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LETTER TO THE EDITOR

Characterization of women's young and mature skin by the 50 MHz high-frequency ultrasound technique

To the Editor,

High-frequency ultrasound imaging (HFUS) is a real-time powerful tool for the diagnosis, clinical management, and therapy monitoring of skin conditions. This study aimed to describe the impact of skin aging from a dermal perspective. The images of the skin of the subjects were randomly collected from the flexor and extensor areas of the forearms. The areas were marked 10 cm up from the subjects' wrists, and parameters from the dermis were analyzed to characterize the young and mature skin.

Several skin changes caused by aging were observed. In a woman's young and healthy skin (Figure 1A,B), the epidermis appears as a hyperechoic line (entrance echo), which is highly reflective; the dermis appears as a less bright hyperechoic band, with dermal echogenicity mainly provided by collagen and brighter than the subcutaneous tissue, which appears as a hypoechoic band due to fat lobes. The dermal content of collagen, its type, orientation, and beam size affect dermal reflectivity/echogenicity.[1]

In the other skin images indicated in Figure 1C,D, the gradual aging of the skin is evidenced with the advanced age. According to Figure 1, the echogenicity decreases with aging, especially in the upper dermis, due to the sensitiveness of the relationship between this parameter and the content and organization of collagen bundles.[2] With aging occurs atrophy of the dermis, elastosis, decrease and fragmentation of collagen fibers, increase of matrix-degrading metalloproteinases and inflammatory infiltrates, alteration of the structure of the connective tissue of the dermis, decreased dermis veins, etc[3,4] These topics also justify the changes in echo-texture observed in this skin layer.

The parameters obtained by HFUS can detect both intrinsic and extrinsic aging. Yet, since the causes of intrinsic and extrinsic aging are different, many clinical signs may appear but they can be difficult to differentiate.[3,4] We compared the characteristics of the flexor (with a predominance of intrinsic aging) and extensor forearm area (chronically exposed) of the same person (Figure 2). In the older subject's image, the protected region (Figure 2A) presents a less evident subepidermal low-echogenic band (SLEB) when compared to the exposed one (Figure 2B). SLEB has been defined as a visible low echogenicity band in the upper dermis immediately below the epidermal input echo and it is an important indicator of photoaging and is probably a visual manifestation of elastosis, degradation of collagen, and accumulation of glycosaminoglycans and aqueous tissue in the papillary dermis.[5]

The images of the younger subject did not present SLEB in any of the situations (Figure 2C,D). Plus, the images of the photo-exposed region and the older subject presented hypoechogenic dermal areas in the dermis in greater quantity and with greater contrast (Figure 2).

Data on changes in the deeper layers of the dermis are not yet well elucidated. However, in Figure 2, the younger skin shows a more echogenic lower dermis than the older skin, besides presenting greater uniformity of the echo-texture.[6]

In this report, several skin changes caused by aging could be described and evaluated by the 50 MHz HFUS. In general, the younger skin presents greater dermal echogenicity and fewer irregularities. Also, it is possible to infer the severity of photoaging from the presence and dimension of SLEB in the upper dermis. Mature skin presents less dermal echogenicity, a greater amount of hypoechogenic infiltrates in the dermis, and a pronounced SLEB. The method can be used as a complementary and accurate instrument in evaluations of skin aging, effectiveness of cosmetics, and anti-aging dermatological treatments, allowing a new level of efficacy evaluation of dermatological and cosmetic products.

Mariane Massufero Vergilio and Silas Arandas Monteiro e Silva should be considered first authors.

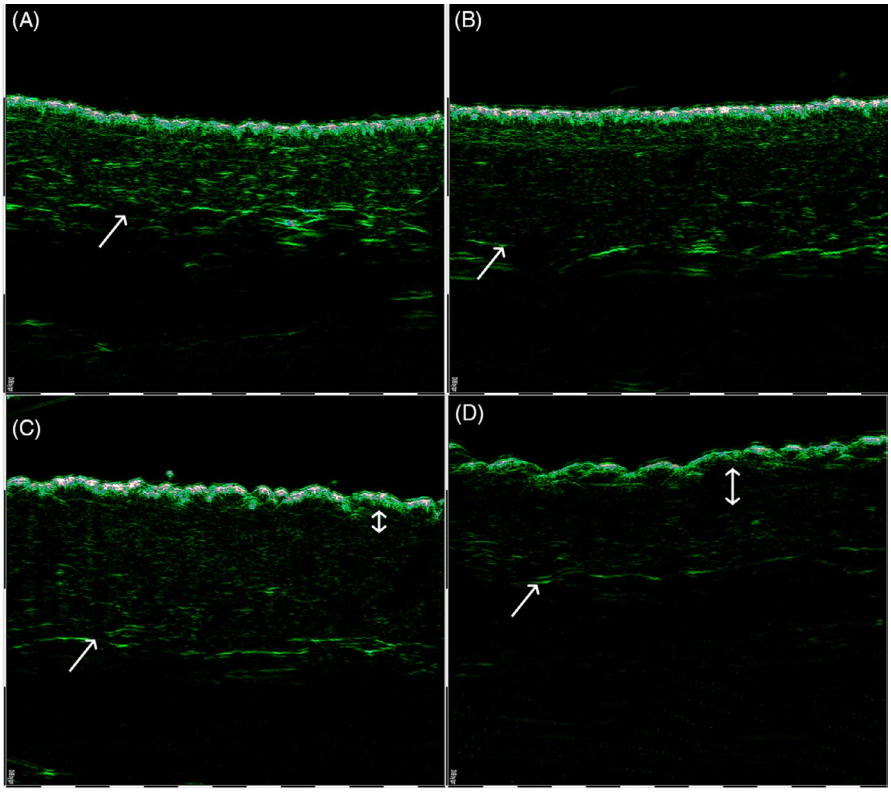

FIGURE 1 Sample of skin imaging using US 50 MHz (B-Scan system), showing the main alterations caused by aging. Sonographic skin images were obtained from the inner part of forearms from, respectively: a 19-y-old woman (A) 22-y-old woman (B), a 56-y-old woman (C), and a 60-y-old woman (D). The arrows indicate regions of the dermis that show changes between the images, caused by aging

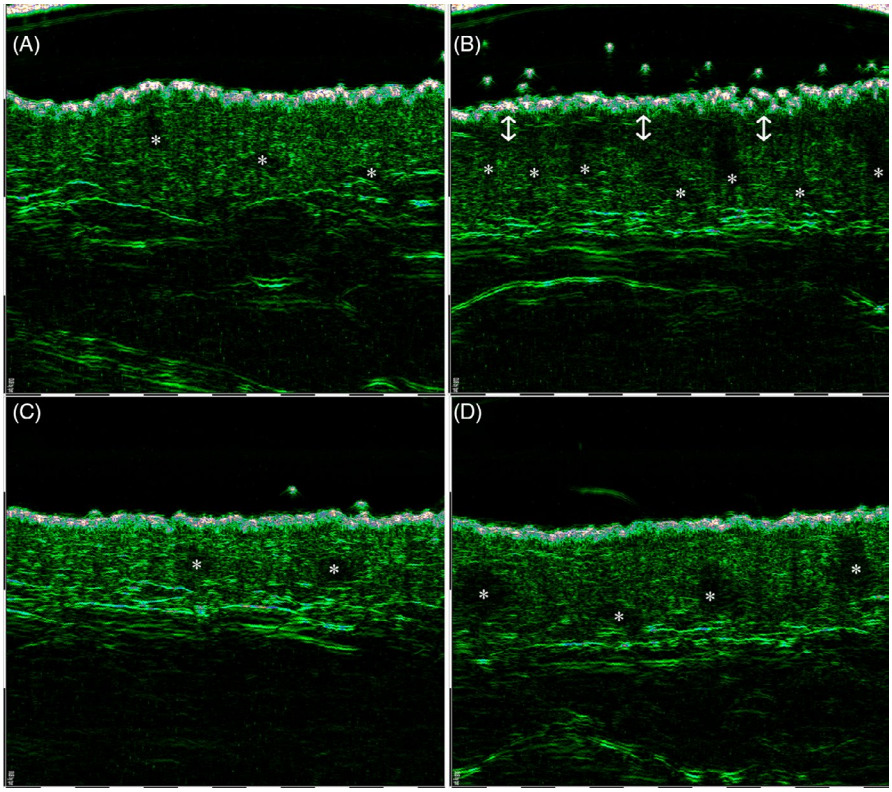

FIGURE 2 Sample of skin imaging using US 50 MHz (B-Scan system), showing the changes caused by aging, through the sonographic image of the photo-protected region of the forearm of a 60-y-old person (A) and a photo-exposed region of the forearm of the same person (B). Figure (C and D) show, respectively, images of a photo-protected region of the forearm, a 32-y-old person, and a photo-exposed region of the forearm of the same person. Asterisks (*) represent hypoechoic regions present in the dermis. The arrows indicate the presence and dimension of SLEB in the upper dermis

KEYWORDS

dermis age-related echogenicity, high-frequency ultrasound, skin aging, skin roughness, skin thickness, subepidermal low-echogenic band

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CONFLICT OF INTEREST

None.

AUTHOR CONTRIBUTIONS

Mariane Massufero Vergilio: Conceptualization, Methodology, Formal analysis, Investigation, Writing-Original draft preparation, Visualization. **Silas Arandas Monteiro e Silva**: Reviewing and Editing. **Louise Idalgo Vasques**: Formal analysis, Investigation, Writing-Original draft preparation. **Gislaine Ricci Leonardi**: Writing-Resources, Reviewing and Editing, Supervision.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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