblique muscle disorders

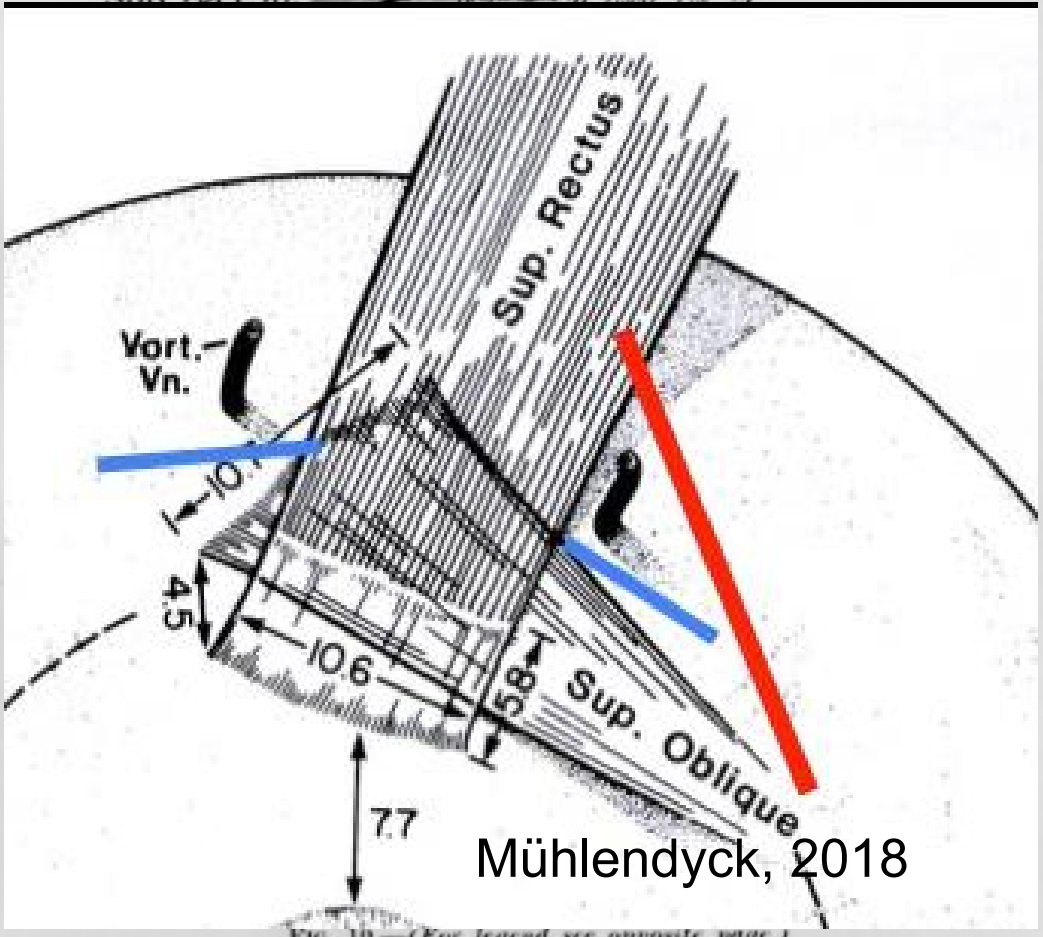
- Strab. sursoadductorius
- Strab. deorsoadductorius
- Brown´s Syndrome
- Combined dysfunctions of oblique muscles

Brown´s syndrome: Clinical characteristics

- restriction of elevation in adduction
- Y-symptom
- excyclotropia in up-gaze
- abnormal head position (chin elevation)


A
a
b
A1
B
B1

Etiology of Brown‘s Syndrome



Mühlendyck, 2018

Fig. 10.—(For legend see opposite page.)

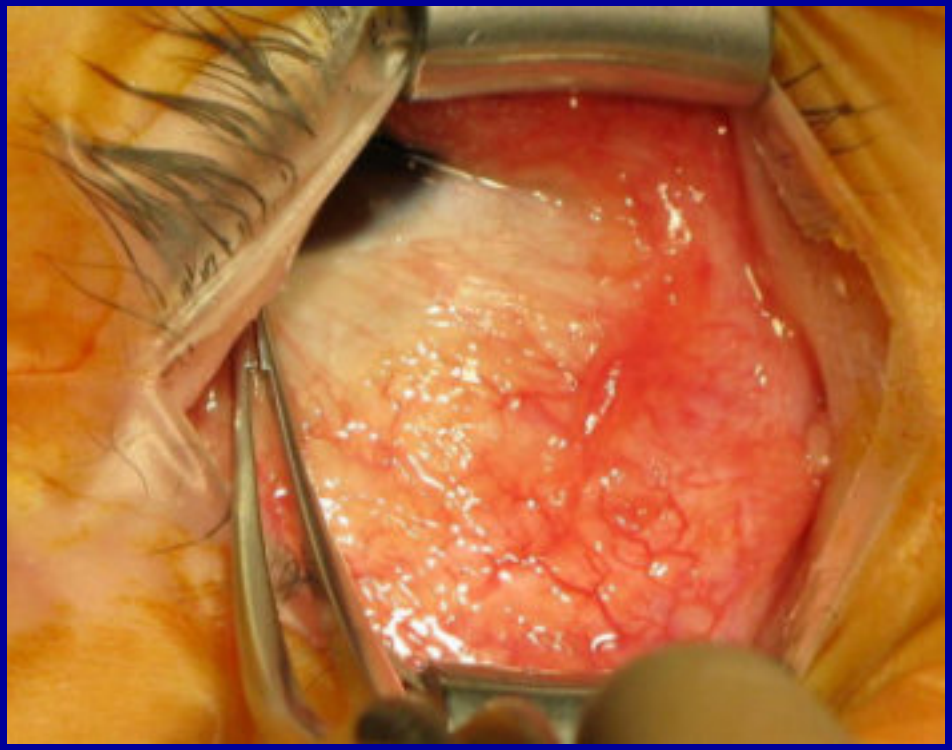
Fink, 1951

Brown´s syndrome: Therapy

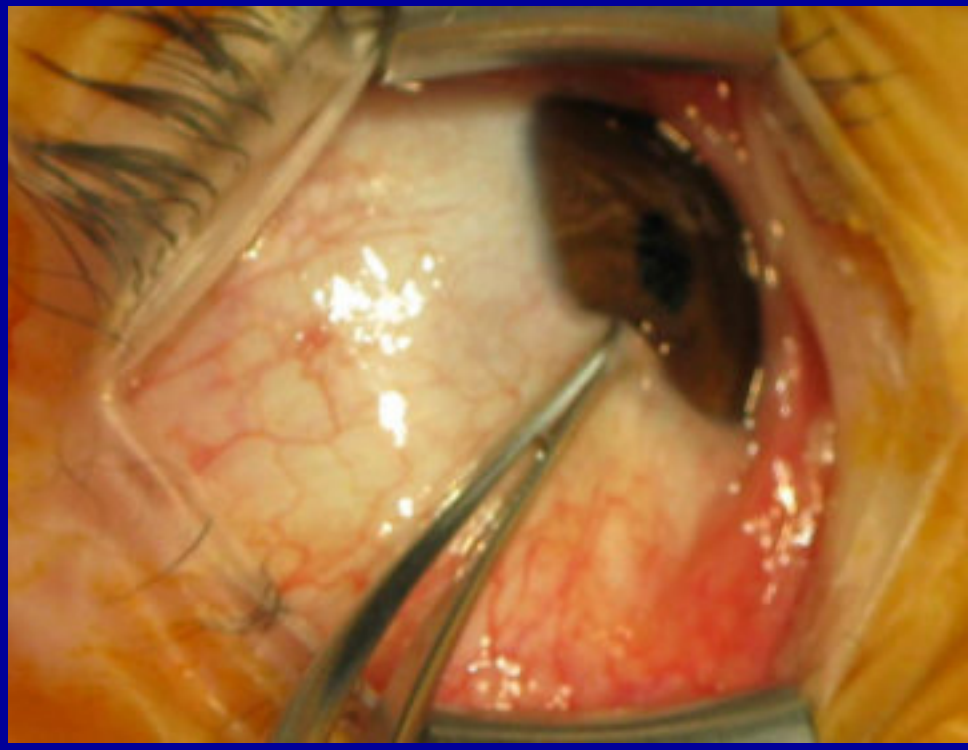
- Posterior strandectomy (Sup. oblique tendon remains untouched!)

  (Mühlendyck 1996)

Forced duction test

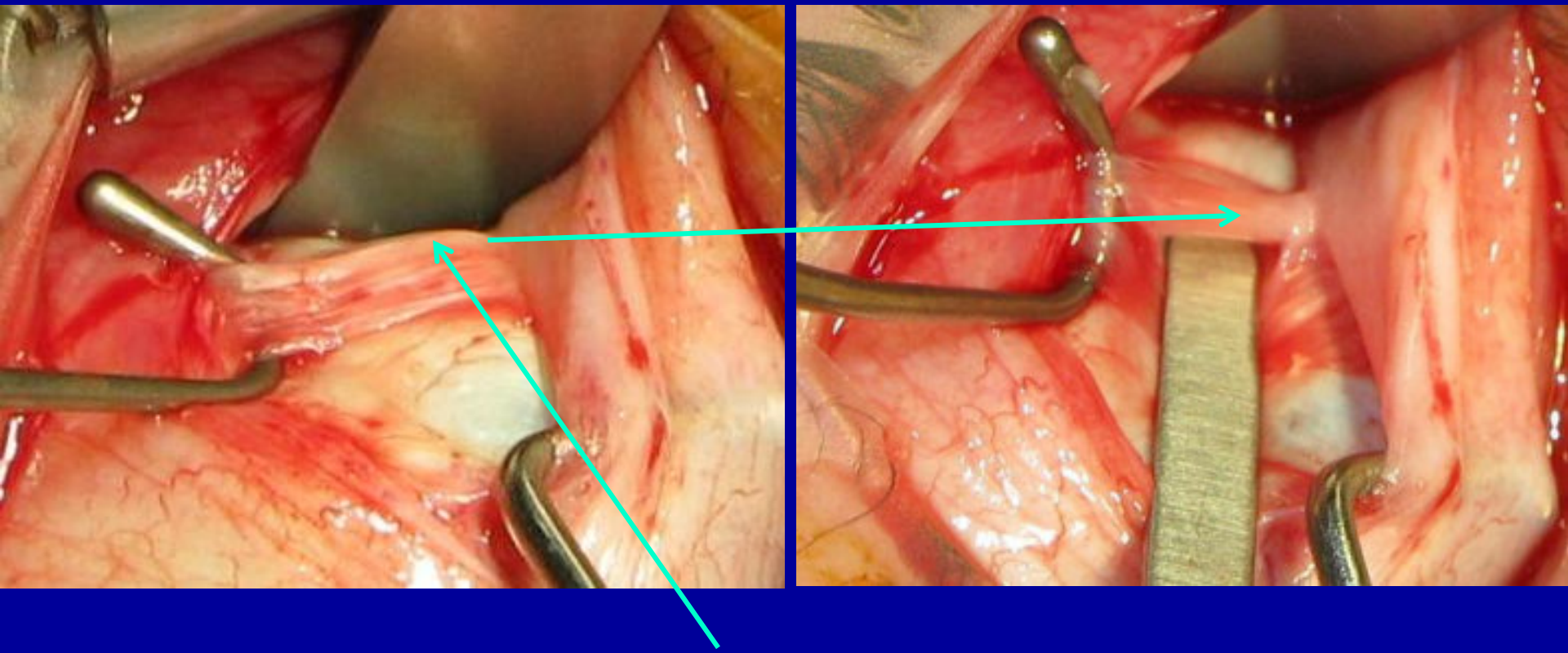


Elevation in abduction



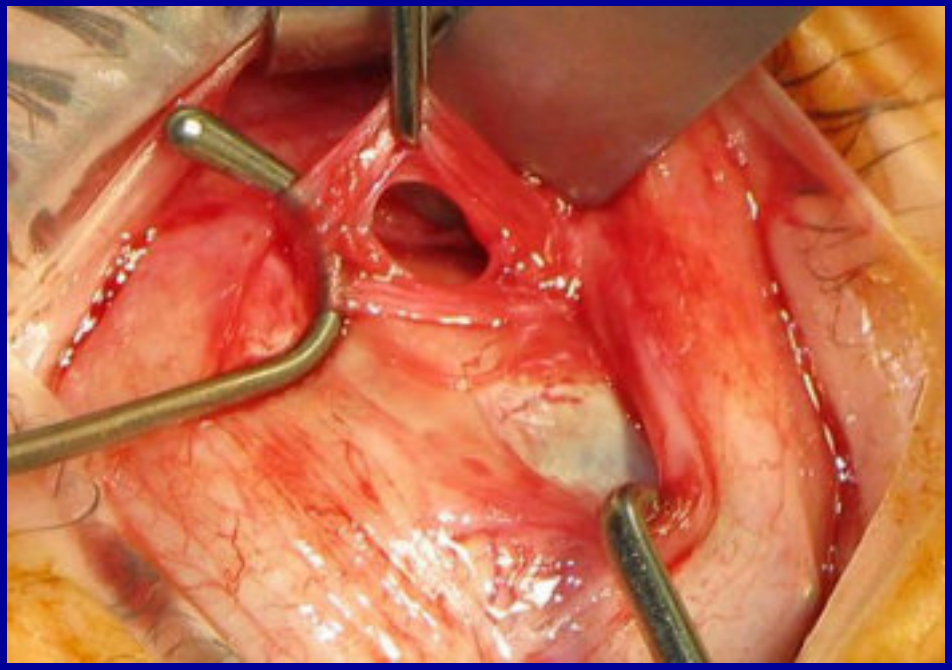
Elevation in adduction

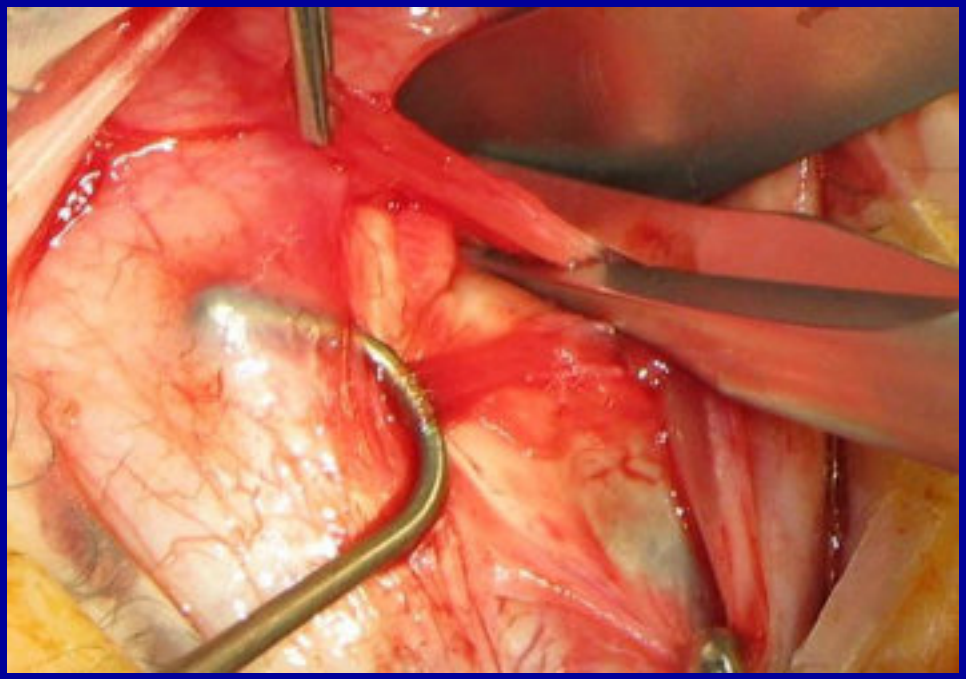
RE: Superior oblique with a far anteriorly positioned insertion and a fibrotic strand at the posterior margin of the tendon



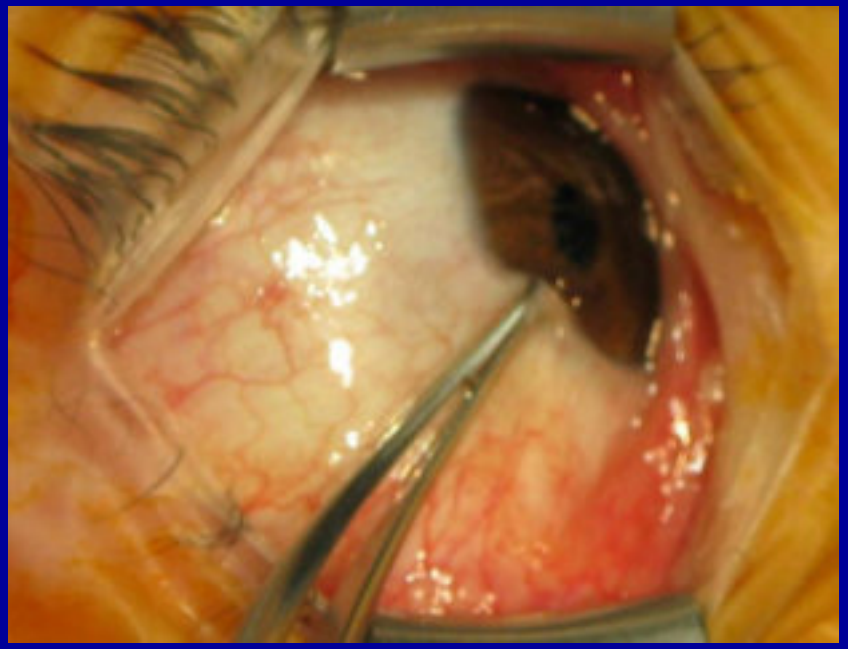
fibrotic strand – with an insertion far anterior to the equator

Strand separation and partial excision

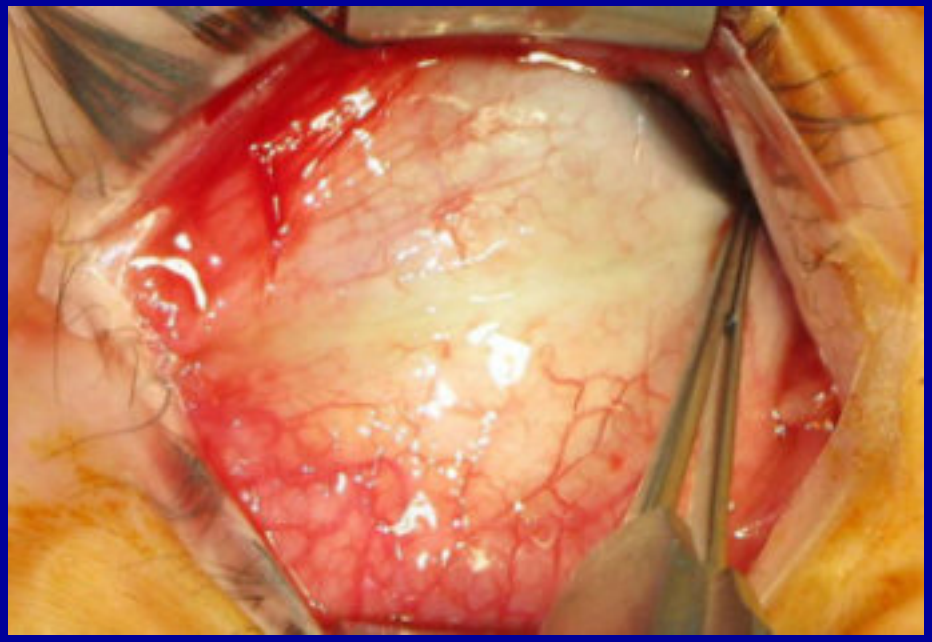




Pre- und postoperative forced duction test



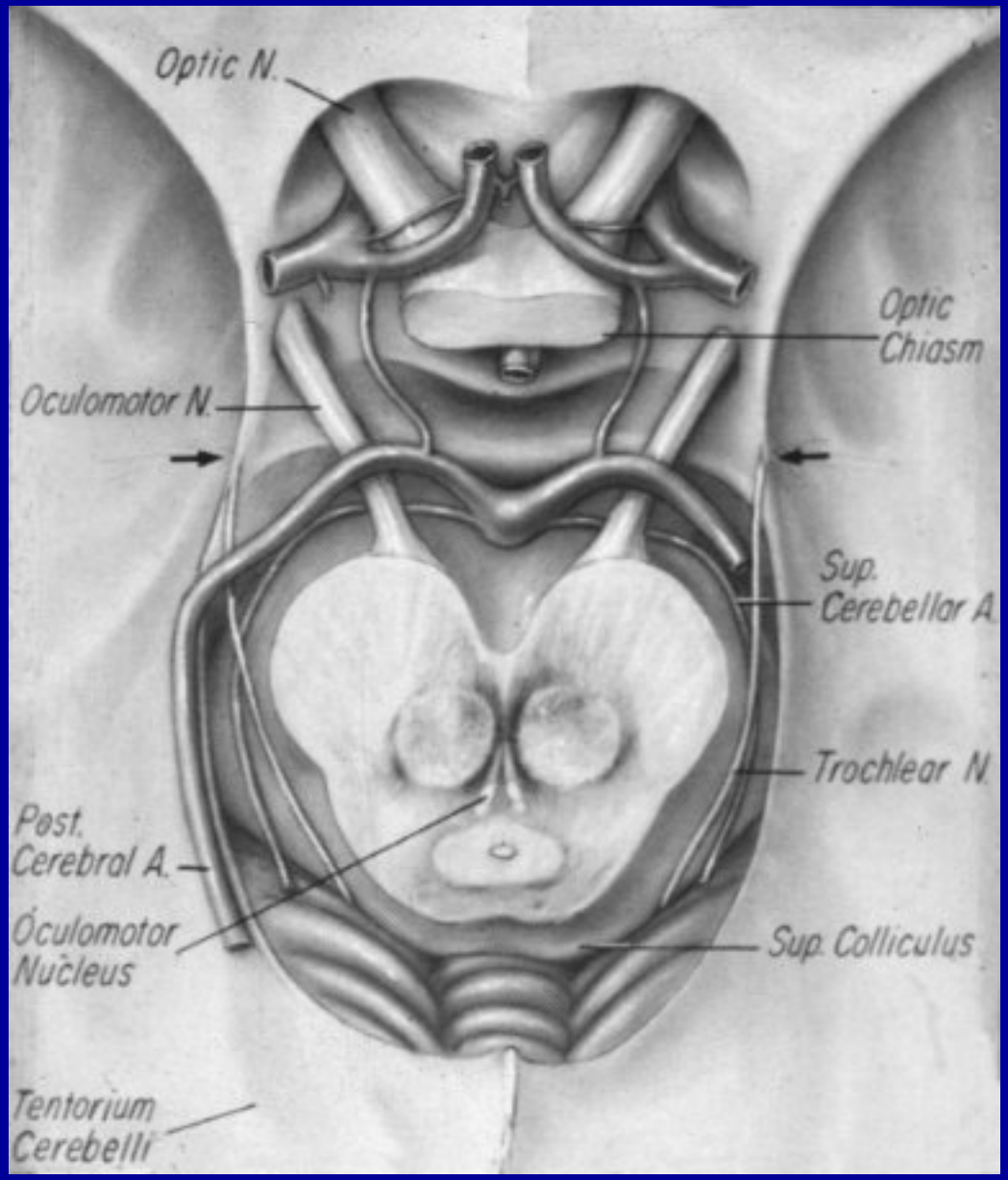
Rreop at elevation in adduction



Postop at elevation in adduction

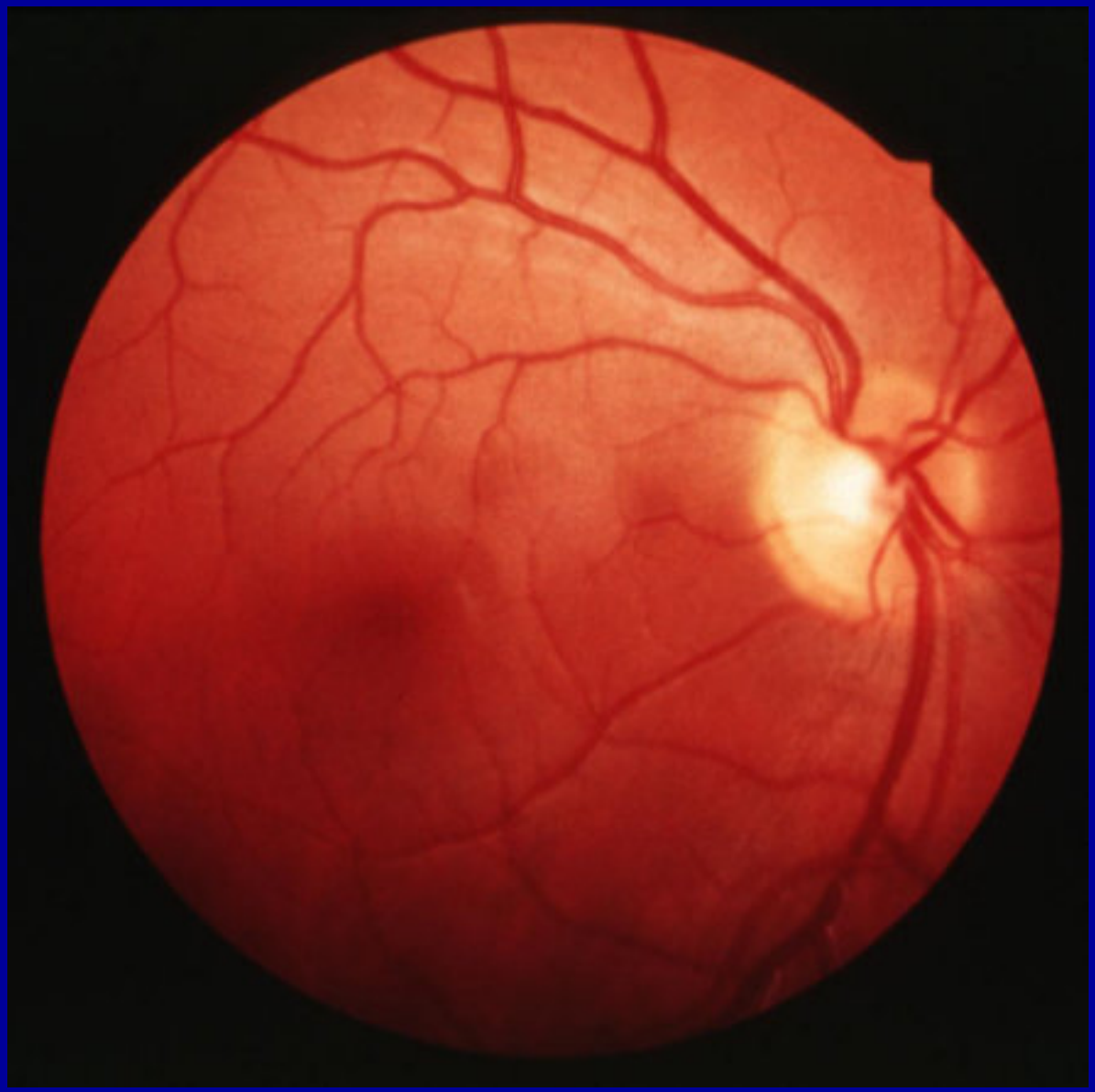
Acquired oblique muscle disorders

- Trochlear palsy
- Brown´s Syndrome


Optic N.
Optic Chiasm
Oculomotor N.
Sup. Cerebellar A.
Trochlear N.
Post. Cerebral A.
Oculomotor Nucleus
Sup. Colliculus
Tentorium Cerebelli

Trochlear palsy: Clinical characteristics

- Excyclotropia in down-gaze:
  - < 15° in unilateral cases
  - > 15° in bilateral cases
- vertical deviation
  (maximum in down-gaze)
- horizontal incomitance (V-symptom)
- BHTTpositive (maximum in down-gaze)



Trochlear palsy: Diagnosis

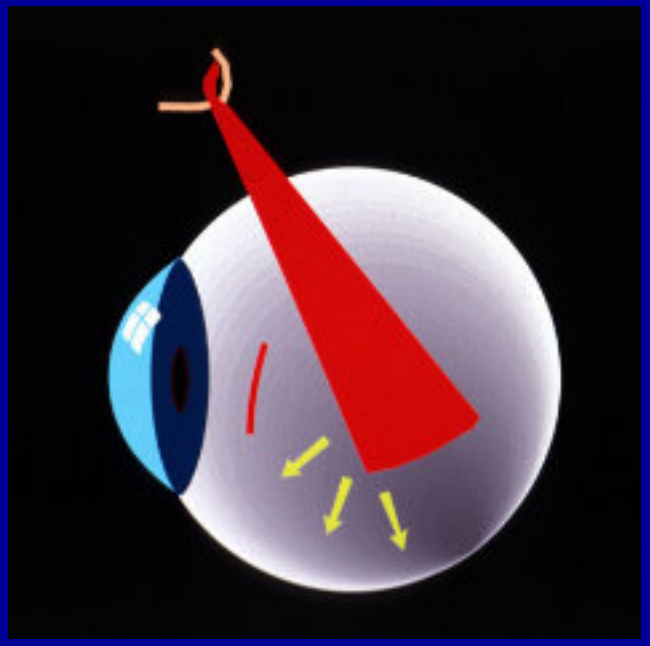
- history: sudden onset (trauma, operation)
- differentiation from decompensated strabismus sursoadductorius

DD: Strab. sursoadd. - trochlear palsy

	strab. sursoadd.	trochlear palsy
- history (photo)	head tilt ⊕	negative
- onset	intermittend	sudden
- vertical deviation	comitant in adduction	maximum in downgaze
- cyclotropia	small, comitant	maximum in downgaze
- sursoadduction	marked	negative
- vertical fusion	"pathologic"	normal
- BHT	not gaze dependent	maximum in downgaze

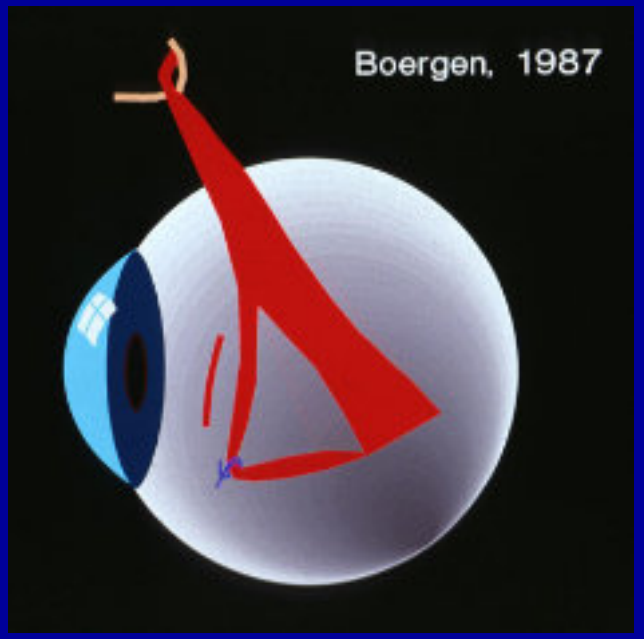
Problems of surgical treatment:

- Torsional , vertical ,and horizontal incomitance
- Risk of undercorrection in down-gaze
- Risk of overcorrection in up-gaze (Brown's syndrome)




Harada u. Ito, 1964


Fells, 1979

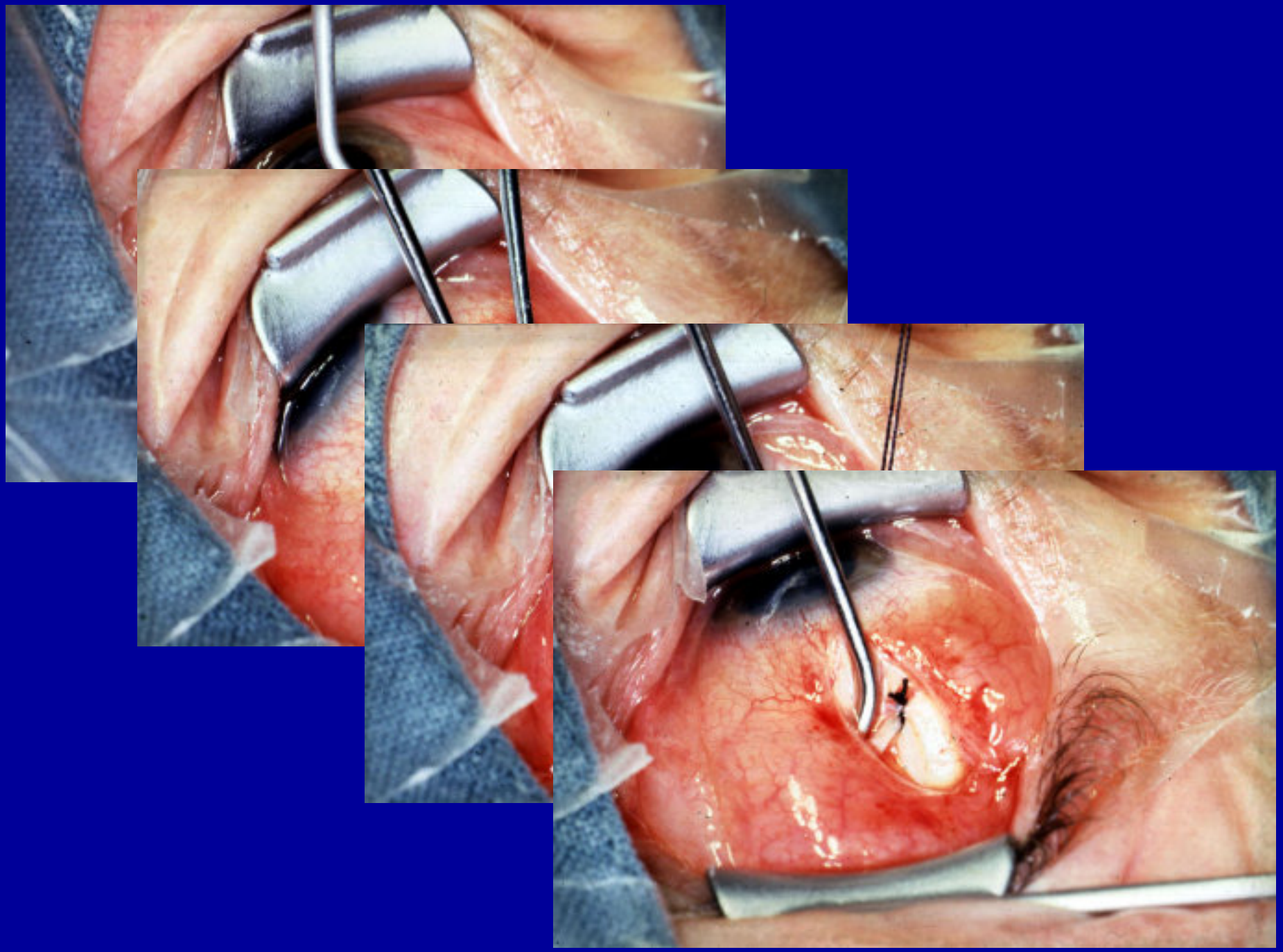

Boergen, 1987

Common surgical procedures

- Harada-Ito operation
- superior oblique tuck
- combined operations on the oblique muscles

Trochlear palsy: Therapy

- modified Harada-Ito procedure
  (bilateral cases; unilateral cases showing < 5° VD in pp)
- superior oblique tuck:
  (bilateral cases with a large V;
  unilateral cases showing > 5° VD in pp)



Preop. findings

Combined Op (n = 15)
Kolling (1986)

add.		RE - Fix.			
0	8	-1	4	0	2
4 Ex		4 Ex		4 Ex	
0	12	0	7	0	3
5 Ex		5 Ex		8 Ex	
0	14	1	8	0	3
5 Ex		8 Ex		8 Ex	

Superior oblique tuck (n = 15)
Kolling (1986)

add.		RE - Fix.			
0	4	0	3	0	1
1 Ex		2 Ex		2 Ex	
0	8	1	5	0	2
4 Ex		5 Ex		5 Ex	
0	12	3	9	0	6
6 Ex		7 Ex		7 Ex	

Modified Harada-Ito Op. (n = 15)
Ebergen (1996)

add.		RE - Fix.			
0	3	0	1	0	0
3 Ex		2 Ex		2 Ex	
2	10	0	3	2	0
5 Ex		4 Ex		3 Ex	
5	12	4	8	4	3
7 Ex		8 Ex		9 Ex	

Postop. findings

Combined Op (n = 15)
Kolling (1986)

add.		RE - Fix.			
0	-8	0	-6	0	-4
7 In		7 In		7 In	
0	0	0	0	0	0
3 In		2 In		4 In	
0	3	2	2	0	1
0		0		1 In	

Superior oblique tuck (n = 15)
Kolling (1986)

add.		RE - Fix.			
0	-7	2	-5	0	-2
6 In		7 In		5 In	
0	0	1	0	0	0
2 In		0		1 In	
0	3	1	3	0	2
1 Ex		0		0	

Modified Harada-Ito Op. (n = 15)
Ebergen (1996)

add.		RE - Fix.			
1	-1	1	-2	2	-1
1 In		2 In		1 In	
2	2	2	0	3	0
0		0		0	
4	5	6	2	5	1
1 Ex		2 Ex		1 Ex	

Postop. findings (3 months)

Combined Op (n = 15)
Kolling (1986)

add.		RE - Fix.			
0	-5	1	-5	0	-3
3 In		5 In		2 In	
0	0	0	0	0	0
0		0		0	
0	1	1	1	0	0
0		0		0	

Superior oblique tuck (n = 15)
Kolling (1986)

add.		RE - Fix.			
0	-7	1	-3	0	-1
4 In		4 In		1 In	
0	1	0	0	0	0
0		0		0	
0	4	3	3	0	1
1 Ex		1 Ex		0	

Modified Harada-Ito Op. (n = 15)
Ebergen (1996)

add.		RE - Fix.			
0	-1	0	-1	3	0
1 In		0		3 In	
1	0	0	0	2	0
2 Ex		0		0	
3	0	3	1	2	0
3 Ex		1 Ex		0	

Bilateral symmetric trochlear palsy after BHT

Tangent screen (mean values)

preop. (n = 4)

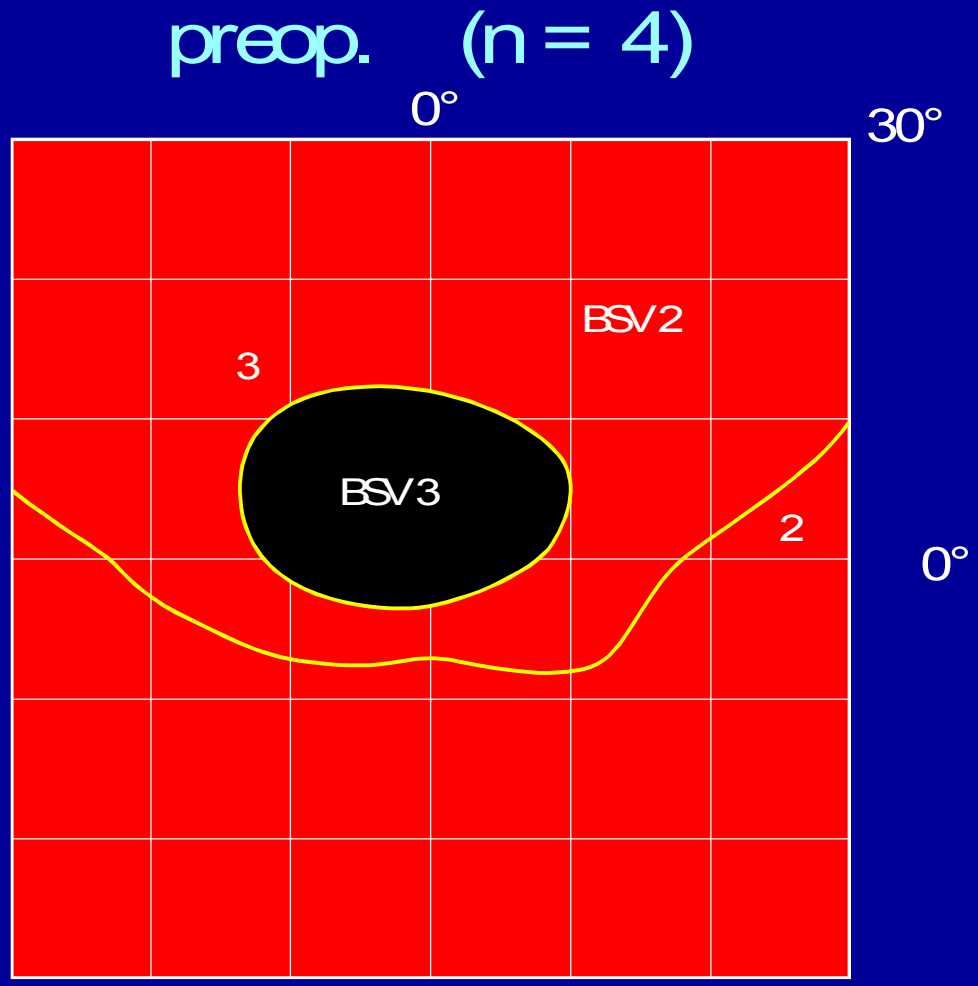
add.		RE - Fix.			
0	0	0	0	0	-1
5 Ex		6 Ex		9 Ex	
1	1	0	0	1	-3
15 Ex		13 Ex		15 Ex	
6	2	4	-1	7	-5
21 Ex		21 Ex		19 Ex	

BHTT:

LE		RE	
0	-3	0	3
17 Ex		15 Ex	

Bilateral symmetric trochlear palsy after BHT

Field of binocular single vision (BSV)



Bilateral symmetric trochlear palsy after BHT

Tangent screen (mean values)

postop. (n = 4)

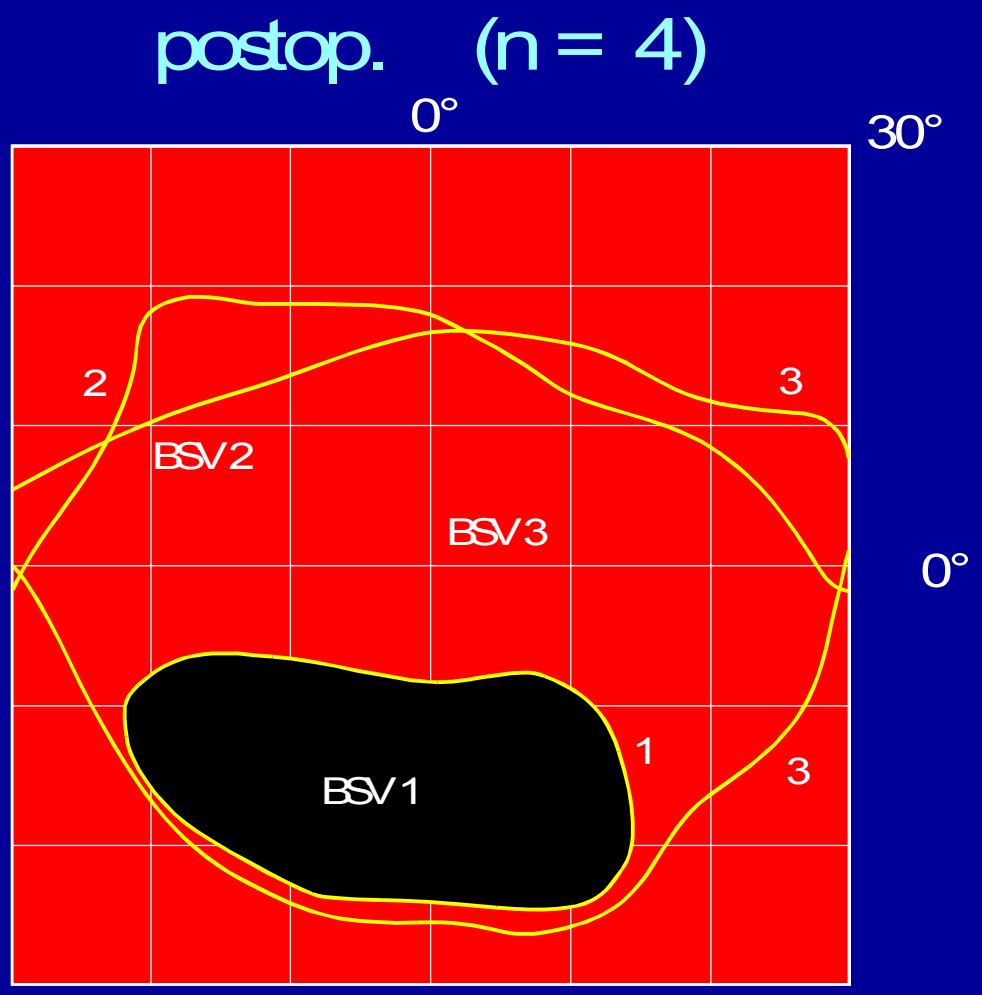
add.		RE - Fix.			
8	-4	7	-1	7	0
14 In		14 In		13 In	
4	-1	2	0	3	0
6 In		4 In		5 In	
4	0	2	0	5	0
1 In		0		1 In	

BHTT:

LE		RE	
4	-2	3	0
3 In		4 In	

Bilateral symmetric trochlear palsy after BHT

Field of binocular single vision (BSV)



Bilateral symmetric trochlear palsy after BHT

Tangent screen (mean values)

3 months postop.

add. RE - Fix.

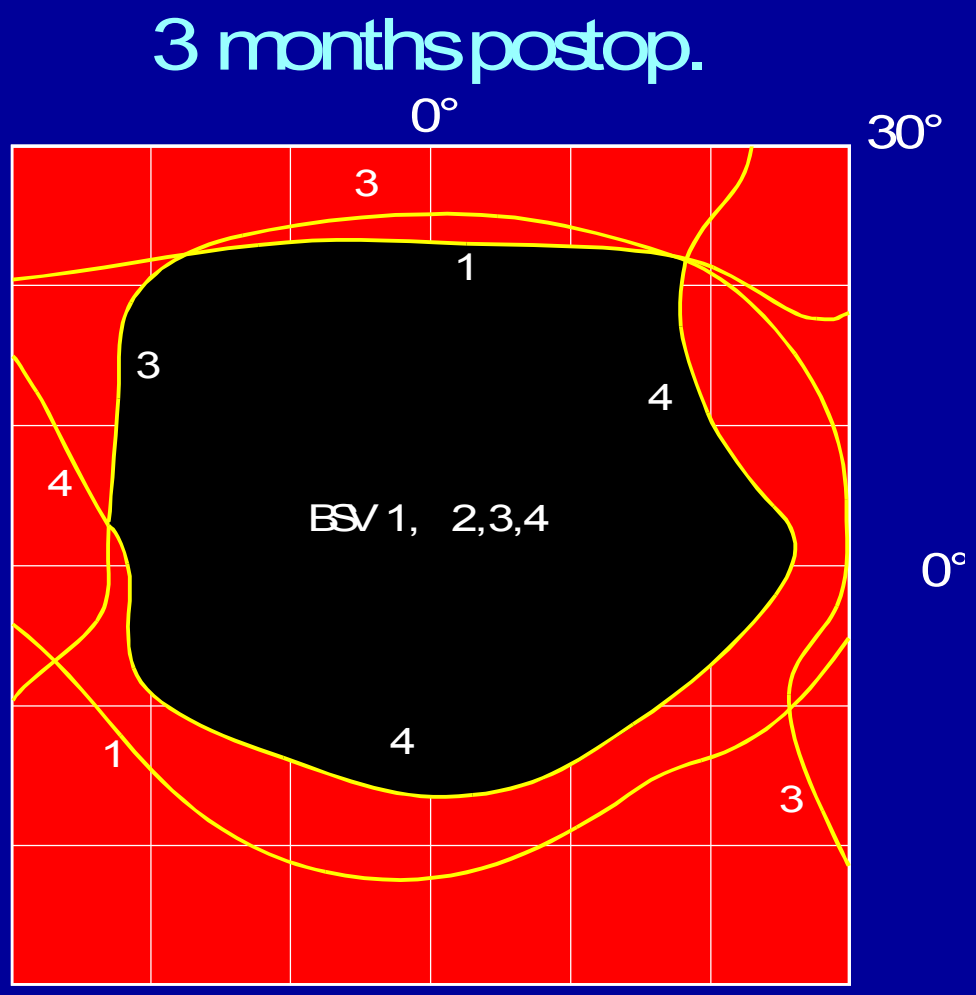
1	0	0	0	1	0
1 In		1 In		2 In	
2	0	0	0	2	-1
1 Ex		1 Ex		2 Ex	
5	1	3	0	5	-2
7 Ex		6 Ex		4 Ex	

BHTT:

LE		RE	
2	-1	2	1
3 Ex		4 Ex	

Bilateral symmetric trochlear palsy after BHT

Field of binocular single vision (BSV)



Bilateral trochlear palsy (preop.)

Tangent screen

Modified Harada-Ito-Op.
(n = 4)
Boergen (1996)

LE- Fix.

0	0	0	0	0	-1
7 Ex		4 Ex		9 Ex	
1	1	0	0	1	-2
12 Ex		13 Ex		14 Ex	
6	3	5	0	6	-3
18 Ex		18 Ex		16 Ex	

Combined Obliquus Op.
(n = 9)
Krzizok et al. (1996)

LE- Fix.

0	1	0,5	-0,5	1	-1
4 Ex		3 Ex		3,5 Ex	
3,5	1,5	3,5	0	4	-3
14 Ex		13,5 Ex		15 Ex	
11	6	11	1	13	-5
23 Ex		24,5 Ex		23 Ex	

Bilateral trochlear palsy (postop.)

Tangent screen

Modified Harada-Ito-Op.
(n = 4)
Boergen (1996)

LE- Fix.

8	-2	7	-2	7	0
13 In		14 In		12 In	
5	-2	2	0	4	0
5 In		5 In		5 In	
6	-1	3	0	5	-1
0		0		1 In	

Combined Obliquus Op.
(n = 9)
Krzizok et al. (1996)

LE- Fix.

4,5	-6	8	-1,5	9	8
20 In		25 In		29 In	
3,5	-2,5	2,5	0	2,5	5
10,5 In		11,5 In		15 In	
6	0	4	-0,5	4	-0,5
2,5 In		0,5 Ex		2,5 In	

Bilateral trochlear palsy (3 months postop.)

Tangent screen

Modified Harada-Ito-Op.
(n = 4)
Boergen (1996)

LE- Fix.

2	0	0	0	1	0
0		0		1 In	
2	0	0	0	2	0
3 Ex		1 Ex		3 Ex	
5	1	4	0	5	-2
7 Ex		7 Ex		6 Ex	

Combined Obliquus Op.
(n = 9)
Krzizok et al. (1996)

LE- Fix.

5	-3	2	-1	2	6
7 In		10 In		10 In	
3	0	3	0	3	0
2 In		2 In		2 In	
7	2	6	1	5	0
6 Ex		7 Ex		6 Ex	

Conclusions

1. Modified Harada-Ito operation sufficiently influences torsional, vertical and horizontal incomitance in unilateral trochlear palsy

2. No risk of Brown´s syndrome compared to superior oblique tuck or combined operations on the oblique muscles

3. Stable effects during follow-up period