Myopia Management aka Myopia Control

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Presentation Objectives
This presentation will
1. Discuss the prevalence of myopia
2. Review strategies for myopia control
3. Spectacles
4. Under-correction
5. Pharmaceuticals
6. Time outdoors
7. Accommodation control
8. Peripheral retinal defocus
9. Orthokeratology

Prevalence of Myopia
Ages 20-30’s
- USA: 36-44%, Increased about 20% in 30 years
- Europe: 42.3%
- Canada: 72.4%

Ages teen’s-20’s
- UK: 32%
- China: 95.5%, Increased >60% in 15 years
- Taiwan: 84%
- Singapore: 81.6%
- South Korea: 96.5%

Global change in human environment mainly in Education, Economics and Electronics.
Myopia is a Public Health concern since High myopia is leading cause of blindness

Incidence of Retinal Detachment
- < -4.74 0.015%
- > -5.00 0.07%
- > -6.00 3.2%

Macular choroidal neovascularization risks
- -1.00 to -2.002x
- -3.00 to -4.004x
- -5.00 to -6.009x

Myopia is a complex condition. The cause is multi-factorial
1. Genetic: myopic parents increase chance for myopia
2. Environment
3. Birth order, if first better vision function
4. Time outdoors
5. Accommodation
6. Amount of near demands

Interventions
1. Spectacles
2. Under-correction
3. Pharmaceuticals
4. Time outdoors
5. Accommodation control
6. Peripheral retinal defocus
7. Orthokeratology

Spectacles
Bifocal or Progressive lenses used to reduce accommodation were used for many years. Research did not show clinically meaningful effect, in fact suggests the “stigma” of bifocal could be seen as a handicap.
Bifocals, PALs to give added plus for near which Can SLOW progression in certain patients. Under-accommodation for near creates blur; added plus gets the patient in focus. Added plus helps those w/ near esophoria and increased accommodative lag.
Determine add that eliminates accommodative lag (and ideally the near eso)

Under-correction
Prescribing less minus is Not supported by published research, Not recommended
In fact……

The effect of myopic defocus on myopia progression was assessed in a two-year prospective study on 94 myopes aged 9-14 years, randomly allocated to an undercorrected group or a fully corrected control group. The 47 experimental subjects were blurred by approximately +0.75 D (blurring VA to 6/12), while the controls were fully corrected. Undercorrection produced more rapid myopia progression and axial elongation (ANOVA, F(1,374)=14.32, p<0.01).

Pharmaceuticals
Atropine Sulfate Ophthalmic Solution is a sterile topical anticholinergic for ophthalmic use. The anticholinergic effect of this product blocks the responses of the sphincter muscle of the iris and the accommodative muscle of the ciliary body to cholinergic stimulation, producing pupillary dilation (mydriasis) and paralysis of accommodation (cycloplegia).
Atropine: lots of side effects, but fairly effective in reducing progression
Side Effects:
Ocular: paralysis of accommodation and fixed mydriatic pupils
Systemic: decreased tears, tachycardia, restlessness and dryness of mouth, throat and skin.
Prolonged use may produce local irritation characterized by follicular conjunctivitis, vascular congestion, edema, exudate, and an eczematoid dermatitis. Severe reactions are manifested by hypotension with progressive respiratory depression. Coma and death have been reported in the very young.

Atropine 1%: 1 gtt 1% or lower concentration daily, long-term
Patient needs to use a spectacle add power and Patient needs sun/uv protection
Progression rates: 0.05 D/yr. myopia w/ atropine vs. 0.50 D/yr. untreated

400 children ages 6-16
200 test, 200 placebo
Rx: -1.00 to -6.00
One eye only/ one drop nightly
1% atropine reduced progression by 77%
Rebound upon discontinuation

ATOM 2 Chia A, et al. Atropine for the treatment of childhood myopia: Safety and efficacy of 0.5%, 0.1%, and 0.01% doses (Atropine for the Treatment of Myopia 2). Ophthalmology 2012;119:347-54.
Surprise findings
0.01% Atropine reduced myopic progression 0.49D over 2 years (<0.25/year).
This was to be the control for the two higher concentrations
Visual function was much better Accommodative amplitudes, Visual acuity, Pupil size
Slower rebound during wash-out period
0.01% Atropine used with peripheral retina control, Orthokeratology may be useful.

More Outdoor Time
The easiest and least expensive treatment possible!
Studies are inconclusive as to the measureable benefit of outdoor activity for myopia control. Vitamin D level not significant
The Association between Time Spent Outdoors and Myopia in Children and Adolescents.A Systematic Review and Meta-analysis
Justin C. Sherwin, MBBS, MPhil,1,2 Mark H. Reacher, MD,1 Ruth H. Keogh, DPhil,3 Anthony P. Khawaja, MBBS, MPhil,1 David A. Mackey, MD,2,4,5 Paul J. Foster, PhD6,7
Conclusions: The overall findings indicate that increasing time spent outdoors may be a simple strategy by which to reduce the risk of developing myopia and its progression in children and adolescents. Therefore, further RCTs are warranted to investigate the efficacy of increasing time outdoors as a possible intervention to prevent myopia and its progression.

Accommodation control
Vision therapy is Controversial; some claim great success
Emphasis on relaxing accommodation and improving divergence
Probably VT is mainly reducing accommodative excess/ pseudomyopia

Accommodative biofeedback using Accomdotrac Vision Trainer
Patients supposed to learn to relax accommodation
Research study questions its efficacy
Unaided VA improved some, without ↓ myopia

Peripheral Optics
Myopes have relative peripheral hyperopia
Emmetropes and hyperopes exhibit peripheral myopia which can effect axial elongation


Stimulus to axial length elongation is mid-periphery defocus
mid-periphery in focus = no elongation
mid-periphery hyperopic defocus = elongation > myopia
mid-periphery myopic defocus = no progression?

Using the knowledge to create contact lenses producing myopic peripheral defocus

**Standard fit: GP or Soft lenses**
On average, patients progress in myopia more slowly WHILE wearing GPs
Rebound effect in myopia if lens wear ceases
Single vision SCLs don’t appear to have any effect on progression
Same as spectacle lens wearers

**Soft Multi-focal Lenses**
Center distance soft multifocals have been presented as a way to reduce myopic progression by forcing a peripheral myopic defocus which is thought to slow axial elongation. Preliminary results on small numbers of subjects are encouraging but more randomized study is required. Requires the wearing of the lenses during the day V/A is somewhat reduced during lens wear due to the multifocal

**Multifocal Soft lens study data**
In a 2 year study conduct by Walline, Greiner et al, they demonstrated at year two an increase in myopia of
-.51+-0.06 in the MFL group
-1.03+-0.06 in the single vision historical control group
An increase in axial length of
0.29mm +/- 0.03mm in the MFL
0.41mm +/- 0.03mm in the SV historical control group
Distance Center MF SCL holds some promise....
Orthokeratology

Lenses can produce significant corneal flattening. Recent research suggests ortho-K may prevent axial elongation in some children.

Overnight OrthoK lenses (reverse geometry design) produce a corneal shape that seems to prevent axial length progression. Relatively Flatter in the center, Steeping in the mid-periphery which produces focused image on the macula but Mid-peripheral focus/myopic.

Myopia Management/ Control with OrthoK

Myopic progression is age dependent
- Age 7-8 most rapid: 65% increased 1.00 or more
- Age 9-10: 13% increased


“On average, subjects wearing ortho-k lenses had a slower increase in axial elongation by 43% compared with that of subjects wearing single-vision glasses. Younger children tended to have faster axial elongation and may benefit from early ortho-k treatment.”

What to look for when recommending OrthoK

1. Amount of myopic increase
2. Parents myopic
3. Time outdoors
4. Maturity of child
5. Parents understanding of procedure

Top 10 Important Things to look for Orthokeratology

1. Sphere Refractive Error : Approval -1.00 to -5.00 at corneal plane, goal -2.00 to -3.00
2. Astigmatic Refractive Error: cylinder should be <1/2 sphere; 1.50 or less WTR cyl, 0.75 or less ATR cyl
3. Keratometry: moderate K’s: 41.00-46.00 best
4. Topography: Corneal cylinder: Big differences in cylinder or Oblique axis that do not match up. ATR cylinder decenters, Cylinder NOT to limbus if >1.50D.
5. Eccentricity: 0.3 to 0.7 good, 0.55 average, <0.3 or >0.7 lens design adjustments
6. Pupil size: Best if <5 in normal light
7. HVID: 11-12mm since lens diameter ~90% of HVID. >12mm spherical corneas have centration issues.
8. Age: younger corneas change faster
9. Tear film: no staining or swelling
10. Motivation: realistic expectations
Case 1
11 year old child with >0.50D myopic progression per year.
Current Rx
  OD -3.50 sphere
  OS -3.50 -0.50x075
Unaided acuity
  OD 20/300
  OS 20/300
Both parents are myopic
Motivation: Swims and cannot see in the water, Reduce progression of myopia

OrthoK lenses
Labs have product specific designs. Some use Diagnostic fit from trial set or supplied lenses
Euclid Systems uses empirical design: Send Rx, manual K’s, Eccentricity, HVID, pupil size then the Lab designs lenses. Other labs have similar offerings
Paragon CRT offers sure-fit: 3 lenses send, return 2

Dispensing Initial unaided VA: 20/300
Emerald Lens: OD 8.88, 10.6, OS 8.82, 10.6
Would you dispense?
  Good comfort, VA with lenses 20/15, Over-refraction: Plano OD & OS
  No Halos or distortion

Day 1 after 6 hours sleeping with lenses
Unaided VA
  OD 20/50, OS 20/50 Continue wearing lenses

Week 1
Unaided VA
  OD 20/25+, OS 20/20- , continue wearing lenses

1 Month follow up
Unaided VA 20/20 all day, clear comfortable vision
  Initial Rx -3.50
  September 2013: -3.50D, 20/300
  September 2014: -0.25, 20/20
Patient and parents are very happy!

Orthokeratology Day 1 procedures come in with lenses on.
History: # of hours sleeping with lenses on (6 or more is best), Comfort VA with lenses on
Over-refraction: +/- 0.50ish best
Remove lenses
Unaided VA
Refration
Topography: Treatment zone centered, Check for Central islands

**Week 1-3: Afternoon visit with lenses off but bring lenses to the visit**
- Follow Up testing procedures
- History: Use of lenses, Vision changes, Happy with outcome
- Unaided VA
- Refraction
- Topography
- Slit lamp
- Inspect lenses
- Review care and handling
- Schedule follow up
- Consider ordering second pair of lenses

**Recommendations**
- Keep the lenses clean since this reduces the risk of Central Staining.
- Stress the importance of conditioning the lens surface prior to wear.
- Consider artificial tear prior to lens insertion
- Use suction cup remover to take lenses off.

**Very Important !!!!**
- Be PATIENT, No changes until one week post or when consecutive results are found.
References


Chia A, et al. Atropine for the treatment of childhood myopia: Safety and efficacy of 0.5%, 0.1%, and 0.01% doses (Atropine for the Treatment of Myopia 2). Ophthalmology 2012;119:347-54


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Atropine for the treatment of childhood myopia: An article review
