Virtual Reality Versus Donor Eye For learning Capsulorhexis: Clinical Trial

Niraj K. Agrawal [1],Haripriya Aravind [1],Tanpreet P. Singh [1], Puja Bhuwania [1]

1 Aravind Eye Hospitals and Post Graduate Institute of Ophthalmology, India

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Introduction

- Capsulorrhexis is one of the most important an difficult steps of cataract surgery to learn
- Animal eyes, donor eyes and manufactured eyes are used as a model for learning Capsulorhexis in wet lab
- Virtual reality simulator can be used as complimentary tool to teach Capsulorhexis

Purpose

- To compare the role of donor eye and EYEsi surgical simulator in learning Capsulorhexis for novice surgeon

Materials & methods

- Study Design- prospective, randomised clinical trial
- Sample size- 10 Ophthalmology residents each group without any experience of Capsulorhexis

  Group I – EYEsi surgical simulator

  Group II – Donor eye
- Total wet lab training period – 15 days

EYEsi Surgical Simulator

- Virtual operating microscope provides stereoscopic image to trainee
- Capsulorhexis module

  Task level 1& 3 – Rhexis predefined by a circular line

  Task level 4 – No line to faciliate orientation
- Each subject of Group- I performed one session on level 1& 3 followed by 15 sessions on level 4 over a span of 15 days

Donor Eye

- For capsulorhexis training on human eyes, donor eyes with corneal button excised for keratoplasty were used

- After completion of 15 days of wet lab training, residents performed capsulorhexis in 10 patients eye in OR under the supervision of a single surgeon

Metrics Evaluation

- Raising flap : Without peripheral extension and deep cortical fibres disturbance
- Completion of rhexis : Without peripheral extension
- Circularity : circular in shape
- Size : 6 - 7mm
- Time : < 3minutes
- Tissue protection : No endothelial touch, churning of lens fibres and iris touch

- Each of the above criteria was scored as 1 on completion or else it was scored as 0 (Total capsulorhexsis score = 6)

- Capsulorhexis that has run out of zonules was given a score of 0 for all criteria except for raising the flap

Results

Metrics for each group during capsulorhexis was analysed and compared by Chi square and Fisher's Exact test

Variables	Success Rate		
	Simulator Group-I	Donor Eye Group-II	P Value
Raising of flap	94%	94%	1.000
Completion of rhexis	54%	68%	0.151
Size (6 -7 mm)	32%	50%	0.067
Circularity	36%	56%	0.045
Time (3min)	40%	60%	0.046
Tissue Protection	50%	64%	0.157

	Simulator Group-I	Donor eye Group-II	P value
Total Score	51%	65.3%	0.001

- Variables like rhexis completion, size and tissue protection were better in Group II although not statistically significant

- Group II showed significantly higher success rate in circularity *(p=0.046)*,time *(p= 0.046)* and total score *(p=0.001)*

Discussion

- While donor eyes exactly simulate the human tissue characteristic, wet lab trial on porcine, manufactured eyes, on red glow grapes and Virtual reality (EYEsi) simulator has been done in various studies

- ***Bonnie An Henderson et al,*** in their study used porcine, manufactured and human eyes for learning capsulorhexis

- ***Chigusa Hashimoto et al***, attempted to change the capsular structure of porcine eyes by injecting formalin mixed hydroxy ethyl cellulose or visco elastic material

- ***Edwin -c-Figueria et al***, **used red glow grapes model and found that tension applied to grape skin by non dominant index finger and thumb does not accurately reproduce the effect of zonules on the capsule**

- **Virtual reality simulator still faces limitation with regard to tissue characteristics and the haptic feed back**

- **On EYEsi the haptic input comes from the fulcrum effect of the rigid plastic wall of the eye model,while there is no haptic feed back from intraocular tissue and eye wall *(Elisabeth Feudner et al)***

- The result of our trial clearly showed the benefits of donor eye

- We hypothesise that this may be due to
  - better tactile sensation
  - feel of tissue characteristic of human lens capsule
  - effect of zonules
  - haptic feed back from the capsule and eye ball

Conclusion

Wet lab practice on donor eyes is a very valuable tool in learning capsulorhexis

Thank You

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