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Assessment of the Interference of Hyperdiluted Calcium Hydroxyapatite for Neck Rejuvenation in the Ultrasonographic Evaluation of Thyroid

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ABSTRACT

Background: Sagging neck skin is a common complaint, and the use of calcium hydroxyapatite injection is a traditional treatment approach for this region. The published literature is limited concerning the possible interference in imaging exams of hyperdiluted product, which presents radiopaque features, for the assessment of deep structures to the application.

Objective: To assess possible interferences in the ultrasonographic evaluation of thyroid after application of hyperdiluted CaHA on the neck region.

Methods: This was a prospective, blinded, and controlled study. Patients had their cervical regions treated with diluted CaHA (1:4). Ultrasonographic evaluations of thyroid were conducted on day 0 (pre-procedure), day 15, and day 60 by two radiologists blinded to the application.

Results: On day 0 no exclusion criteria were observed. On day 15 technical artifacts that difficulted the evaluation but did not make the complete assessment of the thyroid unable, were seen. On day 60 the artifacts of posterior acoustic shadowing were considerably reduced, not bringing any difficulty whatsoever for evaluation of the gland.

Conclusion: Treatment of sagging neck skin with diluted CaHA in 1:4 does not negatively impact the ultrasonographic evaluation of the thyroid as early as 15 days, and particularly after 60 days from the procedure.

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INTRODUCTION

Cervical region is strongly impacted by the aging process that may progress with skin atrophy, accumulation of submental fat, wrinkles, loss of contour, and sagging skin. Among so many changes in this region, sagging skin is unquestionably one of the most impactful. For this reason, the treatment designed to stimulate the production of collagen in this region has stood out.[1]

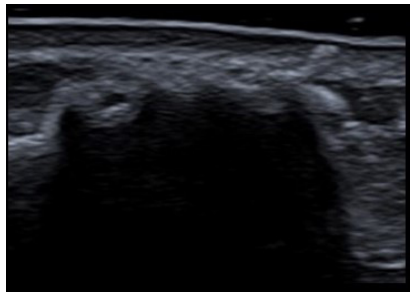
One of the major allies in the prevention and treatment of this region are the injectable biostimulators and, among these biostimulators, the calcium hydroxyapatite is highlighted. Its biostimulatory ability of activating fibroblasts leads to the production of type 1 collagen, elastin, and proteoglycans in addition to improving the skin elasticity and thickness.[2]

The growing demand for minimally invasive procedures, along with the anatomical complexity of the cervical region, is followed by the increase in complications rate, as well as by a concern regarding the possible interference of these products in the assessment of underlying structures of the skin planning on the neck.

The great question regarding the use of calcium hydroxyapatite on the neck is whether the calcium component of the product and its radiopaque features could negatively impact the assessment of underlying structures after the treatment, such as the thyroid gland.

On ultrasound examination, undiluted calcium hydroxyapatite manifests as hyperechogenic deposits with posterior acoustic shadowing[3] (Figure 1), which may limit the evaluation of

FIGURE 1. Ultrasound image (B mode 24 MHz) showing irregular hyperechogenic material with posterior acoustic shadowing, which is a common characteristic of the undiluted calcium hydroxyapatite.



deep structures, though literature is scarce when it comes to published studies on the aspect and repercussions of this product in hyperdiluted conditions, which is the currently recommended technique by international consensus for treating the neck skin, decolletage, and body.[4,5]

OBJECTIVE

To assess possible interferences in thyroid ultrasonographic evaluation after the treatment of the cervical region with hyperdiluted calcium hydroxyapatite in the subdermal plane, as well as to evaluate related findings to the product application in this dilution in the above-mentioned anatomic region.

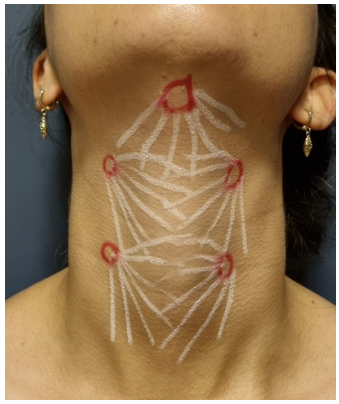
MATERIALS AND METHODS

This was a prospective, blinded, and controlled study conducted at Instituto Boggio, São Paulo, Brazil. All ethical policies recommended by the journal were strictly followed, exactly as stated in the guidelines for authors. The study was duly appreciated by the ethics committee of Hospital Moriah (São Paulo - Brazil) under number CAAE: 58517922.3.0000.8054 and favorable opinion under number: 5.488.636.The subjects signed the written informed consent form.

Patients complaining about sagging in the cervical region, without contraindications, and who did not have previous treatment with biostimulators, were selected and divided into two groups.

The first group was composed of 10 women who underwent conventional treatment of the cervical region with 1.5 mL of calcium hydroxyapatite in a 1:4 dilution by linear retro-infusion technique and using a micro cannula of 22 Gauge. Five vectorized figures composed of 7 points were marked, one in the submental and two in each side of the neck, according to the outlines in the image (Figure 2) standardized in a previously published study.[6]

FIGURE 2. Marking of the neck application with 5 figures composed by 7 points. Each figure has 7 vectors, where each vector receives 0.2 mL of product in a dilution of 1:4.



The second group (control) included 5 women of the same age range, with no previous injectable treatment in the cervical region. All injectable procedures were conducted on the same day by the authors. Dilution of hydroxyapatite was done with 1.5 ml of product with the addition of 1.5 ml of lidocaine 2% and 4.5 ml of saline solution.

Patients were evaluated by two radiologists with experience in dermatologic ultrasound examinations. Radiologists were blinded regarding treated or untreated subjects (groups 1 and 2) with emphasis on both: the findings concerning the product, and its relationship with the thyroid assessment.

TABLE 1.

Questionnaire Responded by the Radiologist in Each Assessment. Results were organized and analyzed using a Microsoft Excel spreadsheet.

QUESTIONNAIRE: 2 BLINDED ULTRASONOGRAPHERS

Patient number: _____

Date of the exam: _____ ( ) day 0 ( ) day 15 ( ) day 60 ( )day 180

( ) THERE WAS EVIDENCE OF PRESENCE OF THE PRODUCT – Y/N

( ) IF YES: WHAT WAS THE TOPOGRAPHY OF THE PRODUCT.
(intradermal-ID, subdermal-SD, subcutaneous-SC, intramuscular-IM, THYROID

( ) WERE THERE ANY DIFFICULTIES IN THE ASSESSMENT OF THIS THYROID? Y/N

( ) IF YES, WHAT WAS THE IMPACT:

( ) NO DIFFICULTIES

( ) THERE WERE DIFFICULTIES, BUT 100% OF THEM WERE EVALUATED

( ) THERE WERE DIFFICULTIES AND THE EVALUATION OF THEM WAS IMPOSSIBLE

( ) if the product was observed: what was the finding: _____

Ultrasonographic assessments were conducted as follows: 1) pre-procedure screening to evaluate possible thyroid injuries or pre-existing changes in the cervical region; 2) on day 15 – fifteen days after injection (a period that bruising and possible measuring biases were already healed); and 3) on day 60 – sixty days after injection and, if the study required, a new assessment would be carried out on day 180 – 6 months after the application.

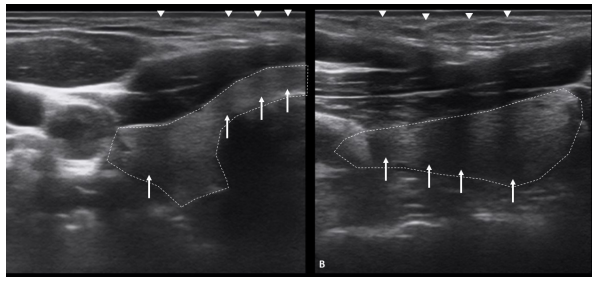
The exclusion criteria of the study were family and/or personal history of thyroid diseases and patients that presented any pathological findings on day 0 (pre-procedure screening).

Radiologists responded to a questionnaire (Table 1) with the following considerations. If there was evidence of any product: if so, 1) what finding was related to the product; 2) in which anatomical plane the product was located; 3) the impact of this product in the thyroid assessment (A - without any difficulties, B - interference that did not impair the assessment, or C- interference that impaired the assessment).

RESULTS

All volunteers who were able to participate in the study were women. There was no evidence of any exclusion criteria conditions. The average age of participants was 43 years, and it ranged from 34 to 64 years.

FIGURE 3. Ultrasound images (mode B18 MHz) showing the presence of hyperechogenic material in superficial subcutaneous (arrowhead) characteristic of diluted calcium hydroxyapatite, determining a discrete posterior acoustic shadowing (arrows) in the thyroid (dotted line), in axial (A), and sagittal (B) planes.



In the evaluation of day 15 (fifteen days after application) both radiologists were able to identify with 100% assertiveness that there was product in the neck of the patients and, in the same way, they were able to identify that there was no evidence of product in the neck of the control patients. In 100% of cases, the image finding was of hyperechogenicity with mild posterior acoustic shadowing. The product was found in superficial subcutaneous plane in all the cases (this was also a coherent finding among both radiologists; Figure 3).

FIGURE 4. Summary of ultrasonographic findings on day 15 by radiologist 1.

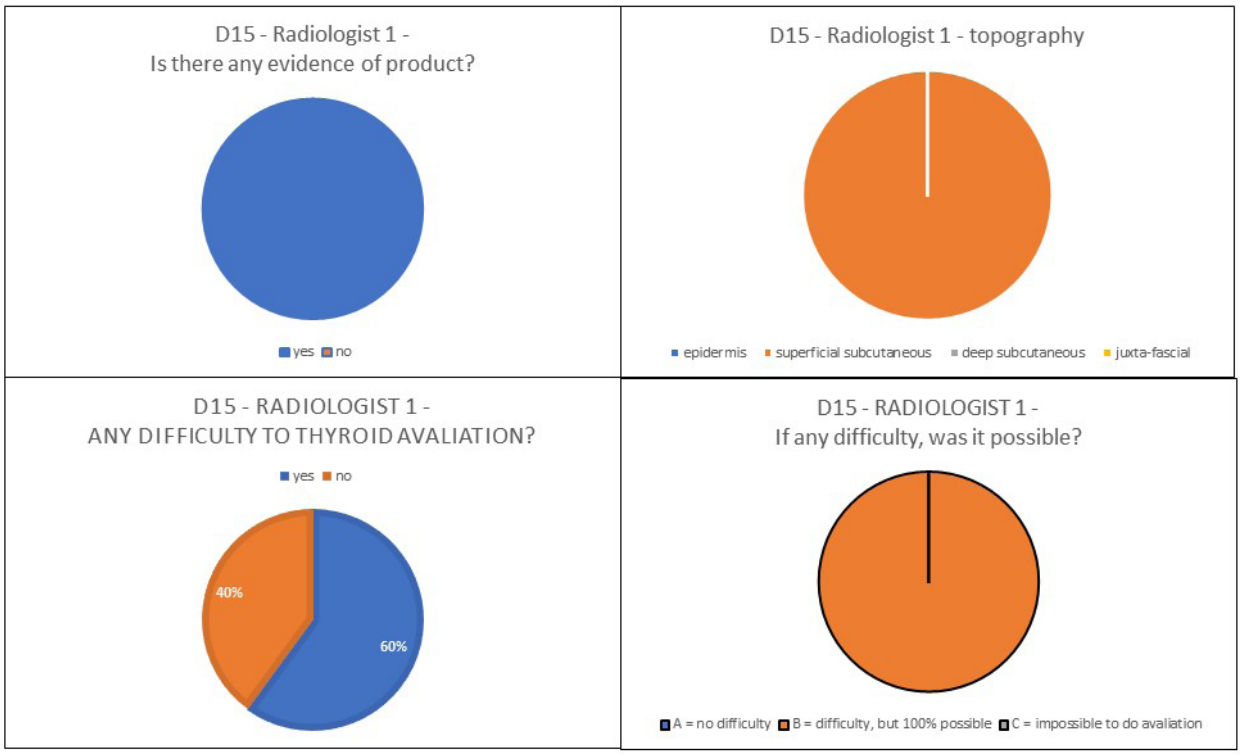


FIGURE 5. Summary of ultrasonographic findings in day 15 by the radiologist 2.

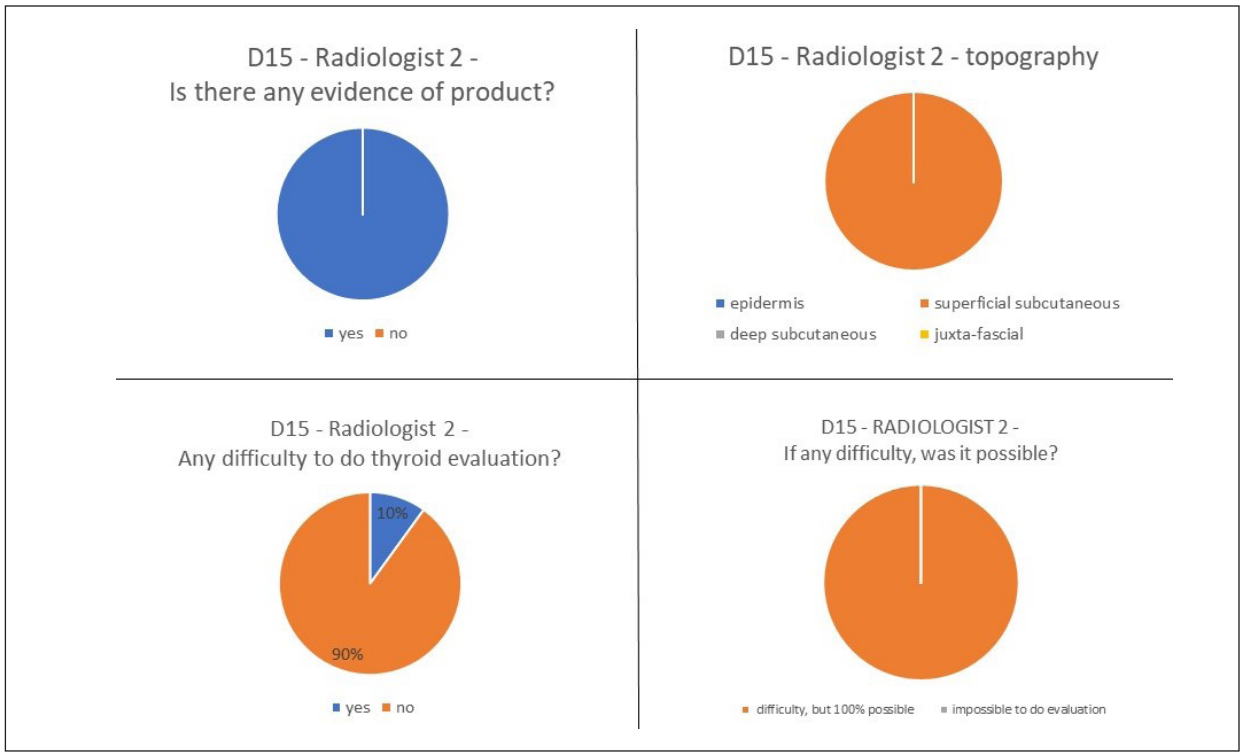


FIGURE 6. Graphics on day 60 showing the correspondence of 100% in answers between the two radiologists. However, this finding made it possible to identify the product without any impairment to the ultrasonographic evaluation of the thyroid.

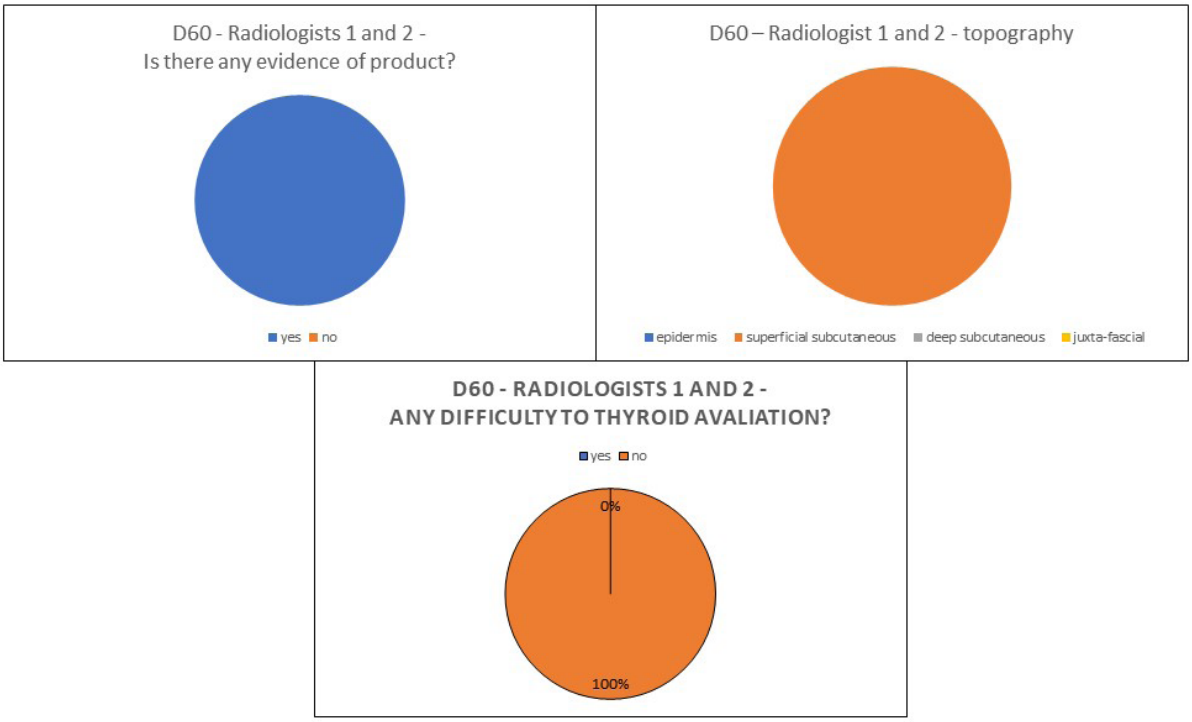
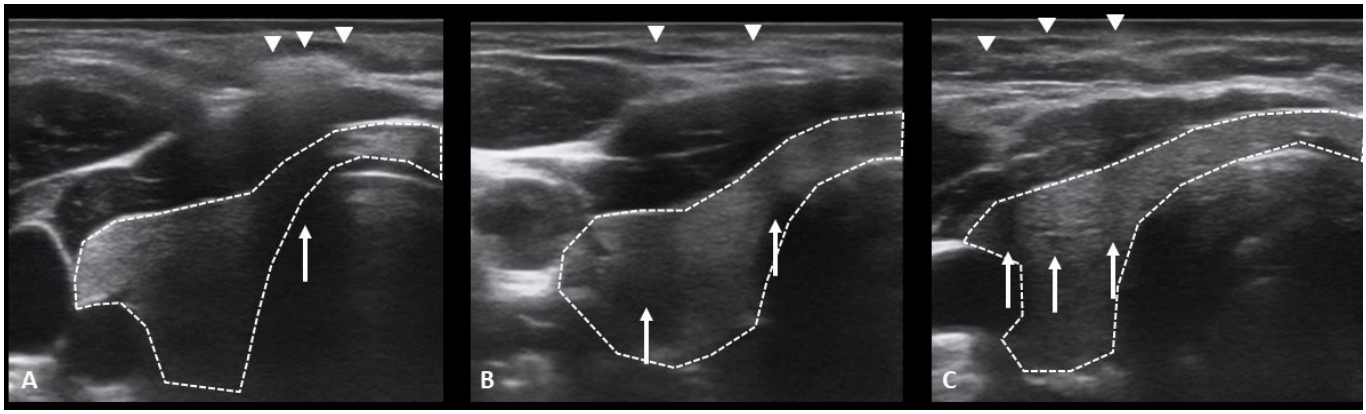


FIGURE 7. Ultrasound images (mode B 18 MHz) in axial plane of the right lobe of thyroid showed the presence of hyperechogenic material in the superficial subcutaneous (arrow heads), characteristic of diluted calcium hydroxyapatite, which determined gradual reduction of posterior acoustic shadowing day 0 (A), day 15 (B), and day 60 (C). Dashed line = thyroid; Arrows = posterior acoustic shadow



For radiologist 1 on day 15, 4 of the 10 cases no longer presented any artifact of the product that could make it difficult to evaluate the thyroid on the dynamic exam. Among the 6 cases that presented difficulties on day 15, all answers were B (despite the slight technical difficulty, it was fully possible to assess the thyroid; Figure 4).

For radiologist 2 on day 15, 9 of 10 cases did no longer present any technical difficulty, and the single case that had difficulty due to posterior acoustic shadow was fully possible to evaluate (response B of the questionnaire; Figure 5).

The assessments of radiologists 1 and 2 were identical on day 60. In all treated volunteers it was still possible to observe the existence of the product, and in 100% of cases the anatomic topography of the product remained in the superficial subcutaneous plane and after this point (day 60), there were no more technical difficulties to evaluate the thyroid (Figure 6). In the assessment of day 60, one of the subjects in the control group was erroneously identified as having the presence of the product in the neck. When it was observed, by the author, a finding that was not expected in the ultrasound report, the patient was questioned and informed that, during the study, she has done an application of deoxycholic acid on the submental fat of her neck.

Since on day 60 100% of patients did not present any difficulties in the assessment of their thyroid in the ultrasonography exam, the investigators understood that there was no reason to keep the follow-up until day 180 and decided to end the study.

DISCUSSION

Cosmetic injectable treatments have grown substantially in the last few years. The botulinum toxin, the hyaluronic acid fillers, and biostimulators, for instance calcium hydroxyapatite and poly-L-lactic acid are the most frequently used products nowadays.

Calcium hydroxyapatite is a product with collagen biostimulating capacity and has been widely used for facial and body treatments. Its high safety profile, especially on nodule formation, mainly where the skin is extremely thin, such as the neck skin, makes calcium hydroxyapatite one of the major allies to the injector physicians who manage the aging of their patients.[7]

The dilution of this product varies according to the topographic region to be treated, the thickness of the local skin, and the injector's experience. A new concept related to calcium hydroxyapatite has been applied to body treatment: hyperdilution, which may be from 1:2 to 1:6, according to international consensus.[4,5,8]

The cervical region is one of the regions that is routinely treated with hyperdiluted calcium hydroxyapatite. The neck skin is characterized to be thin, delicate, and mostly presenting a scarcity of subcutaneous tissue, just under the skin, the platysma and the superficial cervical fascia are found. The neck area to be treated with biostimulators goes from the line of the inferior mandible down to the supraclavicular line, which includes the skin just right above the thyroid gland.

The thyroid is an endocrine gland butterfly-shaped that is located below the thyroid cartilage of larynx and the tracheal rings, and posterior to the platysma muscle and/or the superficial cervical fascia.[9] The ultrasound is a simple exam, but of vital importance in the diagnosis of nodules, cysts in addition to morphological, and functional assessment of the gland.

Since the anatomical plane of calcium hydroxyapatite injection is the subdermal one, obviously in the hands of experienced

injectors, its use does not represent a risk or bring consequences to thyroid physiology, but its possible interference in the evaluation of pathologies was questioned. It is also important to remember that no minimally invasive procedure is risk-free, and in the hands of inexperienced injectors, the injury of deep structures of the neck, and the deposition of the product in the wrong plane is one of the major concerns.

It is known that calcium hydroxyapatite presents a hyperechogenic characteristic with posterior acoustic shadowing at the ultrasound examination.[3,10,11] Most published studies evaluated an application of hydroxyapatite, without dilutions, and, in most cases, used as a filler. The neck, characteristically, presents one of the thinnest skins of the body and for greater safety of the treatment, an intermediary dilution is necessary.[4,5] The standardization of the body treatment by vectorized figures in a dilution of 1:4 was published by the author and this has been a referral to improving the rationalization of the treatment.[6]

So far medical literature lacks an ultrasonographic evaluation of hyperdiluted calcium hydroxyapatite form and particularly, if this technique can negatively impact the assessment of noble structures underlying the application plane, such as the thyroid in cervical treatment.

Our findings show that despite being hyperdiluted, the hydroxyapatite keeps its heterogenicity, also generating the posterior acoustic shadowing artifact. When the thyroid is evaluated after recently receiving the injection, for instance, 15-days later, experienced radiologists can recognize the product and, even though there is some degree of difficulty in the thyroid assessment, there is no negative impact in the final assessment. Posterior analyses, such as 60 days after the injection, still allows the identification of the product, but the possible artifacts do not impair on the evaluation of the thyroid, characterizing a gradual reduction of the artifact over time, with no impairment on the glandular assessment (Figure 7).

According to the radiologists who participated in the study, the product could not be identified by the radiologists who were not specialists in dermatological ultrasound and/or professionals who did not know that a previous treatment was performed and did not conduct the so called 'active seeking'.

Although a small number of patients were treated in this study (n=10), this was a prospective and controlled study with radiologists blinded to the groups, therefore, providing reliability to these findings. Studies such as this one can shed light on other questionable approaches, which can be potentially interesting, for example, for the treatment of saggy breasts with injectable biostimulators.

CONCLUSION

Based on the findings of this study, we concluded that calcium hydroxyapatite applied in the hyperdiluted form of 1:4 for the neck rejuvenation has little interference and does not impair the assessment of the thyroid in just 15 days after the injection. After 60 days from injection, although it is still possible to identify the product by ultrasonography, its artifacts do not impair the underlying thyroid assessment by any means. It is understood, therefore, that given the concern of imaging follow-up of the thyroid with ultrasound, the calcium hydroxyapatite, in a hyperdiluted form, is proved to be a safe product for the treatment of the cervical region.

DISCLOSURES

The author is a Brazilian speaker for the company Merz Aesthetics, one of the manufacturers of calcium hydroxyapatite (Radiesse®). For this study, the author declares no conflict of interest.

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