



**High Definition Light Emitting Diode
(LED)
Medical Lighting**

**HEALTH TECHNOLOGY ASSESSMENT SECTION
MEDICAL DEVELOPMENT DIVISION
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DISCLAIMER

Technology review is a brief report, prepared on an urgent basis, which draws on restricted reviews from analysis of pertinent literature, on expert opinion and / or regulatory status where appropriate. It is not subjected to an external review process. While effort has been made to do so, this document may not fully reflect all scientific research available. Additionally, other relevant scientific findings may have been reported since completion of this review.

Please contact: htamalaysia@moh.gov.my, if you would like further information.

Health Technology Assessment Section (MaHTAS),
Medical Development Division
Ministry of Health Malaysia
Level 4, Block E1, Precinct 1
Government Office Complex
62590 Putrajaya

Tel: 603 88831246

Fax: 603 8883 1230

Available at the following website: <http://www.moh.gov.my>

Prepared by:
Dr Junainah Sabirin
Principal Assistant Director
Health Technology Assessment Section (MaHTAS)
Ministry of Health Malaysia

Reviewed by:
Datin Dr Rugayah Bakri
Deputy Director
Health Technology Assessment Section (MaHTAS)
Ministry of Health Malaysia

DISCLOSURE

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EXECUTIVE SUMMARY

Introduction

Light emitting diode, commonly called LED is an electronic semiconductor device that emits light when electric current passes through it. LED do not have a filament that will burn out and they do not get very hot. They are illuminated solely by the movement of electrons in a semiconductor material. A new range of high definition LED medical lighting has been developed. The lamps developed are designed for use in major and minor surgical applications, in addition to general medical examination. It is claimed that High definition LED is a brand new technology with vastly better performance than standard definition LED or conventional surgical lights. This technology review was conducted following a request from the Director of Development and Planning Division, Ministry of Health Malaysia who received requests from surgeons and anaesthetists to use LED medical lighting instead of the halogen lighting (conventional).

Objective /aim

To assess the efficiency and cost-effectiveness of high definition LED medical lighting.

Results and conclusions

The search strategies did not yield any articles related to the efficiency and cost-effectiveness of high definition LED medical lighting used for surgical lighting /operating theatre light. However, there was an article on the use of LED-based light sources for endoscope and one article on the use of LED-based light sources for fluorescence imaging. In conclusion there was no evidence to show the efficiency and cost-effectiveness of high definition LED medical lighting used for surgical lighting /operating theatre light compared to the conventional halogen light.

Recommendation

Based on the above review, clinical research is warranted to show the efficiency and cost-effectiveness of high definition LED medical lighting before it can be recommended for used in operating theatres.

Methods

Electronic databases were searched, which included PubMed, Ovid Medline(R) from 1950 to October Week 4 2009, EBM Reviews-Cochrane Central Register of Controlled Trials, EBM Reviews-Cochrane database of systematic reviews, EBM Reviews - HTA Databases, Horizon Scanning database (National Horizon Scanning Centre, Australia and New Zealand Horizon Scanning.), FDA database and MHRA for published reports. Google was searched. There was no limit in the search. All published articles related to efficiency and cost-effectiveness of high definition LED medical lighting was included.

HIGH DEFINITION LIGHT EMITTING DIODE (LED) MEDICAL LIGHTING

1. INTRODUCTION

Light emitting diode, commonly called LED is an electronic semiconductor device that emits light when electric current passes through it.¹ LEDs are found in many devices. They form the number on digital clocks, transmit information from remote controls, light up watches, form images on a jumbo television screen or illuminate traffic lights.²

Basically, LEDs are just tiny bulbs that fit easily into electrical circuit. But unlike ordinary incandescent bulbs, they do not have a filament that will burn out and they do not get very hot. They are illuminated solely by the movement of electrons in a semiconductor material, and they last just as long as a standard transistor.²

For many years tungsten halide filament lamps have been the primary lighting source for surgical applications and despite some drawbacks, have proven surprisingly robust. Most importantly tungsten halide provides very good colour quality rendition (a pre-requisite for surgical lighting) and is technically simple. Early attempts to replace filament lighting with LED technology were not particularly successful. However, newly available cool brightness LEDs provided the stimulus to reassess LED technology as a potential replacement for tungsten halide.³ A new range of high definition LED medical lighting has been developed by [REDACTED] in the United Kingdom. The lamps developed are designed for use in major and minor surgical applications, in addition to general medical examination. It is claimed due to the solid-state technology used, the lights generate no heat, produce only visible light, and require very little maintenance, as there are no bulbs to replace and the sealed units are easy to clean. In addition, the manufacturer claimed that the lights are extremely efficient, using up to 60 per cent less energy than the current lighting products.⁴

This technology review was conducted following a request from the Director of Development and Planning Division, Ministry of Health Malaysia who received requests from surgeons and anaesthetists to use LED medical lighting instead of the halogen lighting (conventional).

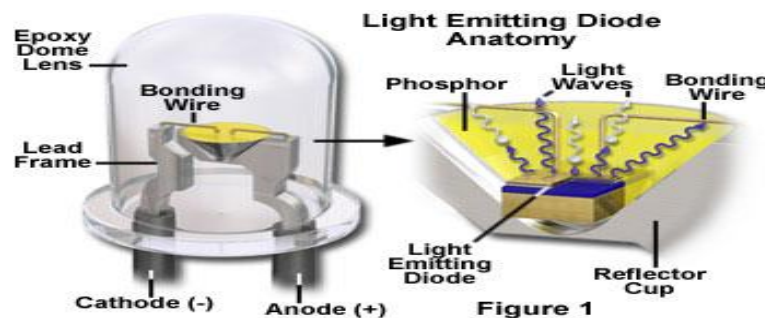
2. OBJECTIVE /AIM

To assess the efficiency and cost-effectiveness of high definition LED medical lighting.

3. TECHNICAL FEATURES

3.1. Light emitting diode (LED)

LED is an electronic light source. LEDs work by the effect of electroluminescence discovered in 1907. All early devices emitted low-intensity red light, but modern LEDs are available across the visible, ultraviolet and infra red wavelengths, with high brightness. LEDs are based on the semiconductor diode. When the diode is switched on, electrons are able to recombine with holes and energy is released in the form of light. This effect is called electroluminescence and the colour of the light is determined by the energy gap of the semiconductor. The LED is usually small in area (less than 1 mm²) with integrated optical components to shape its radiation pattern and assist in reflection.⁵



3.2. High Definition LED Surgical lighting / Operating Theatre light.

It is claimed that high definition LED is a brand new technology with vastly better performance than standard definition LED or conventional surgical lights.⁶

High definition LED has the unique feature of:^{6,7}

- Full Spectrum Colour Rendition - the only surgical lighting with near perfect colour rendition across the visible full spectrum. This reduces eye strain and enables small differences in the tissue to be distinguished easily.
- Fat beam illumination - big, adjustable light beams with more light across the full width of the illuminated area. This allows for uniform vision across the full illuminated area.
- Red Balance Control - the highest R₉ red colour rendition of any product provides the optimum visualization of red tissues. Red balance enhancement compensates for our weakness in distinguishing shades of red for optimum visualization of red tissues.
- Perfect lighting - LEDs do not emit infra red light thus producing 'cold light' that is light from the visible spectrum without heat rays.

- Long life - the life of LED is around 30,000 hours which would be the lifetime of the product.
- Infection control - incorporating Polygiene™ anti-microbial technology to destroy harmful bacteria, viruses and yeasts including MRSA
- Reduced infections - designed and proven to work in ultra clean ventilation (UCV) theatres without disrupting the laminar air flow.
- Efficiency and Cost - High definition LED is massively more efficient at producing more surgical quality light for less power ensuring the light is both economical and environmentally friendly. Using only 100W at full power is a massive three times reduction in power consumption when compared to the power used by the tungsten halogen version.
- Protecting our planet- does not use mercury, lead, Cadmium, CFCs, VOCs, POPs or halogens
- Intergrated Video and Audio – specially designed for integration with the latest Audio-Visual Technology.



4. Methodology

4.1. Searching

Electronic databases were searched, which included PubMed, Ovid Medline(R) from 1950 to October Week 4 2009, EBM Reviews-Cochrane Central Register of Controlled Trials, EBM Reviews-Cochrane database of systematic reviews, EBM Reviews - HTA Databases, Horizon Scanning database (National Horizon Scanning Centre, Australia and New Zealand Horizon Scanning), FDA database and MHRA for published reports. Google was searched. There was no limit in the search.

The search strategy used the terms which were either used singly or in various combinations; HD LED, “high definition ”, “high definition LED”, “light emitting diode”, “surgical lighting” “operating theatre light”, “Galaxy Ultra LED”, and “medical lighting”.

4.2. Selection

All published articles related to efficiency and cost-effectiveness of high definition LED medical lighting was included.

5. RESULTS AND DISCUSSION

There was no retrievable evidence on CE marking or FDA approval.

The search strategies did not yield any articles related to the efficiency and cost-effectiveness of high definition LED medical lighting used for surgical lighting /operating theatre light. However, there was an article on the use of LED-based light sources for endoscope and one article on the use of LED-based light sources for fluorescence imaging.

Lee *et al.* compared the illuminated field using LED endo-illuminator or an arc-lamp based endoscope in terms of uniformity, shadow sharpness and overall image intensity. He concluded that the LED endo-illuminator provides more uniform illumination with sharper shadows, less flickering and better illumination for visual perception than the arc-lamp based system currently used.⁸

Gioux *et al.* described the development of LED-based light sources image-guided surgery, in particular fluorescence-guided surgery in a large-animal model.⁹

6. CONCLUSION

There was no evidence to show the efficiency and cost-effectiveness of high definition LED medical lighting used for surgical lighting /operating theatre light compared to the conventional halogen light.

7. RECOMMENDATION

Based on the above review, clinical research is warranted to show the efficiency and cost-effectiveness of high definition LED medical lighting before it can be recommended for used in operating theatres.

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