

Consecutive Exotropia: assessment and treatment

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Start off with humility :
it is much easier than having it thrust on you

CONSECUTIVE XT

- Any XT happening after previous ET
- Usually after ET surgery
- Rare: **spontaneous** consecutive XT : was ET, no surgery - now XT



HOW COMMON IS CONSEC XT?

Alberto Ciancia [Argentina]:

90% perfect early alignment
after cong ET surgery [n=390]

→ **30%** consec XT over next
25y [50% followup]

Core defect in consec XT

- ... is Medial Rectus underaction
- WHY / HOW do we get this MR underaction?

RETROSPECTIVE SERIES

- All my patients with consecutive XT seen &/or operated in last 5y
- A few had surgery earlier, but were seen in this period
- 225 patients seen
- 119 have surgery [~ 50%]

WHY DOES CONSEC XT HAPPEN?

➤ EARLY

LATE:

➤ INSERTION MIGRATION

➤ GENERIC

➤ STRETCHED SCAR

1. Early consec XT n=9 [7.5%] WHY?

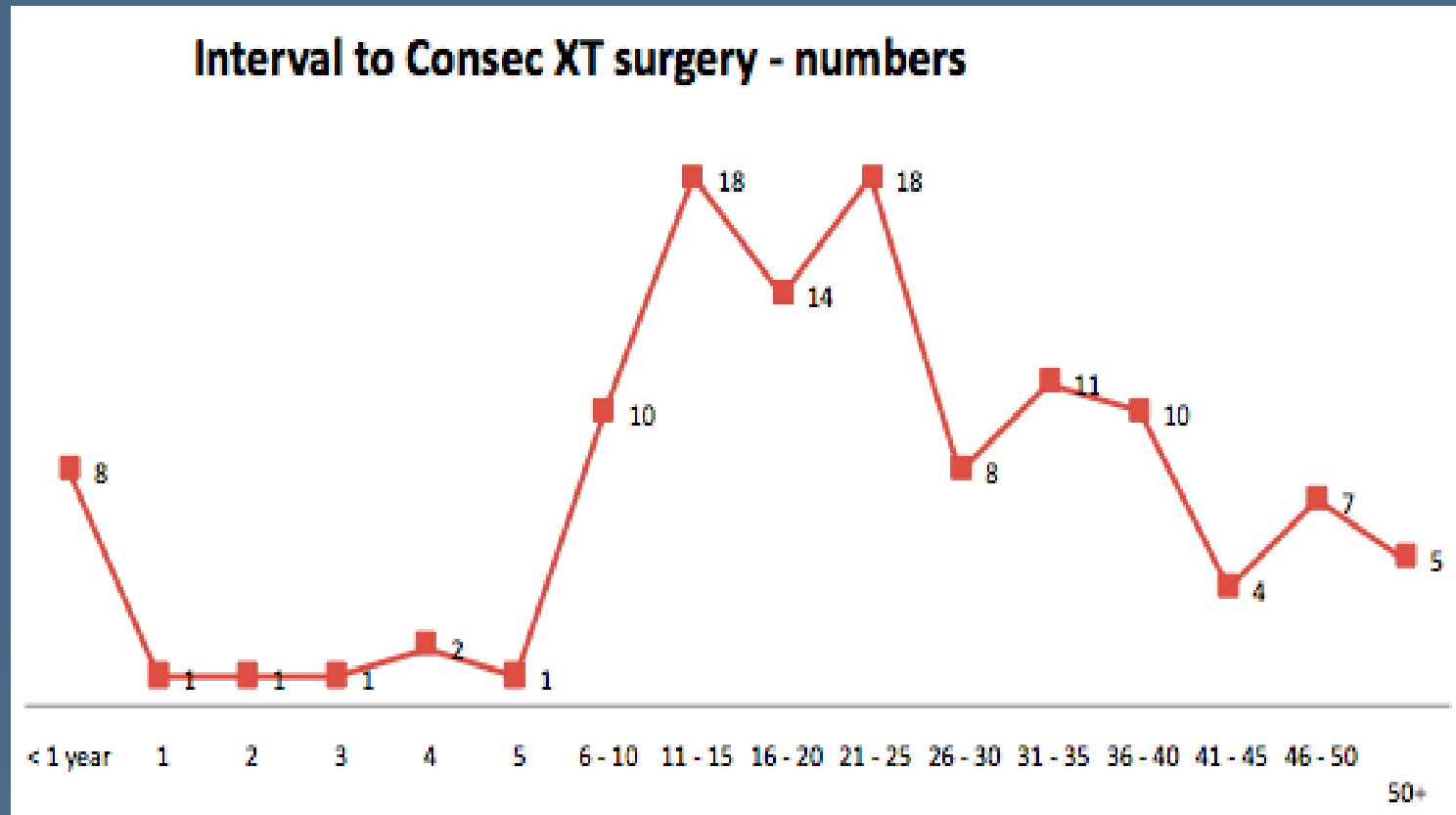
- 1: Poor suturing technique
- 2: Knots come undone
- 3: Aberrant early healing

1. Early consec XT :
'Slipped muscle' ~2w after surgery

CASE: Explore 'slipped muscle'
– no vicryl seen.

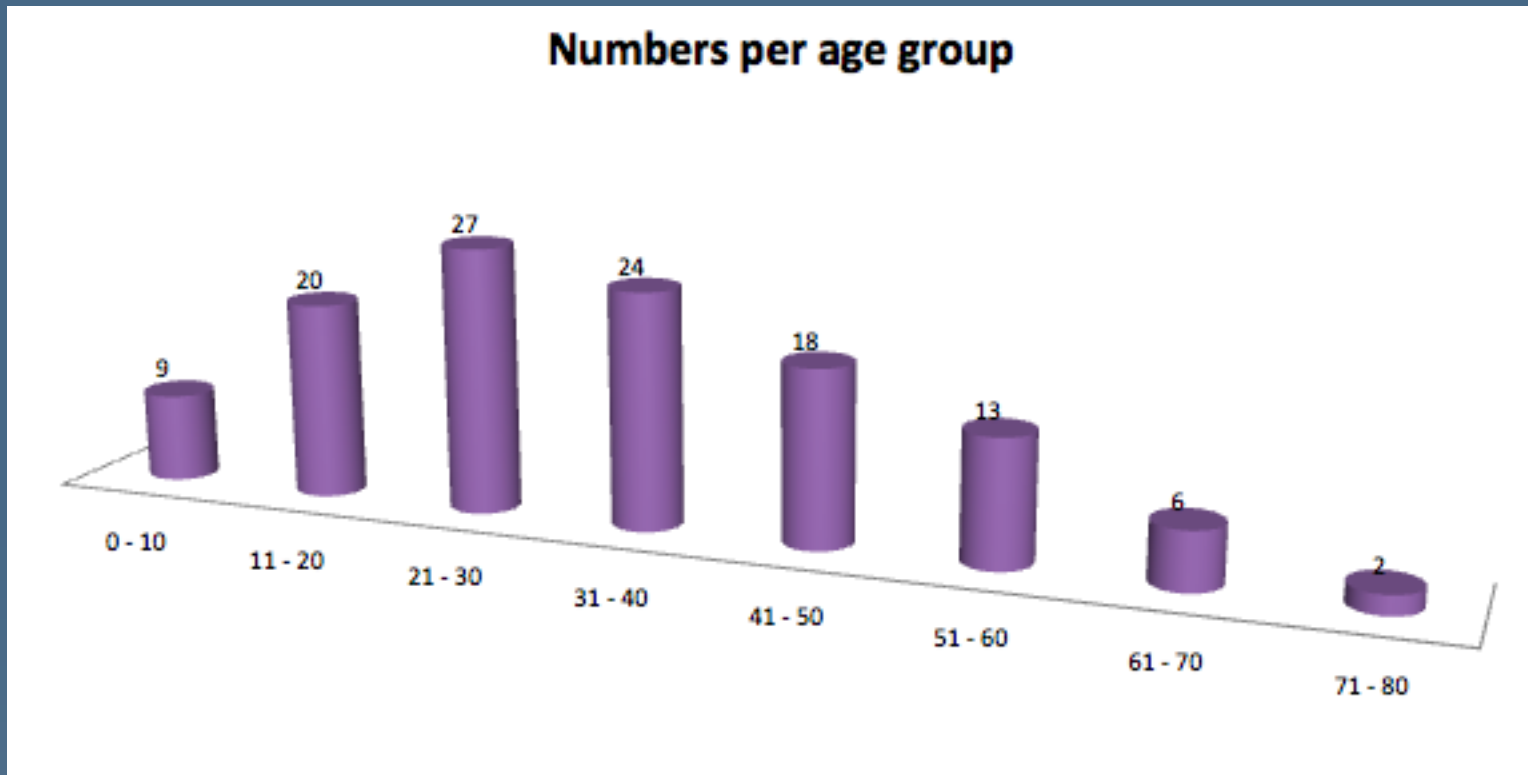
Did the pt pull it out somehow?
Was it faulty and it hydrolysed
in 2 weeks?

50% of patients: 2ND & 3RD decades after last ET surgery

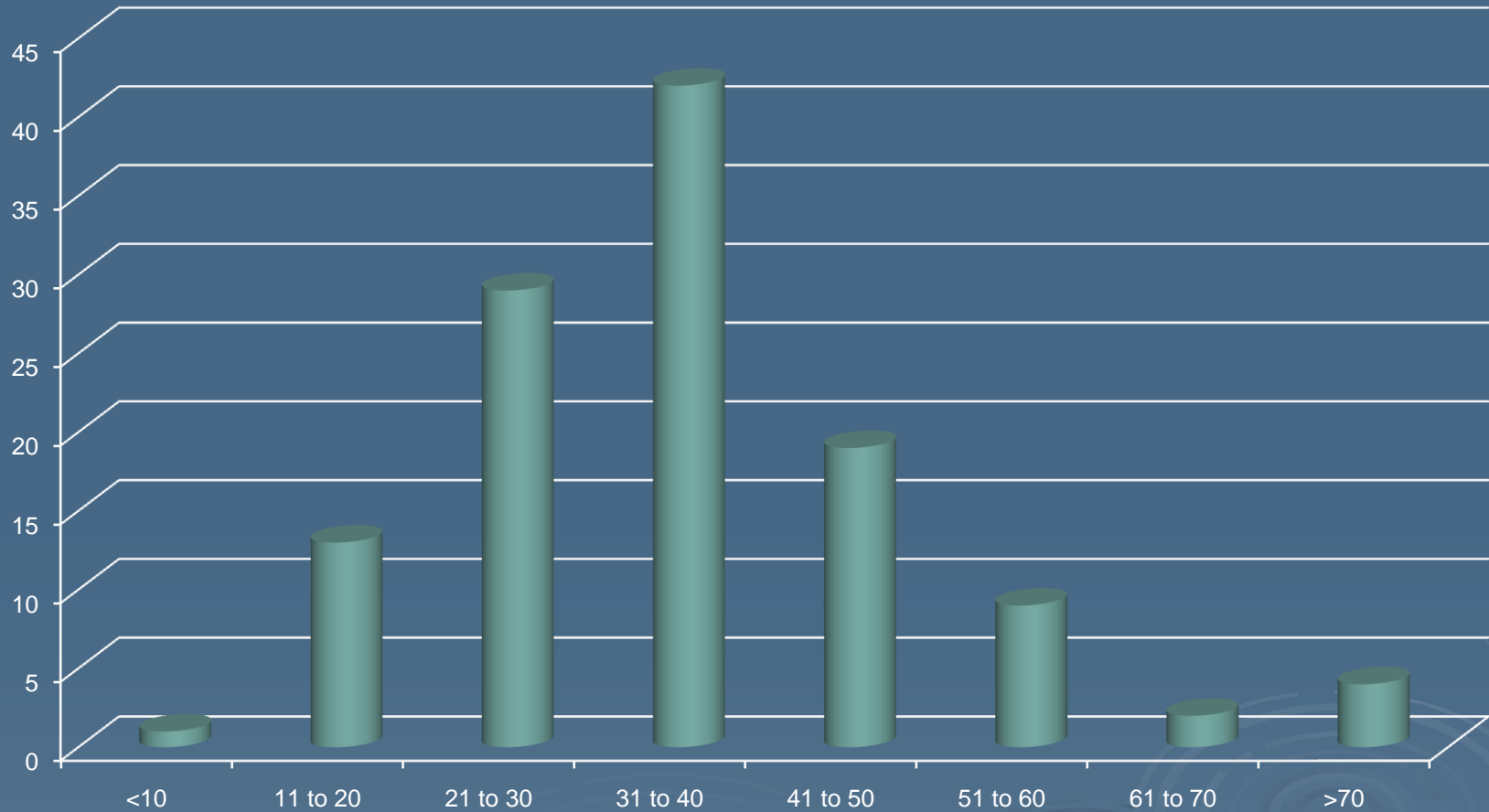


MEDIAN TIME TO SURGERY 22 YRS. AVERAGE 23.

THIS IS AN ADULT DISEASE



Distribution of pre-op angle Δ



2. Insertion migration n=11 [9%]

- If Dr X recesses a MR by 4mm, & if I was to photograph it* or explore it a week later it might be 4 +/- 1mm.
- There are artifacts in measurements, in how traction sutures or locking forceps pull on the limbus or insertion & stretch the sclera anterior or behind the insertion etc. **so some small real or apparent “insertion migration” is expected.**

* PAT in ET study
Kowal MEACO 2009

Insertion migration

- If I have good records [esp. my own] that show 5mm recess and I find the muscle 13mm from limbus **that's probably insertion migration.**
- Possible mechanism : Shifting the insertion might change the mechanical stresses on different parts of the sclera & have an effect on growth.

IRENE LUDWIG'S AOS THESIS

Trans Am Ophthalmol Soc. 1999

RELATED SCAR REMODELING PHENOMENA IN STRABISMUS

Migration of Scleral Reattachment Site

Strabismus surgeons have noticed that sometimes the final muscle reattachment site on the sclera is not the same as the original surgical attachment site^{119,127} (Fig 60). Migration of the reattachment site has also been shown in

nonabsorbable sutures may prevent this. The mechanism of scleral site migration is unknown, but it could be hypothesized to be related to greater tension on the more anterior fibers of the scar, with gradual lengthening, as well as increasing scar strength of the shorter, less-stressed posterior fibers. Because there is no corresponding scleral wound to direct the scar position, collagen fibers will attach themselves anywhere, and will adhere better where they are under less tension. As remodeling progresses, the position gradually shifts posteriorly. Nonabsorbable suture should reduce tension on the scar, reducing position shift.

Insertion migration

- Total known cases 11 [=9%]
- Total unrecognised cases ??

3. 'GENERIC' causes for consec XI ?Wrong surgical dose for this case

Surgical tables make MANY assumptions:

- normal globe size

bigger globe needs bigger surgery for same angular effect

- normal globe shape

prolate vs. oblate : egg-shaped – longer axis A-P or transverse

- average muscle stiffness

....many reasons why the 'standard' surgical dose may not be the best dose for this particular case

Surgical tables make MANY assumptions...

- average scleral rigidity

clearly varies with globe size and refraction

- average mechanical response of antagonist

must vary with initial stiffness

....many reasons why the 'standard' surgical dose may not be the best dose for this particular case

The correct EI operation doesn't 'grow' with the pt

MR is repositioned to align the eyes &
allow best early visual devtpt

Subsequent growth of
globe, muscle, orbit & any insertion
migration may alter this perfect
mechanical 'balance' →
**mechanically disadvantage the
repositioned MR**

4. Delayed consec XT - WHY?

'Stretched scar'

- look for stretchmarks, healing of other surgical scars,
- Scar remodelling is an ongoing lifelong process
- Scar is metabolically more active than tendon
- Seminal papers by **Ludwig, Irene H J AAIPOS. 2000 & Trans Am Ophthalmol Soc. 1999**
 - Use non-absorbable sutures - ↓↓ recurrence of stretched scar

Scar remodeling after strabismus surgery

Irene Ludwig, MD, Alan Chow, MD JAAPOS 4: 326-333; 2000

“When we explored the ... muscles of patients with such overcorrections, the expectation was that the muscles would be found normally healed at their original surgical attachment sites and that repositioningwould repair the deviations.

... many of the overcorrection cases demonstrated a segment of amorphous scar tissue separating the tendon from its attachment site on the sclera”

▪



Scar remodeling after strabismus surgery

Relative to all reoperation cases, lengthened scars were estimated to be found ... in the subset of patients with late overcorrections, in about 50%. **[LK series: 42%]**

- Mean time between original strabismus surgery and scar repair 122 mo (range 1-612 mo). **[LK series: 307 mo]**
- Median age at time of repair 19 y (range 3-68 y) **[LK series: 33 y, range 3-68y !]**.

Scar remodeling after strabismus surgery

- The time course of the development of strabismus overcorrection was gradual in most cases, and overcorrection was not seen in any patients immediately after surgery, as would be expected with an improperly attached muscle.

How to recognise stretched scar

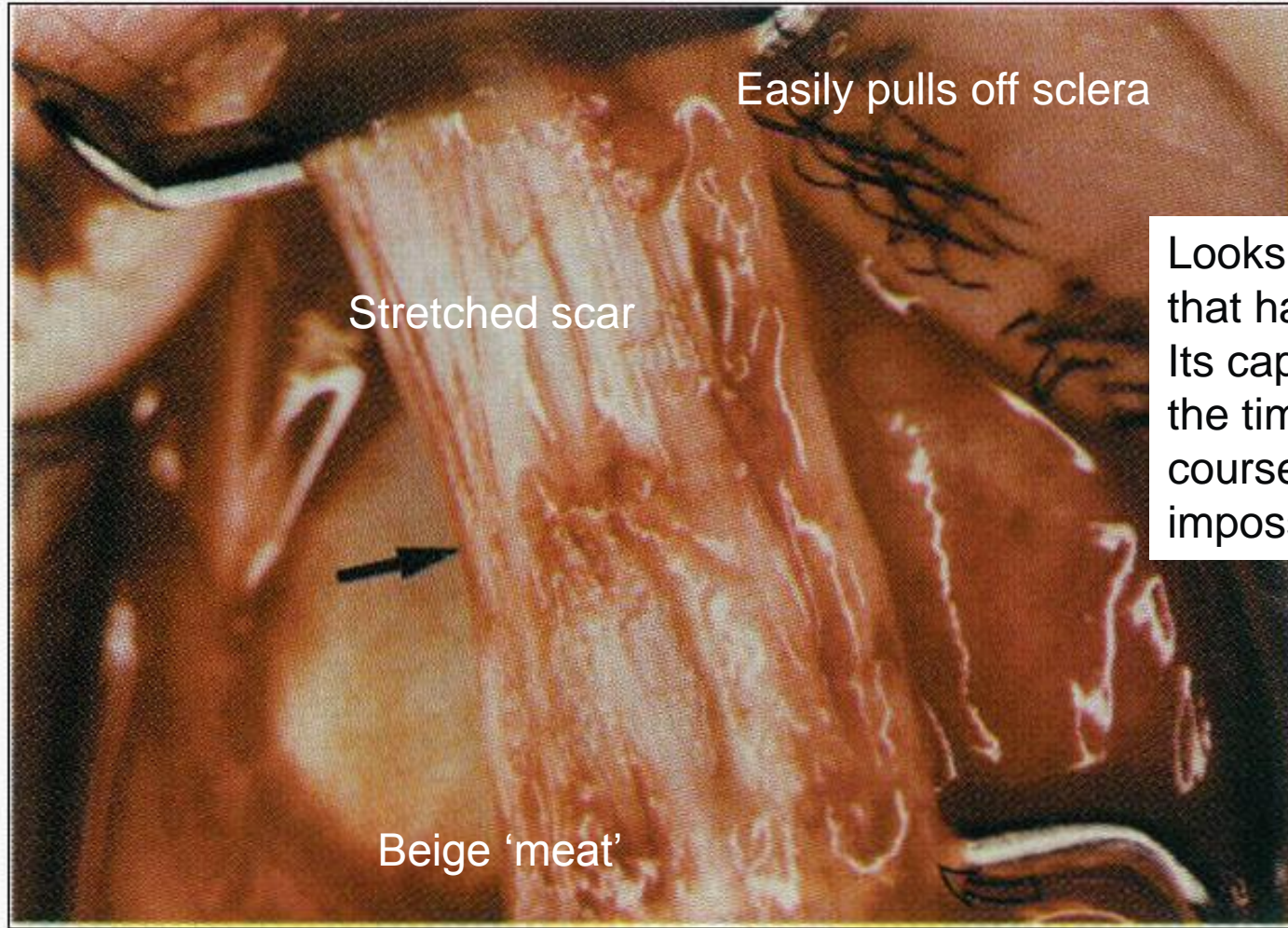


FIGURE 11

PRINCIPLES OF TREATMENT

- Core defect in consec XT is Medial Rectus underaction
- R_x : Have to make MR function normal [or near- normal] for satisfactory long term result

#1 LMR UA

L XT R 6/6, L 6/12 Previous L R-R



HAVE TO
FIX THE
LMR UA TO
FIX THE
L XT



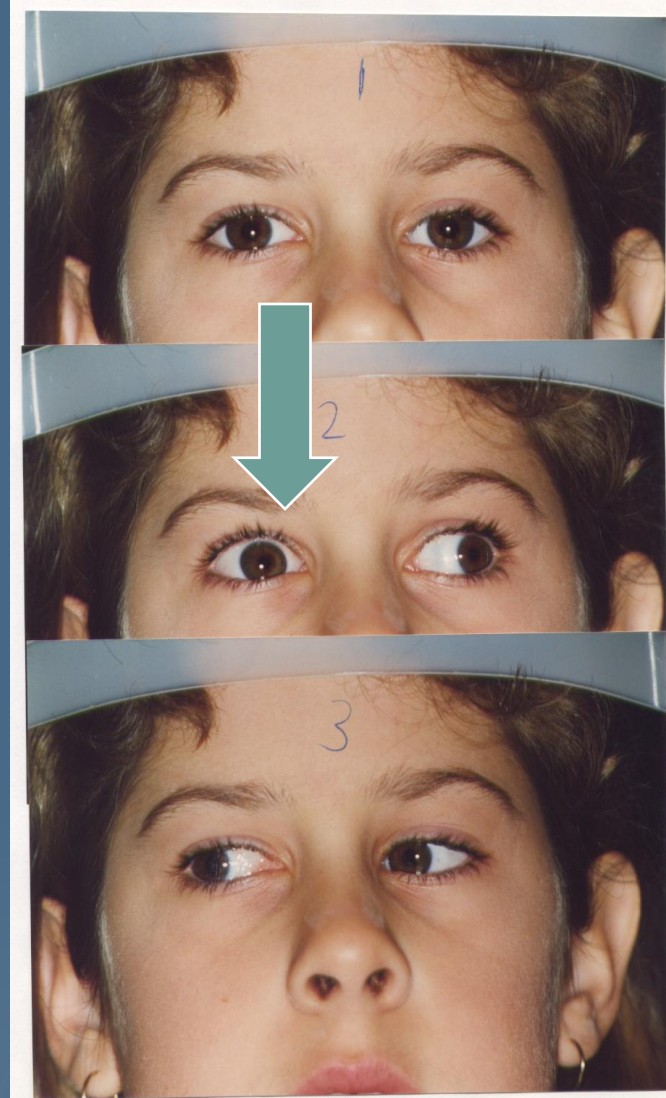
#2 RMR UA

R XT R 6/12, L 6/6 Previous R R-R

R XT

**IS IT RMR UA?
OR
IS IT TIGHT RLR?
OR
IS IT BOTH?**

Right Gaze
LMR normal



**TIGHT RLR FROM
'CHRONIC XT' LOOKS
THE SAME AS
MR UA AND
PRESUMED WEAK RMR.**

**CAN ONLY
DIFFERENTIATE AT
SURGERY**

**HAVE TO NORMALISE
BOTH**

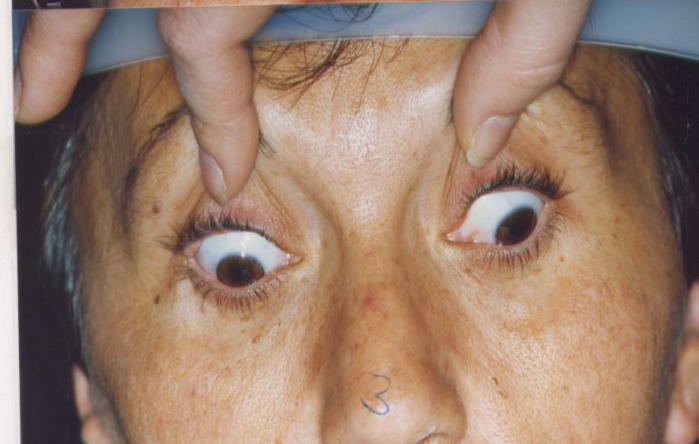
MR underaction and laterality of XT :
Mechanical explanation not always the only one

- Usually **LMR UA** → **L XT**
- If the R is sensorially
'superior', **RMR UA** can
drive a **L XT**

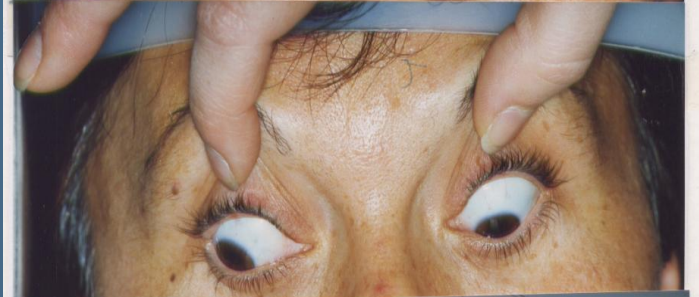
R 6/6 L 6/12 PREVIOUS BMR



LXT



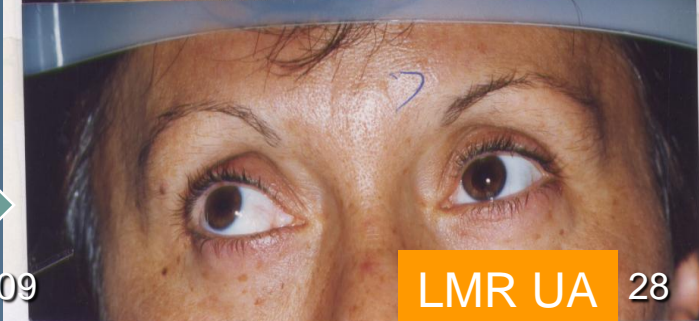
Cooper's 1961 dictum: **not a reliable guide**



RMR UA



MR UA
L > R



LMR UA 28

#3 : L XT L>R MR UA
 'A' pattern SO OA OU

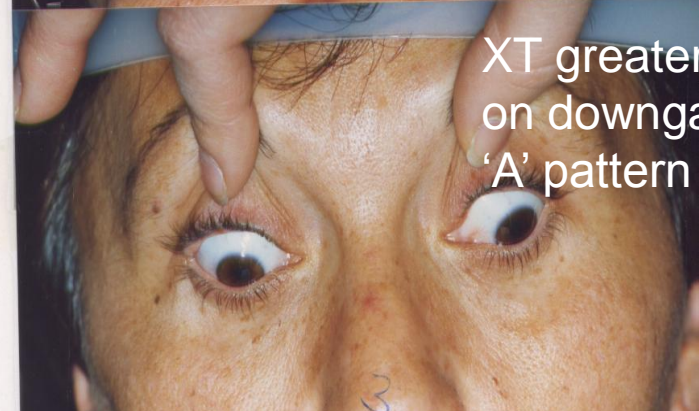


L XT

Sup obl
 OA OU



XT greater
 on downgaze
 'A' pattern



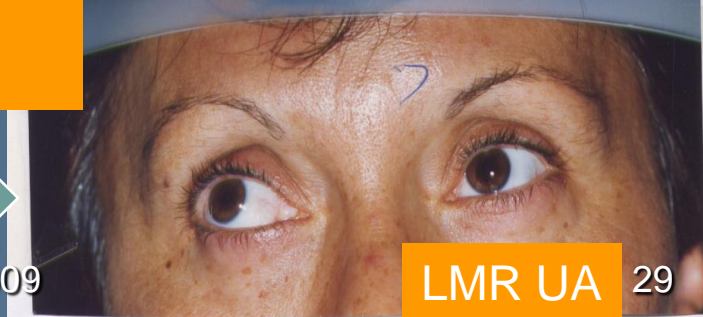
WILL NEED TO FIX
 THE CYCLOVERTICAL
 ANOMALY AS WELL



3. RMR UA



MR UA
 L > R



LMR UA 29

These are difficult cases

- Careful complete assessment
- Careful pt education : pt's expectations need to be same as Dr's expectations
- 2nd opinions sensible

These are difficult cases

- *Need to make MR function normal or XT will recur*
- Difficult to dissect out tendons
- Muscle 'meat' can be 20+ mm from limbus
- Adjustables often necessary
- Fat may be present
- NO surgical tables
- Intra-op 'spring back' as a guide
- Guide: Early ET $\geq 10 \Delta$

RESULTS THIS SERIES

Great result	D & N $\leq 10\Delta$	n =75	63%
	Ortho D&N	37	31%
	One or both of D&N = 0	51	43%
OK result	D & N, one $\leq 10 \Delta$ or both $\leq 20 \Delta$	29	24%
Not good enough	Both D & N $> 20 \Delta$ or further surgery recommended	12	10%

4 : convergence excess

No correlation between quality of result and:

Size of preoperative angle of XT	P= 0.21
Putative mechanism of XT - stretched scar - Insertion migration - 'generic'	P=0.11
Duration of postop follow-up	P=0.19

LENGTH OF FOLLOWUP

< 2 MONTHS	37%
2-6 MONTHS	20%
6-12 MONTHS	11%
1-2 YEARS	14%
> 2 YEARS	17%

MOSTLY ADULT POPULATION - DON'T
RETURN IF THEY DON'T NEED TO OR
DON'T WANT TO

REPEAT SURGERIES : FOR ET

➤ 7 require SURGERY [6%]

➤ 10 require BOTOX [8%]

REPEAT SURGERIES : FOR XT

- 14 REQUIRE 2ND SURGERY [12%]
- 2 /14 REQUIRE 3RD SURGERY FOR XT
- **12% REQUIRE >1 SURGERY**

IMPERFECT RESULTS

- 12%: 2nd [or 3rd] surgery for XT
- 6% : surgery for ET [some have botox 1st]
- **Σ 18% have second surgery**
- ..additional 6 [5%] have Botox for ET
- ***10% : still > 20Δ or have another reason for another surgery***

- **2/3 STRAIGHTFORWARD COURSE**

Pre-op diplopia prediction

- These pts have sensory adaptation for both ET & XT : troublesome persistent diplopia rare

Highly reliable pre-op indicators of very low diplopia risk:

- If prismatic simulation of surgical correction doesn't → diplopia
- Photos of aligned eyes with no diplopia

Diplopia : Special caution

- Pt who had 1st surgery late
- Sensorially less 'flexible'
- Paradoxical diplopia more common

RESULTS 1

Consecutive exotropia surgery

GOMEZ DE LIANO SANCHEZ et al Arch Soc Esp Oftalmol. 2001

➤ Retrospective n= 30

SURGICAL PLAN:

➤ LR Rc OU for $< 35 \Delta$

➤ Advance 1-2 MR if $> 35 \Delta$

➤ **70%: $\leq \pm 10\Delta$ $> 50\%$ one surgery.**

RESULTS 2

➤ Donaldson MJ, Forrest MP, Gole GA

Surgical management of consec XT

J AAPOS. 2004

n=59.

- S_x : LR Rc, MR adv to original insertion
- Time to XT S_x mean 14y (4mo-47 y) *LK 23y*
- Mean preop XT 32 Δ
- Result $\leq \pm 10\Delta$: 71% @ final follow-up *LK 63%*
- 66% : exodrift after surgery - mean 8 Δ

RESULTS 3

Outcome of a surgical treatment protocol for late consecutive exotropia following bilateral medial rectus recession for esotropia.

Mims JL 3rd, Wood RC. Binocul Vis Strabismus Q. 2004;19(4):201-6.

- 119 children followed 6 mo - 15 y after surgery
- LR recess 7 - 8.5mm if $\leq 23 \Delta$ XT
- LR Rc & advancement of one previously recessed MR to the insertion if $\geq 24 \Delta$ XT.
- The overall "success" rate for this protocol was 74% at 2- 4 y postop'.

Spontaneous consec XT

Alan Scott : unpublished series n= 19

- ET $\leq 20 \Delta$ Onset $\leq 2y$
- $\geq +4$ DS Amblyopia ≥ 1 line
- 12/19 : spontaneous consec XT
- Only 4/19 stayed ET
- ET usually declined \geq age 5
- **“This set you don’t want to touch surgically at an early age”**

- ***LK : 70 ET pts, $\geq +6$, 2003-5***
- ***2/70 spontaneous consec XT***
- ***UNRECOGNISED SELECTION BIAS***

Spontaneous consecutive XT

- 2 cases of spontaneous consecutive XT
 - 2% of all consecutive XT
 - High +, amblyopia, cong ET
- # 1 : 10 yo F, infantile ET
 - XT first noted ~ 2 yo
 - Now XT 10Δ with V
 - R +8.75, L +7.00
 - R amblyopia 6/12
 - No surgery

Spontaneous consec XT

➤ # 2

- 30 yo F
- Infantile ET ? Age onset XT
- RXT 35Δ
- R +7.50, L +4.50
- R 6/45
- R Rc/ Rs : RET 7Δ

SUMMARY - CONSEC XT

- Difficult to assess and operate
- Common in a dedicated strabismus practice
- Common in a cong ET population
- Expect 2/3 to do very well
- 10% do not do well

Starting with humility is easier than having it thrust on you

Thank You



Yarra River footbridge Melbourne Australia

Kowal MEACO 2009

Factors UNrelated to outcome

➤ Hyperopia

Previous audit: high + common

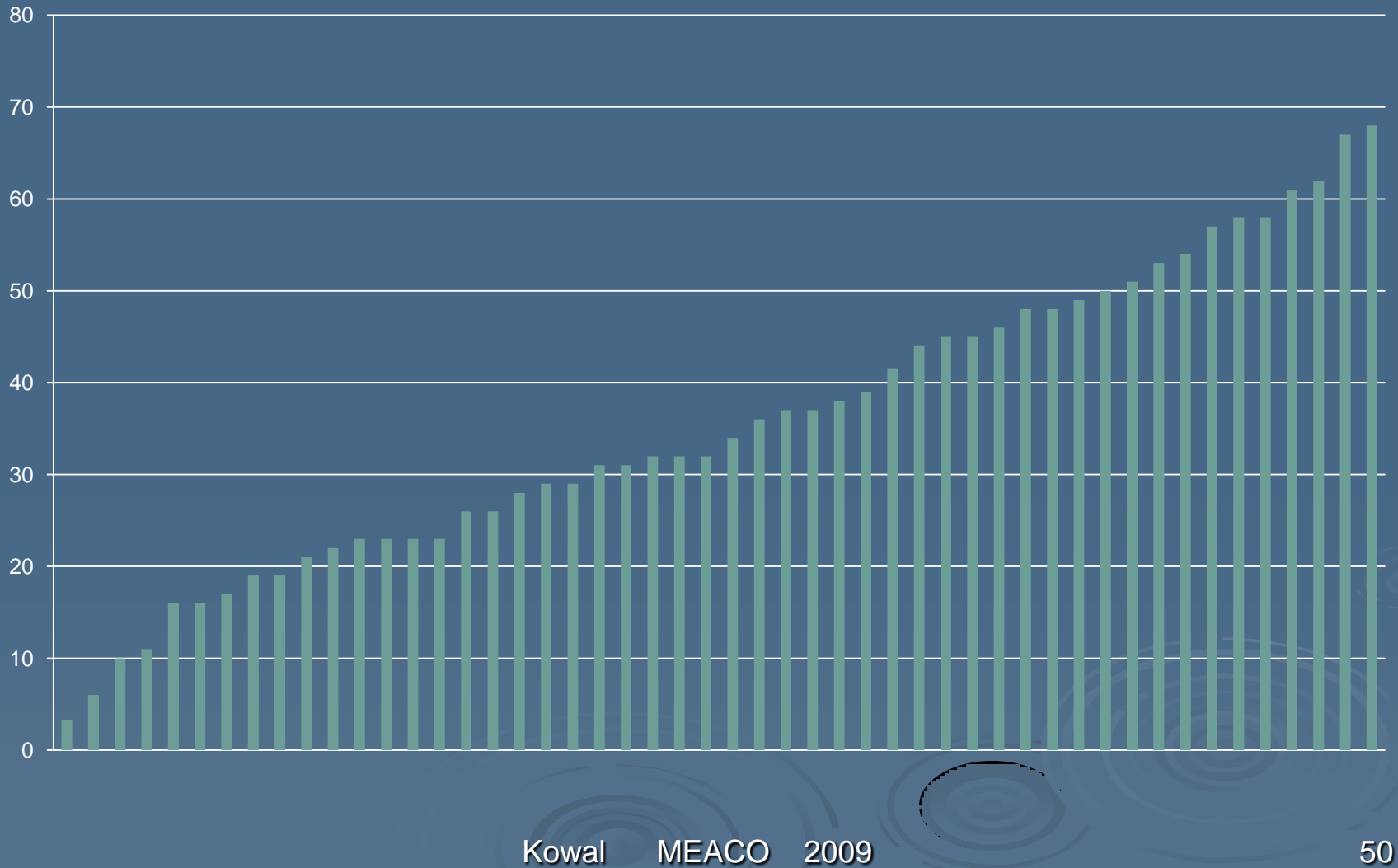
➤ Amblyopia

Mean time between ET and XT surgery

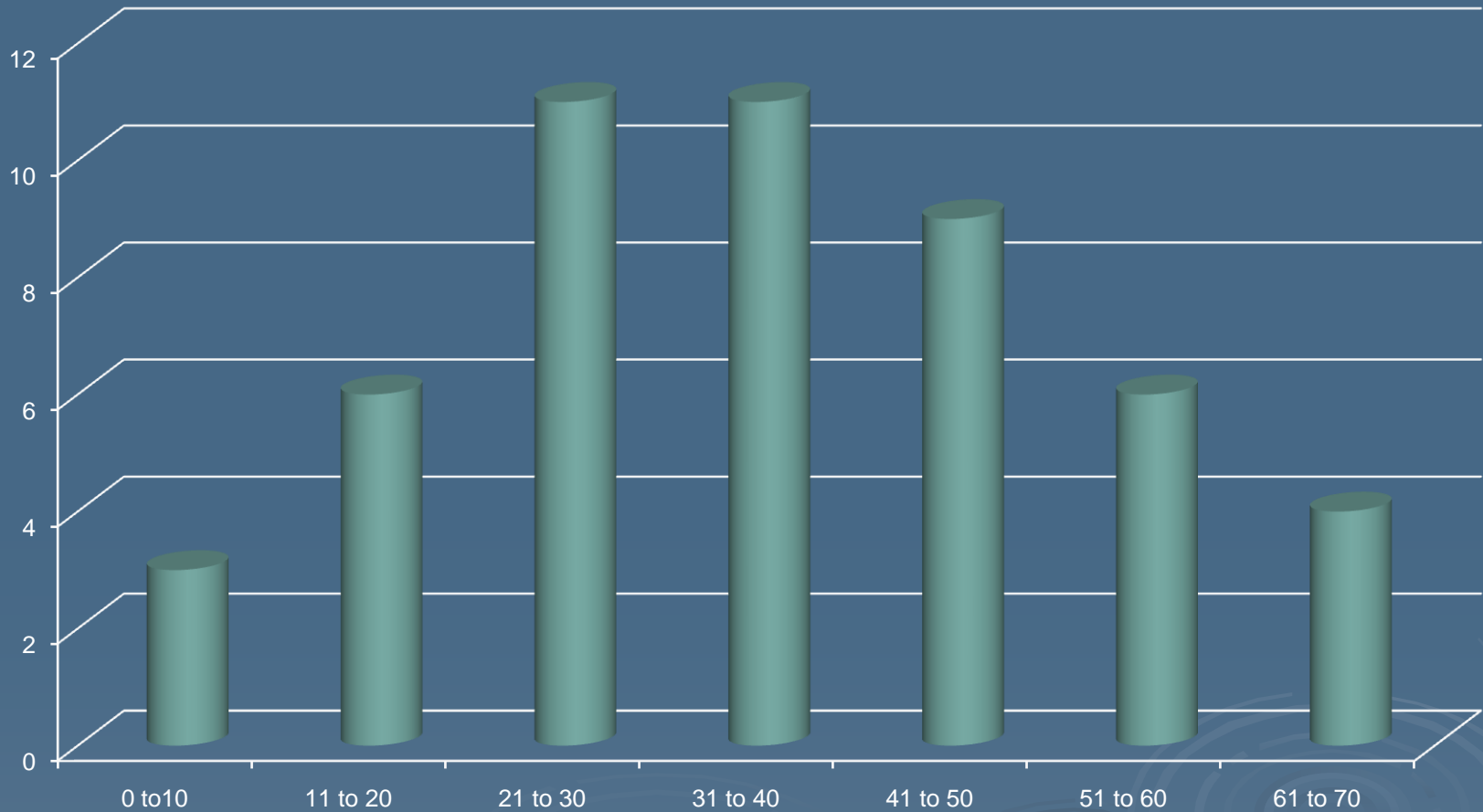
- for stretched scar group = 25.6 years (median 23)
- ALL: MEDIAN TIME TO SURGERY 22 YRS. AVERAGE 23.

Age distribution at time of XT surgery (Years)

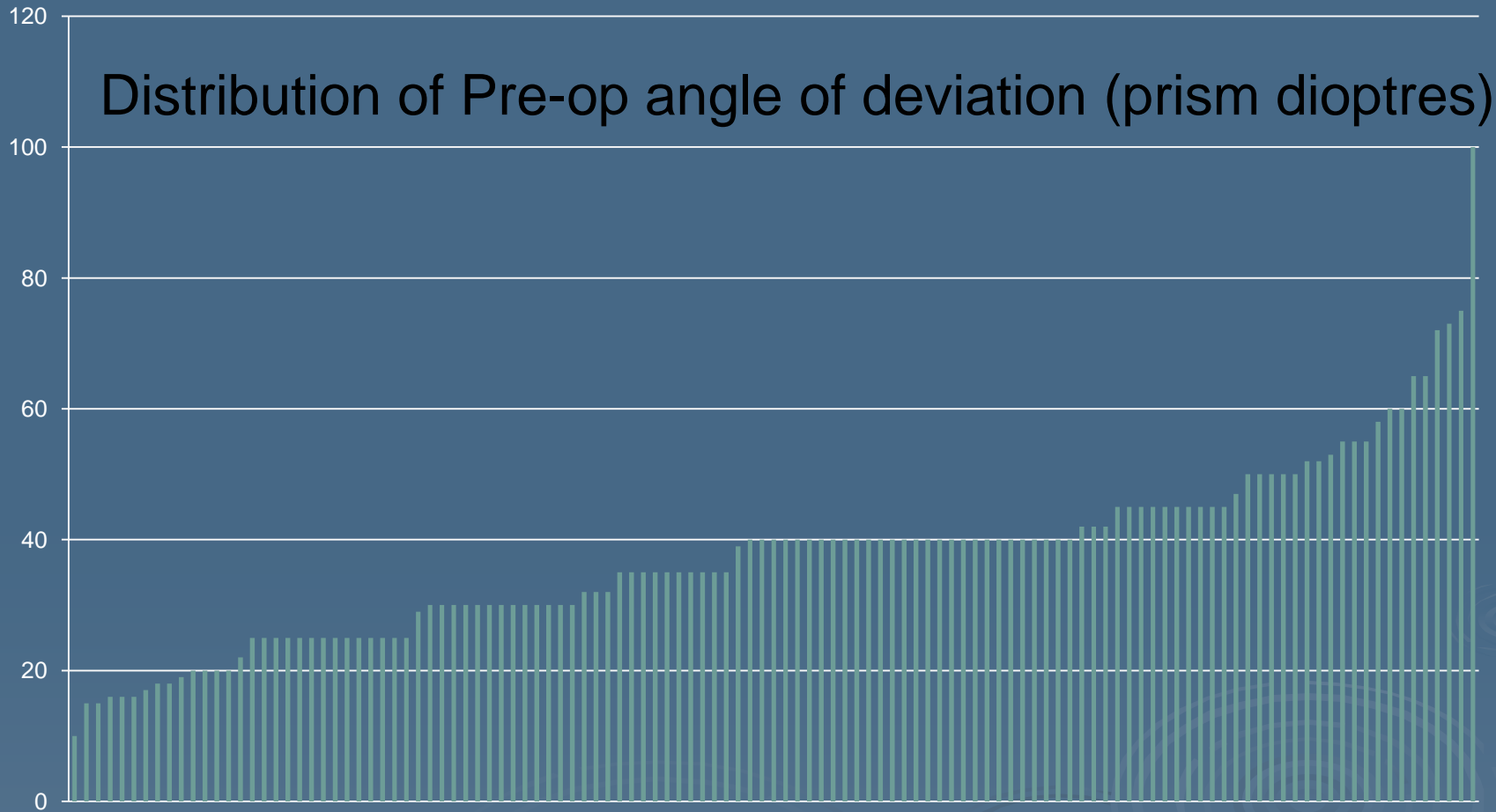
B



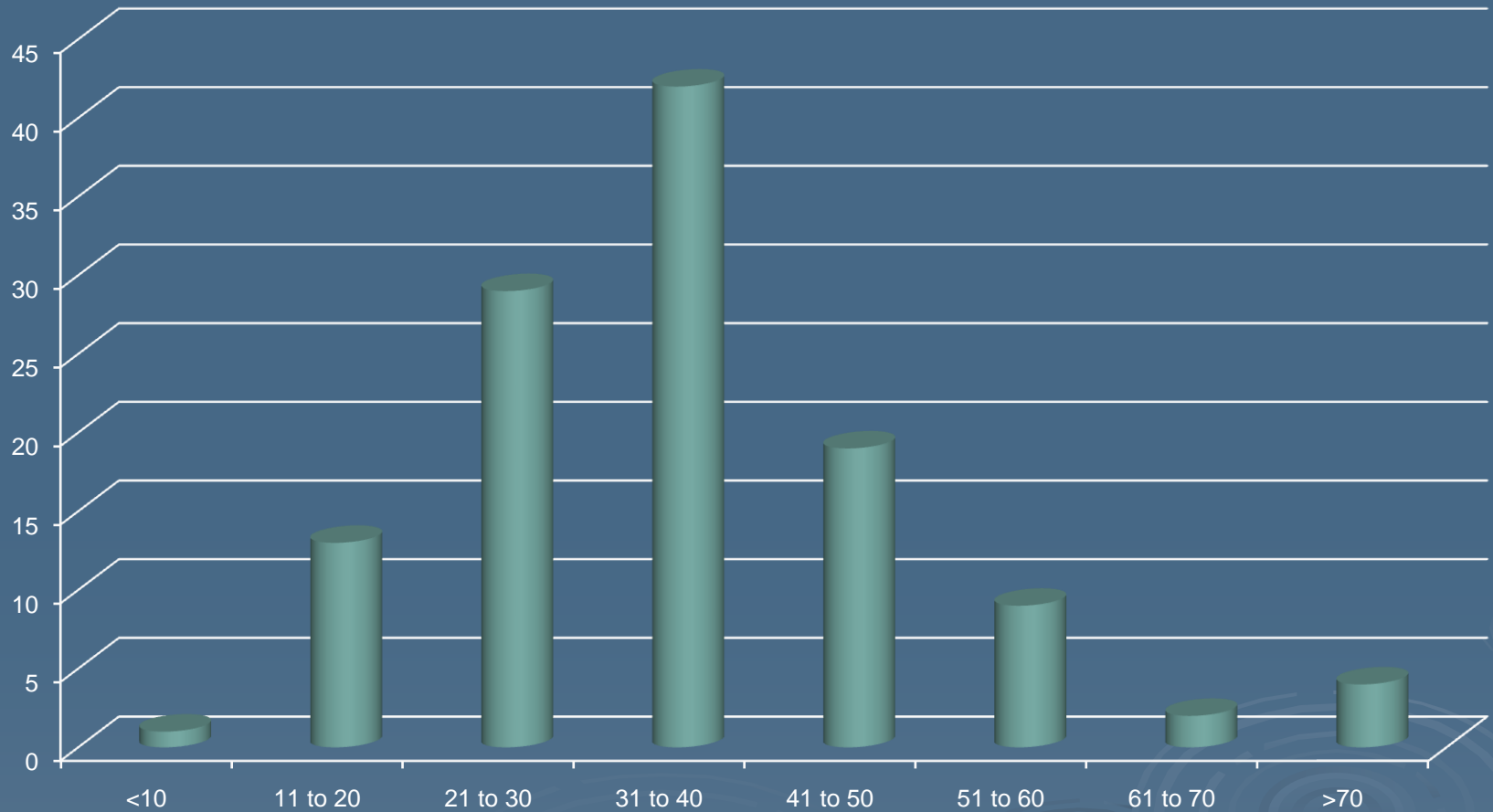
Age distribution (B) in years



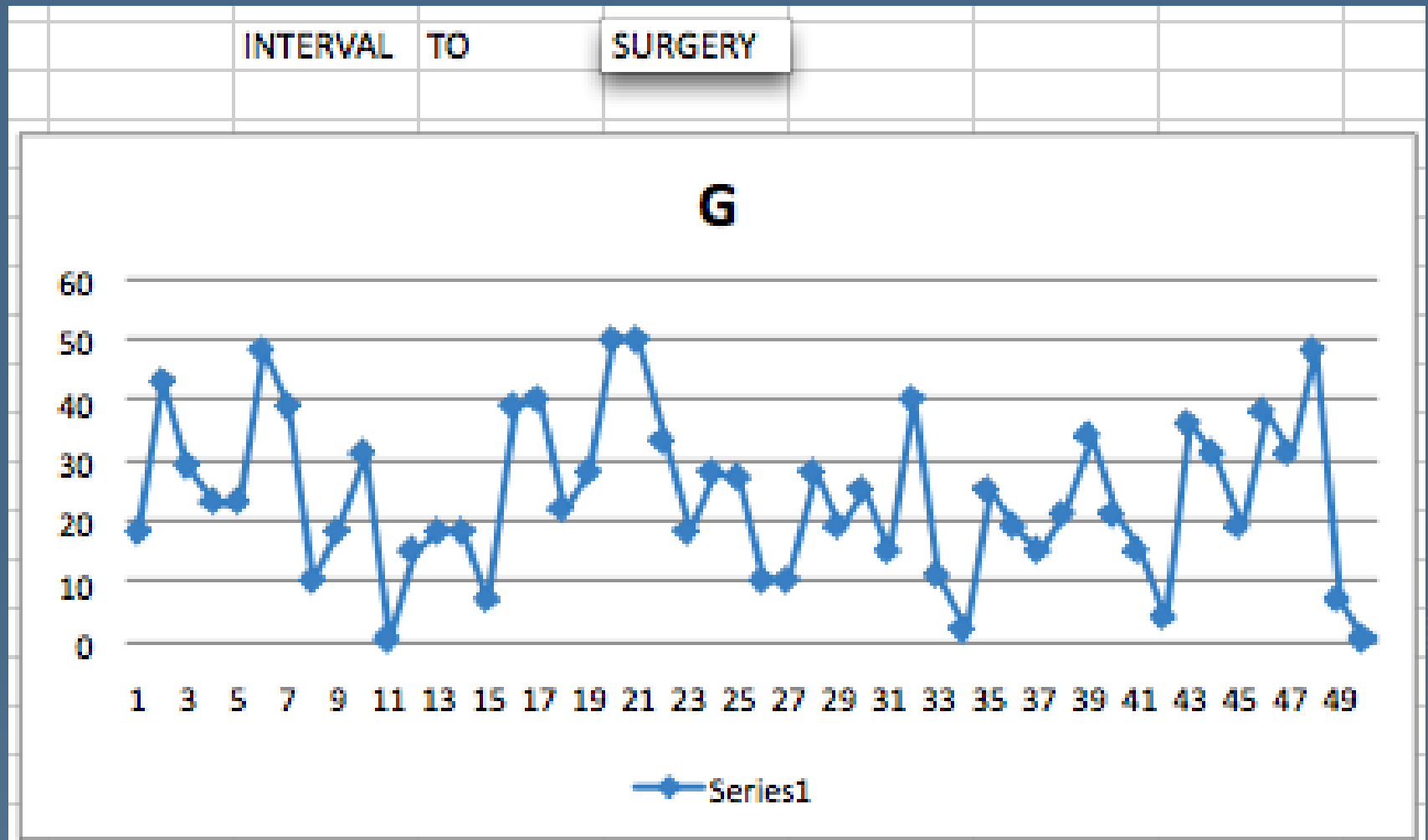
Distribution of Pre-op angle of deviation (prism dioptres)



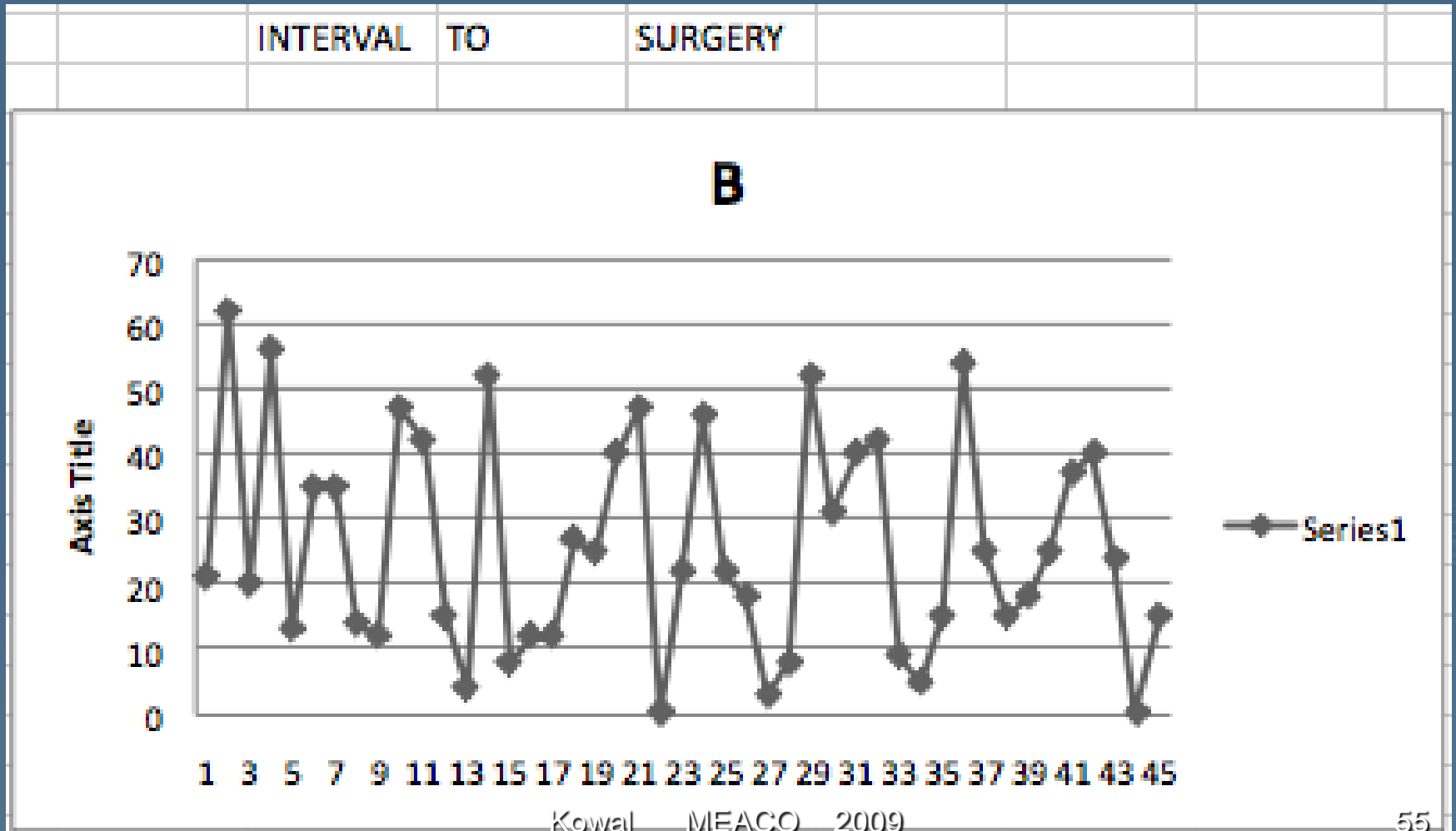
Distribution of pre-op angle (All)



'GENERIC' CONSEC XT



STRETCHED SCAR : LK SERIES



STRETCHED SCAR: LUDWIG SERIES

Scar Remodeling After Strabismus Surgery

587

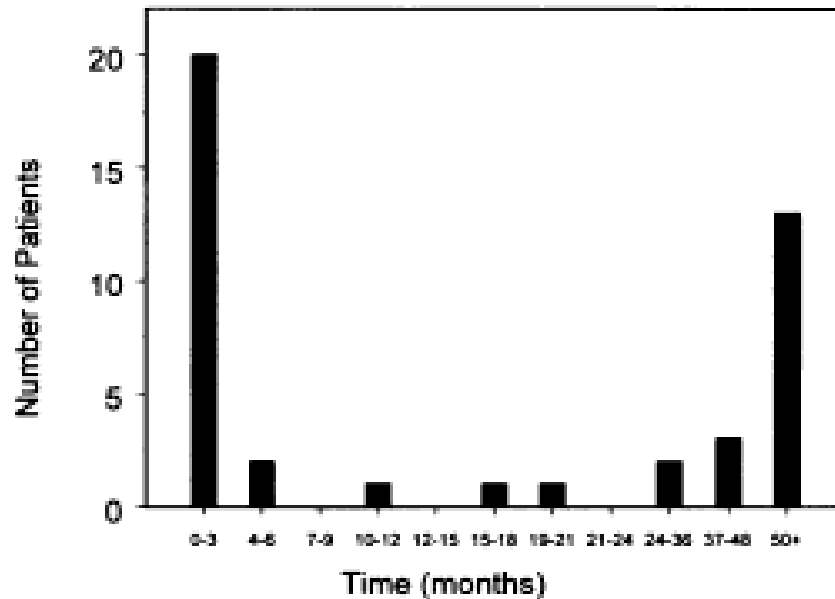


FIGURE 2

Time to stretch based on patient history or previous records (43 patients). Another 31 patients recalled gradual onset of secondary strabismus, 3 were aligned for years followed by subacute change, and 57 had no recollection.

Ludwig: time to stretch.

Kowal: time to surgery.

Stretched scar group

- Mean time between ET and XT surgery for B group (including 5 with B + something else) = 25.6 years (median 23)
- Age at time of XT surgery – Mean 35.5 years
- - median 33 years
- Range of ages at Xt Sx 3.3 to 68 years (ref graph slide 2