COPE Course ID : 93965-PB / 94238-PB

RECENT ADVANCES IN THE PREVENTION AND CONTROL OF MYOPIA

Speaker: Prof Ian MORGAN (Australia) Visiting Fellow, Research School of Biology, Australian National University, Australia

COPE COURSE OUTLINE

RECENT ADVANCES IN THE PREVENTION AND CONTROL OF MYOPIA

Course Description

This course presents an overview of recent advances in the prevention and control of myopia, with a dual focus on prevention through public health measures, and control through clinical interventions. In the context of myopia, this largely equates to prevention of the onset of myopia through public health interventions in schools, and clinical interventions to control the progression of myopia.

Course Learning Objectives

To ensure that participants are aware of and understand:

- The rationale for joint public health and clinical responses to complex diseases
- Major characteristics of the current epidemic of myopia in East and Southeast Asia
- The individual and social costs of the epidemic
- Associations of myopia with risk factors, and whether they are proximal or distal, and causal
- The major causal risk factors, namely intense educational pressures from an early age, and limited time outdoors
- Current prospects for prevention of myopia based on increasing time outdoors and reducing educational pressures, and barriers to implementation
- Current methods for the clinical control of myopia progression
- The implications of the concepts of premyopia and hyperopic reserve
- The likely outcomes from rigorous implementation of public health and clinical approaches

Course Outline

1. Many common diseases require social control through public health measures such as vaccinations and other measures for reducing transmission, as well as advanced medical treatments. Public health interventions are more likely to lower overall social costs.
2. In most of East Asia and parts of Southeast Asia, the prevalence of myopia has reached around 80% in children completing 12 years of schooling. This poses the challenge of timely correction of myopia throughout the school years and beyond. The prevalence of potentially pathological high myopia has reached 10-30% at the same stage, which poses the need to control the progression of myopia.
3. This situation has been reached in all of East Asia, but only in Singapore in Southeast Asia, but an emerging epidemic in most of Southeast Asia, and indeed most of the world, has been predicted.

4. Some of the economic costs of this epidemic have been estimated. An estimate for mainland China suggested that inadequate correction of myopia could cost China 1-3% of its GDP, predominantly through loss of productivity. Full social costs have never been assessed.
5. Epidemiological conclusions have oscillated between genetic and environmental causes of myopia. The rapid emergence of the epidemic has demonstrated that environmental exposures must play a major role. In addition, molecular genetic research has not found the associated genetic variation expected from twin studies.
6. Numerous associations of myopia with risk factors have been reported. It is important to distinguish between proximal and distal risk factors, and most importantly, between those that are causally associated with myopia.
7. Two powerful causal risk factors have been identified, namely intense educational pressures from an early age, and limited amounts of time spent outdoors.
8. Other risk factor associations reported, such as with sleep, or with GDP, may not be causal.
9. An evolutionary perspective suggests that for most of human history, there was little myopia, and the little that existed was probably genetic in origin, because there was no formal education and people spent a lot of time outdoors. Myopia started to emerge as a major social problem only as mass education systems started to develop over the last 200 years.
10. The epidemic of myopia began to emerge in East Asia and Singapore after the end of the Second World War, as the Asian Tiger economies started to develop mass education systems..
11. The emergence of an epidemic of myopia was delayed in China by political factors, but rapidly emerged once China started on the same path of rapid economic development.
12. Increasing the amount of time that children spend outdoors presents as an obvious approach to prevention, but may be limited by the heavy learning demands imposed on children in East Asia. However, concentrating on the preschool and early primary years may make this more feasible. This approach has been most systematically pursued in Taiwan.
13. Decreasing the educational load in the early years has not been systematically pursued, and this approach may be limited by the heavy rote-learning load imposed by learning to read and write Chinese characters, as compared to alphabetical or syllabic writing systems.
14. The recent Double Reductions policy in mainland China, while not developed to deal with myopia, aims to reduce early educational pressures, and may free up more time for outdoor activities during the school day. These developments need to be closely monitored in terms of development of myopia and ultimate educational outcomes.
15. In contrast to the uncertainties of the school-based public health approaches, clinical management of myopia and the control of myopia is more straight-forward. Correction of myopia may be facilitated through development of systematic school screening and referral.
16. Orthokeratology, use of low-dose atropine, and myopia defocus and dot technology spectacles are now well-established approaches. All seem to be effective, and generally safe. Precautionary logic suggests that the least invasive approaches should be preferred.
17. Red light therapy appears to provide a promising approach, but unresolved questions about its safety have been raised.
18. Recently, the concept of a premyopic state, in which children are at high risk of becoming myopic, has been developed. Adapting clinical interventions for controlling myopia progression to limit myopic shifts in refraction, thus preventing the development of myopia, is now an active research area.
19. An old concept of hyperopic reserve as a protection from myopia has also been revived. This has two levels of meaning – one is that the more hyperopic you are, the further you have to go to become myopic. But there is a deeper meaning to the concept. Epidemiological

research suggests that the preferred state for refraction is in the range +1.0D to +1.50D. Once refractions drop out of this range, myopia rapidly develops, particularly in younger children. The time window for prevention is thus quite narrow.

20. Projections based on currently available methods for control of myopia progression suggest that prevention of most of the excess high myopia associated with the epidemic is feasible. These methods should now be standard of practice for optometrists and ophthalmologists.
21. Projections based on the less well-established school-based interventions used in Taiwan suggest that substantial reductions in the prevalence of myopia can also be achieved with systematic implementation.

COPE Course ID : 93966-GO / 94239-GO

How Might Astigmatic Blur Affect Myopia Control

Speaker: Prof KEE Chea-su (Hong Kong) Head & Professor, School of Optometry; Associate Director, Research Centre for SHARP Vision, The Hong Kong Polytechnic University, Hong Kong

Course Description

This talk addresses the significant public health issue posed by the myopia epidemic and the need to explore the role of astigmatism due to its frequent coexistence with myopia.

Course Learning Objectives

By the end of this lecture, the audience should be able to:

- Appreciate the importance of understanding the origins of myopia control strategies
- Differentiate characteristics of optical signals driving eye growth
- Recognize evidence supporting astigmatism's role in myopia development
- Discuss the potential impacts of astigmatic blur on myopia control strategies

Outline

I. Origins of myopia control strategies
   a. Importance of animal studies
   b. Refractive parameters
   c. Structural parameters
   d. An example of a successful myopia control strategy

II. Optical signals regulating refractive development
   a. Form deprivation
   b. Spherical defocus
   c. Astigmatic blur

III. Role of astigmatism in myopia development
   a. Clinical evidence
   b. Empirical evidence

IV. How might astigmatic blur affect myopia control
   a. On-axis vs. off-axis optical aberrations
   b. With-the-rule vs. Against-the-rule astigmatism
   c. Neuronal vs. structural

COPE Course ID : 93967-PH / 94240-PH

How does atropine inhibit myopia - do we understand its mechanism of action?

Dr Regan ASHBY (Australia) Associate Professor, Molecular & Biochemical Therapeutics, University of Canberra, Australia

Course description

This course will present the latest evidence regarding the suggested mechanism by which atropine inhibits myopic eye growth. This presentation will outline why it is critical to understand how a drug functions, with regards to safety and efficacy, and how determining the mechanism by which atropine functions is extremely complex due to its broad-spectrum action. This course will also touch on clinical considerations when prescribing atropine.

Course learning objectives

- Understand the drug family to which atropine belongs.
- Understand its broad cross-reactivity with other families of receptors in the eye.
- Appreciate the difficulties in determining the mechanism by which atropine inhibits ocular growth due to its broad cross-reactivity and the extensive binding capability of atropine within all layers of the eye.
- Appreciate the literature with regards to the efficacy of atropine when prescribed at different doses.
- To review our understanding of the safety profile of atropine.
- To review the clinical considerations when prescribing atropine to a patient already being treated with psychotropic compounds for behavioral disorders or alike.

Outline

- Understanding the drug family to which atropine belongs
    - Atropine is a muscarinic-cholinergic antagonist
- Understand the cross-reactivity with other families of receptors in the eye
    - Atropine can bind the following family of receptors:
        - Nicotinic-cholinergic
        - Serotonergic
        - Adrenergic
- Determining the mechanism by which atropine inhibits ocular growth is complex
    - Understanding the action of atropine is complicated by a number of factors that will be discussed, including: the role of receptor subtypes, receptor

distribution (the potential for multiple target sites), receptor specificity (cross-reactivity), drug pharmacokinetics, genetic variability, interactions with the disease state, and compensatory mechanisms in response to drug treatment.

- At what dose and treatment frequency is atropine most effective, and is there evidence that its action change with dose?
    - Atropine has been trialed at a number of doses in the range of 0.01-1%, we will discuss the findings.
    - Animal models indicate that atropine's mode of action may change at different concentrations of use.
- The safety profile of atropine.
    - To review the short-term and long-term ocular changes observed in animals and humans and to discuss any potential risks.
- To review the clinical considerations when prescribing atropine to a patient already being treated with psychotropic compounds for behavioral disorders or alike.
    - There are a number of psychotropic compounds that may interact with atropine (or vise versa). What are the clinical implications?

COPE Course ID : 94027-GO / 94383-GO

Myopia Management: From Control to Prevention

近視管理：由控制到預防

Speaker: Prof CHEN Zhi (Mainland China) Director, Specialty Contact Lens & Myopia Control Center, Fudan University Eye & ENT Hospital, Shanghai, China

Course description

This course describes the trend of myopia onset over time, provides ECPs with the methodology to identify children at high risk, and reviews on the clinical trials aiming at myopia prevention through slowing of axial elongation in children. The latest research findings of this field will be discussed.

Course learning objectives

- To recognize the most advanced techniques in myopia control
- To understand the trend of myopia onset over time and its impact
- To know how to predict refractive status without cycloplegia in children
- To learn to identify the children at higher risk of myopia onset and fast progression
- To know what is available as potential interventional measures for delaying myopia onset

Outline

1. The standard of care for myopia control in children
    A. Optical: orthokeratology, multi-focal SCLs, multiple segments spectacle lenses
    B. Pharmaceutical: different concentrations of atropine
2. The trend of myopia onset over time in China and its impact
3. Predicting refractive status without cycloplegia in children
    A. Using big database of over 36,000 children
    B. Predicting refractive status based on age, gender, K reading, and axial length

4. Interventions for delaying myopia onset
    A. Outdoor activity
    B. Repeated low red light (laser therapy)
    C. Atropine
    D. Highly aspheric lenslets spectacles
5. Case studies
    A. A 6-year old girl, who has two myopic parents, presenting with uncorrected visual acuity of 0.8 in both eyes, has an averange corneal K reading of 43.00 and axial length of 22.85. Her initial non-cycloplegic auto-refraction is -1.25D.
    1) Is she myopic? How do you know without cycloplegic refraction?
    2) Is she at high risk of myopia onset or progression?
    3) What else information do we need to process on intervention?
    4) What is the first recommended intervention will you give to the child and her parents?
    5) What if step four does not work out in a few months?

    B. An 7-year old boy diagoned of -0.25D with uncorrected visual acuity of 0.8 in both eyes, just did a follow-up visit. His axial elongation during the last three months was 0.2 mm, without any optical or pharmaceutical interventions. His father and grand-mother were highly myopic. The boy was extremely sporty and refused to wear spectacle lenses. What is the best option for myopia control at this stage?
    1) Is he at high risk of fast progression? Why?
    2) Does he need intervention immediately?
    3) What's the best option at hand, given that he's reluctant to wear spectacles?
    4) How soon should the ECP follow up on him?
    5) What's the alternative plan if step three does not work out as expected?

Use of atropine for prevention of myopia onset in pre-myopia children

Speakers: Dr CHEN Jun (Mainland China)
Senior Researcher, Shanghai Eye Disease Prevention and Treatment Centre, Shanghai, China

Outlines For Lecture

Description:

This lecture is to introduce both the established and emerging evidence on atropine for myopia prevention. It will provide a comprehensive overview of the characteristics and latest findings on premyopia, the effectiveness of atropine in preventing myopia among premyopic children, and future potential research directions.

Learning Objectives:

· To understand the concept of premyopia and the characteristics of premyopia.

· To know the current evidence on permyopia and the knowledge gap.

· To know the effectiveness of atropine on myopia prevention among premyopia.

· To know the future potential research direction of atropine on myopia prevention among premyopia.

Outline of Lecture:

I. Why prevention is more important?

a) The burden of myopia and myopia complications

b) The cost-effectiveness of myopia prevention and control

II. Why premyopia is a key stage for myopia prevention?

a) The characteristics of premyopia

b) The prevalence of premyopia

c) The current findings on premyopia

III. What is the evidence of atropine on myopia prevention among premyopia children

a) Results from LAMP2

b) Upublished results from Shanghai

c) Findings form other related studies

IV. What is the potential mechanism and how to interpret it?

a) The known and unknown evidence about premyopia and atropine

b) Potential mechanism for premyopia

c) Future potential research direction