Premature babies are sensitive to light. The more premature the baby, the more this applies. At the same time, it is not enough to simply dim the light; this is a complex topic.
Influence of light on premature babies

Most people find it difficult to sleep in the presence of bright light. Formerly however, despite this, the most vulnerable patients, the premature babies in neonatal intensive care units, were often exposed to continuous bright light. Even as late as the 1980s, a light intensity of 600 to 1,000 lux was generally accepted\(^1\), which is equivalent to the harsh lighting in a TV studio.

Protection from intense light

Nowadays, people are aware that premature babies need a light environment that promotes their development and understand that intense light should be avoided. This applies not only to babies born before the 32nd week of gestation, who are especially at risk because their pupillary light reflex has not yet developed, but to all premature babies. Several studies have shown that a supportive light environment reduces the level of cortisol, extends sleep duration, stimulates the release of growth hormones, and encourages the early development of a circadian rhythm\(^2^3\). Continuous bright lighting is therefore detrimental to premature babies. But what is the alternative? Three different approaches are found in common practice: first, a cyclical light exposure regimen, usually with a nighttime phase and daytime phase of 12 hours each; second, dimmed lighting so the light is turned down whenever the premature baby is asleep; and third, a continuously dimly lit environment.

Cyclical light exposure is especially beneficial

Several studies have shown that cyclical light exposure imitating the circadian sleep-wake rhythm is the most beneficial and can even shorten the length of stay in the hospital. Amongst other things, it has positive effects on systems including vital parameters and hormone regulation. Additional reasons:

- Guyer et. al.\(^4\) reported that premature babies exposed to cyclical lighting had longer nighttime sleep periods than those exposed to dimmed light.
- Borniger et al. found in animal experiments that even low lighting of 5 lux at nighttime resulted in increased anxiety-like behaviour and delayed growth\(^5\).
- Exposure to cyclical light also significantly reduces crying and agitation in very small premature babies (30.6 ± 0.95 weeks), while simultaneously showing faster weight gain and greater daytime activity for these babies (in comparison to those exposed to dimmed light)\(^6\).
- Furthermore, in any case, a neonate's eyes are not yet fully developed, but the eyes of premature babies are even more so underdeveloped. A baby cannot even open its eyes until about the 26th week of pregnancy. Following this time, the type and intensity of visual stimuli affect the development of visual acuity, colour vision, growth of the eyeball and retina development\(^7\).

Dimmed lighting as an alternative method?

Morag and Ohlsson reported that continuous dim light clearly had similar disadvantages to continuous bright light\(^8\): the underlying idea – that it is also dark in the uterus – does indeed appear obvious to start with. Nevertheless, a foetus also experiences a rhythm due to increased activity, higher noise levels and also stronger lighting during the day as compared to nighttime, which is not taken into account with continuous dim lighting practices.

Moreover, a study of mice showed that light in the uterus promoted foetal eye development\(^9\). The explanation for this finding is that the visual pigment melanopsin is already created before birth. Experiments presented by a research team surrounding Richard Lang from the Cincinnati Children's Hospital Medical Center found that in the darkness of the uterus the pigment can "recognise" whether it is bright "outside". If no light signals reach the uterus, this can lead to impaired vision or blindness.

In addition, there is another completely different aspect to continuous dim lighting that has to be taken into consideration: the effect of the light on hospital staff and the parents. A certain minimum level of light makes it easier for the staff to carry out their work. It is also sometimes

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necessary – for instance when detecting neonatal jaundice – to reliably measure the baby’s skin colour, which makes it essential to have light of sufficient intensity and colour. As for the parents, there are explicit indications that not only the stress, but also the artificial light, can lead to sleep disorders among family members if they spend nights in the neonatal unit\(^7\). Similarly, there may be detrimental effects on the staff’s sleeping patterns.

A complex topic

All these indications suggest unequivocal benefits from exposure to cyclical light. Accordingly, the American Academy of Pediatrics (AAP) has issued clear recommendations for introducing cyclical light in neonatal intensive care units. The American College of Obstetricians and Gynecologists also recommends this type of light practice. Furthermore, the light source should be infinitely adjustable within the range of 10 to 600 lux and the area for each patient should be equipped with spotlights for individualised lighting. However, it is not always easy to implement the recommendations in day-to-day clinical practice. Amongst other challenges, it is not very easy to estimate how much light the premature babies are actually exposed to. A large number of aspects have to be taken into consideration.

For example, the direction of a light source plays a major role – it should never be shining directly into the baby’s face. It is also relevant whether the device being used is open or closed. Even the thickness of the device’s walls has an influence because it determines how the light is refracted. Another consideration is the device cover which restricts the influence of the light from above far more than it restricts light from the side. However, if no cover protection is provided, the light will affect the premature baby’s eyes less when it is lying on its side than when it is on its back\(^7\). In other words, if the premature baby is lying in a darkened room in an incubator with a cover, the best position for the baby is on its back. If the incubator does not have a cover, the best position for the baby is on its side.

And finally, not all covers are the same. The thicker and darker the cover, the better it is at reducing the amount of light. Then there are sleep masks which reduce the amount of light considerably better than covers do.

All these aspects show that determining the lighting conditions for premature babies is more complex than it appears at first. However, at the same time, it is very important for the development of these tiny patients that this topic be tackled in order to give them the best possible start in life.

Summary

- Light used to be an underestimated topic on neonatal wards because it is more complex than it seems.
- Today we know that light can damage the child’s development in many ways.
- At the same time, circadian light regimes can exert a positive influence on premature babies.
- It is therefore important to control and limit the influence of light.
REFERENCE:


