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Wood's lamp

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Wood's lamp was invented in 1903 by a Baltimore physicist, Robert W. Wood.[1] It was first used in dermatology practice for the detection of fungal infection of hair by Margarot and Deveze in 1925.[2] Wood's lamps are small, durable, inexpensive, safe and very easy to use. Although mainly used in the diagnosis of some infective and pigmentary dermatoses, they have recently been used as a diagnostic tool for certain skin cancers.

Physics

Wood's lamp [Figure - 1] emits long-wave UV radiation (UVR), also called black light, generated by a high pressure mercury arc fitted with a compound filter made of barium silicate with 9% nickel oxide, the "Wood's filter." This filter is opaque to all light rays except a band between 320 and 400 nm with a peak at 365 nm. Fluorescence of tissues occurs when Wood's (UV) light is absorbed and radiation of a longer wavelength, usually visible light, is emitted. The output of Wood's lamp is generally low (< 1 mw/cm²).[2] The fluorescence of normal skin is very faint or absent and is mainly due to constituents of elastin, aromatic amino acids and precursors or products of melanin.[3]

Technique of Wood's lamp examination

The use of a Wood's lamp does not require great skill. However, some practical points should be kept in mind to avoid misinterpretation of results.[4],[5],[6]

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- The lamp should ideally be allowed to warm up for about 1 minute.
- The examination room should be perfectly dark, preferably a windowless room or a room with black occlusive shades.
- The examiner should get dark adapted in order to see the contrast clearly.
- The light source should be 4 to 5 inches from the lesion.
- Washing the area before subjecting it for Wood's lamp examination should be avoided since it may yield false negative results due to dilution of the pigment.
- Topical medicaments, lint and soap residues should be wiped off from the site to be examined since these may fluoresce under Wood's light. Common sources of error are bluish or purplish fluorescence produced by ointments containing petrolatum, green fluorescence by salicylic acid containing medicaments, and light reflected from examiners white coat producing light blue fluorescence.

Applications of Wood's lamp



Superficial fungal infections

Tinea capitis

The first use of Wood's lamp was for the detection of tinea capitis based on the fact that some dermatophyte species produce characteristic fluorescence under UV light. The chemical responsible for the fluorescence is pteridine.[7] Wood's lamp is helpful in the diagnosis and treatment of an individual patient as well as for mass screening and control of epidemics in schools.[8] It can also help to assess the length and response to treatment; the end point being emergence of non-fluorescent hair. Dermatophytes that cause fluorescence are generally members of the *Microsporum* genus. However, the absence of fluorescence does not necessarily rule out tinea capitis as most *Trichophyton* species, with the exception of *T. schoenleinii*, are non-fluorescent.[7] The fluorescence pattern of dermatophytes is shown in [Table - 1].

Pityriasis versicolor

Malassezia furfur emits a yellowish-white or copper-orange fluorescence. Wood's lamp can detect sub-clinical infection and the extent of infection. It can also help distinguish *Pityrosporum folliculitis* from other causes of folliculitis.[9]

Bacterial Infections



Pseudomonas infections

Pathogenic *Pseudomonas* species produce a pigment 'pyoverdin' or 'fluorescein' which shows green fluorescence under Wood's light. Fluorescence is detected when the bacterial count exceeds 10⁵/cm², the number required for infections.[10] Wood's lamp can detect early *Pseudomonas* infection of burn wounds and widespread cutaneous erosions in pemphigus, toxic epidermal necrolysis and Stevens-Johnson syndrome. The diagnosis of ecthyma gangrenosum can also be made earlier than confirmatory blood culture reports by injecting saline into the wound and examining the solution thus withdrawn under Wood's light.[11]

Erythrasma

Corynebacterium minutissimum shows coral red fluorescence under Wood's light due to water soluble coproporphyrin III produced by the organisms. Hence, washing the area will remove the fluorescence. Subclinical colonization by these organisms can also be detected using Wood's lamp, in the toe webs, scalp or the trunk.[8],[9]

Acne vulgaris



Coproporphyrin is the major porphyrin produced by *P. acnes* that imparts orange-red fluorescence to the comedones inhabited by *P. acnes*. Facial follicular fluorescence correlates well with the *P. acnes* population.[12]

Coral red fluorescence is frequently seen in normal individuals over facial follicular openings and the papillae of the tongue. Similar fluorescence due to proto- or coproporphyrins may be occasionally seen in squamous cell carcinomas and even non-malignant leg ulcers. Some

malignant neoplasms of the gastrointestinal or respiratory tracts may show similar fluorescence.

Pigmentary disorders



Hypopigmentary and depigmentary dermatoses

a) Hypopigmentation in fair skinned persons can be very difficult to discern. In hypopigmented or depigmented lesions there is less or no epidermal melanin. Consequently, there is a window through which the light induced autofluorescence of dermal collagen can be seen. Due to the abrupt cut-off in the visible emission from lesional skin, the margins of hypopigmented or depigmented spots appear sharper under Wood's light. The lesions appear bright blue-white due to autofluorescence.[6]

Wood's lamp is therefore helpful in making a diagnosis of vitiligo[13] and particularly differentiating it from pityriasis alba, leprosy and post-inflammatory hypopigmentation or for identifying evolving lesion in a fair skinned person. It is similarly useful in demonstrating evolving lesions of chemical leukoderma[13], leukoderma associated with melanoma,[14] the ash leaf macules of tuberous sclerosis,[15] and hypomelanosis,[16] especially in the fair skinned. Wood's lamp can also help to differentiate nevus depigmentosus from nevus anemicus; the latter does not show accentuation with Wood's light. Follicular repigmentation following oral photochemotherapy can also be demonstrated earliest by the use of Wood's light.

Hyperpigmentary dermatoses

Wood's lamp can be used to determine the depth of melanin in the skin. The variations in epidermal pigmentation become more apparent under Wood's light. For dermal pigmentation, this contrast is less pronounced. However, this applies only for the fair skin types and not for type V or VI skin.[17]

Based on Wood's light findings, Sanchez et al[18] classified melasma into four subtypes:

epidermal, dermal, mixed and Wood's light inapparent. Wood's light may also serve as a prognostic guide in the treatment of melasma, as the epidermal type of melasma is more likely to respond favorably to depigmenting agents than other types.

Wood's lamp can also be a very useful guide in chemical peeling. Addition of salicylic acid (in a 1:5 ratio) or fluorescein sodium (1:15 ratio) to peeling solutions and observing for green and yellow-orange fluorescence respectively under Wood's light helps to avoid overcoating of the peeling solution and ensures the even treatment of all areas.[19]

Porphyria



Detection of excess porphyrins in the teeth, urine, stool samples, red blood cells and blister fluid in different forms of porphyrias can easily be done with the help of Wood's lamp. Addition of dilute hydrochloric acid to the sample being examined intensifies the fluorescence by converting porphyrinogens to porphyrins.[20] The types of fluorescence observed in the principal porphyrias are shown in [Table - 2].

Photodynamic diagnosis



A relatively newer, non-invasive and simple technique is being developed for the diagnosis of premalignant and malignant conditions. It involves the application of 20% ALA ointment to the tumor and leaving it on for 4-6 hours under occlusion, allowing protoporphyrinogen IX to accumulate, after which the area is illuminated with Wood's light. This photodynamic diagnosis has proved very useful in the diagnosis of basal cell epithelioma, squamous cell epithelioma, Bowen's disease, solar keratosis and extramammary Paget's disease.[21]

Miscellaneous uses



The other lesser recognized but useful applications of Wood's lamp include:

- Demonstration of a burrow in scabies by applying a fluorescent substance like tetracycline paste or fluorescein dye.[22]
- Detection of systemically administered drugs such as tetracycline or mepacrine in the skin and nail lunulae.[23],[24] Topical tetracycline hydrochloride demonstrates coral red fluorescence which changes to yellow after a few minutes under Wood's lamp examination.
- Assessing the protective value of sunscreen creams and barrier creams in industry.[25]
- Wood's lamp may be useful for the detection of allergens on the skin in cases of cosmetic allergies. It has been occasionally used for photo-patch testing although it is not an ideal source for this test. Use of fluorescent markers during patch tests or other tests that require identification of the skin site after 24 or 48 hours is aided by a Wood's lamp. Wood's lamp is also reported to be useful in assessing the adequacy of application of protective creams in industry to prevent contact dermatitis.[25],[26]
- Calculation of the circulation time by injecting intravenous fluorescein.[22]
- Studying cutaneous penetration and epidermal turnover through fluorescent tags.[22]
- Detection of semen on the skin in cases of sexual abuse.[27]
- Wood's light has a sterilizing effect on *Staphylococcus aureus* and mycobacteria and may be used to sterilize culture media.[28]
- Wood's lamp has been used occasionally as a powerful suggestive treatment for warts in pediatric patients with some success.[29]
- UV lamp is also widely used by financial institutions to check fake paper currency or verify signatures and in the industry to detect cracks in ceramics or metals.[6]

Wood's lamp is a simple, non-invasive device chiefly used for the diagnosis of infective and pigmentary dermatoses by dermatologists. However, newer uses, like its application in photodynamic diagnosis of skin cancers, are being continually explored.

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