CHARACTERIZATION OF SKIN LAYERS BY DIFFRACTION OF COLLAGEN FIBRES

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Collagen accounts for about 75% of the skin total dry weight and it is located predominantly in dermis. Changes in orientation and arrangement of this macromolecule during aging and diseases processes are partly responsible for alteration in skin morphology and mechanical properties. These alterations are manifested as wrinkling, loss of elasticity, dryness and impairment in the barrier function. Thus, analysis of collagen characteristics such as distribution, and orientation can provide insight concerning skin functions and conditions.

Small angle X-ray scattering (SAXS) using Synchrotron source is an excellent tool for retrieving the structural organization of tissues rich in collagen. A number of SAXS studies have been performed to study tendom, bone and breast samples. In skin research, SAXS reported very interesting data concerning to the organization of stratum corneum (SC) lipids. However, the use of this powerful technique for skin collagen evaluation has still to be explored. In the present work, we utilize SAXS with Synchrotron radiation to study the supramolecular arrangement of skin layers: SC, epidermis and dermis. Skin samples from subjects of different ages were evaluated. Additionally, skin samples containing areas with stretch marks were studied and compared with intact control skin. Although the most detailed structural information was obtained from the pattern of collagen located in the dermis, reflections corresponding to the intercellular lipid organization of SC were also evidenced. Healthy skin samples presented the characteristic collagen pattern showing series of narrow rings associated to the repeat distance of 67 nm. SAXS patterns of samples from younger subjects presented higher number of diffraction orders and marked anisotropy probably due to a higher degree of orientation of collagen. Comparison of the scattering pattern from normal and stretched skin indicated different organization in the collagen of these samples. This work introduces SAXS using Synchrotron radiation to study skin collagen and to characterize different skin layers in several conditions. The evaluation of collagen arrangement reports information about the aging and conditions of the tissue and the systematic study of different samples allows obtaining scattering signatures characteristic of each skin layer. All in all, the potential of this methodology as a tool for skin studies should be considered.