

*Full Length Research Paper*

# **Anatomical figures obtained by means of a delineation technique as an additional strategy in the clinical evaluation of the thyroid**

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**In patients with morphological alterations of the thyroid, both the physical examination (inspection and palpation) and the imaging studies continue to be the cornerstone for their evaluation, treatment, and long-term follow-up. The realization of anatomical figures, obtained by means of a thyroid morphology delineation technique, is proposed as an additional exploratory intervention strategy in the initial clinical evaluation and follow-up of the thyroid gland with morphological alterations. A micropore paper tape is adhered to the surface of the neck skin, specifically in the area where the thyroid gland is located. Subsequently, with a pen, the outer edges of the gland are gently outlined, using a repeated sequence of palpation-outlining until an anatomical figure of the explored gland and its elements is obtained (e.g. thyroid nodules). The anatomical figures obtained by the proposed technique evidenced the progressive changes in the morphology of the thyroid gland and its elements (example: thyroid nodule). This proposal would be an additional strategy to the physical examination performed by the clinician in his office. Although it is not intended to replace the information provided by imaging studies such as ultrasound or CT scan, it can be of great clinical value for initial office evaluation and follow-up of thyroid disease. This technique has some advantages that are useful to reinforce diagnostic and therapeutic decisions based on physical examination of the gland. In addition, it makes it easier for the patient to have a better perception of the evolution of their own disease.**

**Key words:** Thyroid, propedeutic, anatomical figures, clinical evaluation, delineation technique.

## **INTRODUCTION**

Thyroid diseases are frequent and can be characterized by morphological alterations of the gland itself and/or its function. The latter can be evidenced by changes in thyroid function tests, which are very useful in diagnosis

and follow-up (Stockigt, 2003). Instead, morphological alterations require a proper assessment of size and structure. Therefore, although imaging studies such as ultrasound have demonstrated their importance, physical

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examination of the thyroid gland (inspection and palpation) remains the cornerstone for the evaluation, treatment, and long-term follow-up of thyroid diseases with morphological alterations (Laurberg and Bülow, 2011).

In this document, the realization of anatomical figures, obtained by means of a thyroid morphology delineation technique, is proposed as an additional strategy to the exploratory intervention in the clinical evaluation of the morphological alterations of the gland. This technique is based on the delimitation of the morphology of the thyroid gland to obtain the aforementioned anatomical figures. Its inclusion in the clinical examination of the thyroid gland derives from the need to have an objective clinical evaluation during the follow-up of the thyroid disease, in a context in which it is not always possible to have frequent and serial thyroid ultrasounds.

This proposal is not intended to replace the indisputable value of imaging studies, but rather it would be an additional strategy to the physical examination performed by the clinician in his office. Thus, in order to establish an adequate diagnosis when evaluating a patient with suspected thyroid disease, it is still essential to adequately integrate the data obtained from the clinical history, detailed physical examination, and available biochemical data with the necessary imaging studies such as ultrasound or thyroid scan (Keyes and Tenta, 1980). Thus, the initial evaluation of thyroid function tests is justified when there are compatible clinical data (Stockigt, 1996). On the other hand, imaging studies require an understanding of the embryology, anatomy, and physiology of the thyroid gland as a prerequisite for proper interpretation of diagnostic test results and management of thyroid disorders (Keyes and Tenta, 1980). In addition, in the case of thyroid scintigraphy studies, it is also necessary to know the properties of tracers, such as technetium-99m pertechnetate (Tc-99m) and radioactive iodine (1-123) (Smith and Oates, 2004). The usefulness of thyroid ultrasound in the identification of solid nodules or complex cysts, the evaluation of thyroid size, the echogenic qualities of the gland, and the presence of vascular flow is also recognized. Finally, ultrasound has proven its usefulness in biopsy-aspiration procedures for diagnostic or therapeutic purposes (Hegedüs, 2001).

The technique described here can be of great clinical value for the initial office evaluation and follow-up of thyroid disease. In the author's experience, the anatomical figures obtained by this technique have some advantages that are useful to reinforce diagnostic and therapeutic decisions based on physical examination of the gland. Thus, this technique may be an additional useful strategy for the initial clinical assessment of the size and morphological characteristics of the gland and also for long-term follow-up. Such follow-up can be done both on the thyroid gland as a whole (size and shape) and on specific sites or elements of it (for example,

nodules or cysts). In this way, the clinician can monitor those nodules that show a delay in their therapeutic response and that, therefore, could be the morphological elements to which greater attention would be paid during evaluations with imaging techniques or to define aspiration procedures or biopsy for diagnostic or therapeutic purposes. In addition, the proposed technique allows the patient to have a better perception of the evolution of his own disease. The anatomical figures obtained by this technique are easy to interpret for the patient, who can objectively compare these images and appreciate -guided by the clinician- the therapeutic success or the clinical evolution of their own condition and thereby reduce their anxiety and strengthen adherence therapy. The thyroid delineation technique is described below detailing the three elements of benefit observed.

### **General anatomical aspects of the thyroid**

The thyroid is the largest endocrine gland and is located in the lower part of the anterior and lateral face of the neck, anterior to the laryngotracheal axis, at the height of the fifth cervical vertebra and the first thoracic vertebra (Gil Carcedo-Sañudo et al., 2020). It is shaped like a butterfly with two lateral lobes (right and left) that are joined by the isthmus. A variant of the thyroid lobes that have a third lobe known as the pyramidal lobe is also seen (Rajani, 2020). The gland is usually not visible or palpable under normal conditions, except in thin people with long necks (Domenech et al., 2006).

### **Traditional examination of the thyroid gland**

Among the various methods of palpation of the thyroid gland, the modified Rose Method can be mentioned, which has high sensitivity and specificity for the diagnosis of multinodular goiter, and high sensitivity and specificity for the identification of solitary thyroid nodule. In addition, this method has a high specificity for the diagnosis of goiter with retrosternal extension, followed in sensitivity by the Pizzilo Method. On the other hand, the Crile's Method has shown the highest sensitivity for the diagnosis of solitary thyroid nodule, while the Lahey's method was the ideal clinical method for palpation of cervical lymph nodes (Pattashanee et al., 2022).

The traditional examination of the thyroid gland must be performed delicately and gently in order to perceive the morphological alterations of the gland (asymmetries or nodulations). Its location, shape and size (expressed in cm) must be described; as well as its qualities of mobility, consistency, pulsation, temperature, coloration and pain sensitivity (Domenech et al., 2006).

The thyroid gland is examined with the patient's head extended. The clinician asks the patient to relax his

sternocleidomastoid muscles and slightly flex his head forward. The examiner uses the fingers of both hands to feel the thyroid gland (Domenech et al., 2006). The palpation is performed with both hands both at rest and during a swallowing maneuver, in order to assess changes in temperature, as well as sensitivity and consistency of the gland and/or nodules (Pattashanee et al., 2022). Swallowing is also requested, both during inspection and on thyroid palpation (Domenech et al., 2006). The patient is instructed to swallow while the examiner assesses the anatomical extent of the lobes with the last three fingers of one hand.

Thyroid palpation can be performed with the clinical explorer positioned in front of or behind the patient. When the examiner stands in front of the patient, the thyroid gland is palpated using the balls of the second and third fingers. The right thyroid lobe is examined with the left hand and the left thyroid lobe with the right hand. Palpation of the thyroid with the explorer positioned behind the patient is performed with both hands, placing two fingers of each hand on the sides of the trachea, just below the cricoid cartilage. The right lobe is usually larger than the left. In relaxation, the outline of the thyroid cannot be seen in a healthy patient. Any anatomical abnormality of the thyroid gland is defined by its consistency, size, tenderness, and growth (Pinto and Glick, 2002).

## METHOD

### Thyroid delineation technique

#### *Description of the term*

The concept of delineation is to draw the edges or margins of an object, in this case, the thyroid gland. With this technique, the anatomical figures of the aforementioned gland are obtained.

#### *Indications*

The proposed thyroid delineation technique would be indicated in morphological diseases of the thyroid gland, such as diffuse toxic goiter, simple goiter, multinodular goiter or Plummer's disease. It is also useful in the presence of thyroid nodules or cysts.

#### *Contraindications*

This technique is contraindicated in cases where pain may occur during the examination, as occurs in cases of thyroiditis. In cases in which there are no alterations in the thyroid morphology, it is not always useful, due to the difficulty in adequately identifying the borders of the gland and, therefore, its delimitation. Thus, the traditional clinical evaluation of the thyroid must be carried out previously to document the presence of alterations in the thyroid morphology and to select the patient in whom the application of the delineation technique would be indicated.

#### *Description of the technique*

The proposed technique must be preceded by an appropriate visual

inspection and physical examination of the thyroid gland. The thyroid physical examination is described below and, in a second section, the thyroid delineation technique itself.

**Inspection and physical examination of the thyroid gland:** For an adequate inspection of the thyroid gland, a light source is required, either natural or artificial, which allows full visualization of the anterior part of the neck and the sides.

The patient is asked to perform a swallowing maneuver to identify the thyroid gland. It is inspected for probable thyroid growth and the presence of obvious nodulations or morphological abnormalities.

Once the inspection is done, the physical examination of the thyroid gland is carried out using the previously described traditional method (Domenech et al., 2006). Palpation should be performed with both hands, both at rest and during the swallowing manoeuvre, to assess changes in temperature, as well as the sensitivity and consistency of the gland and/or nodules. To examine the isthmus, the examiner's thumb is placed under the lower border of the cricoid cartilage and over the first two tracheal rings (Pattashanee et al., 2022). Palpation of the thyroid lobes requires the patient to turn their head slightly toward the side to be examined to relax the ipsilateral sternocleidomastoid muscle.

**Thyroid delineation technique:** Once the advisability of applying the thyroid delineation technique to the patient has been verified, they are asked to continue in a seated position, with their neck at the level of the clinical examiner's shoulders and with the upper part of the thorax uncovered to facilitate the delineation.

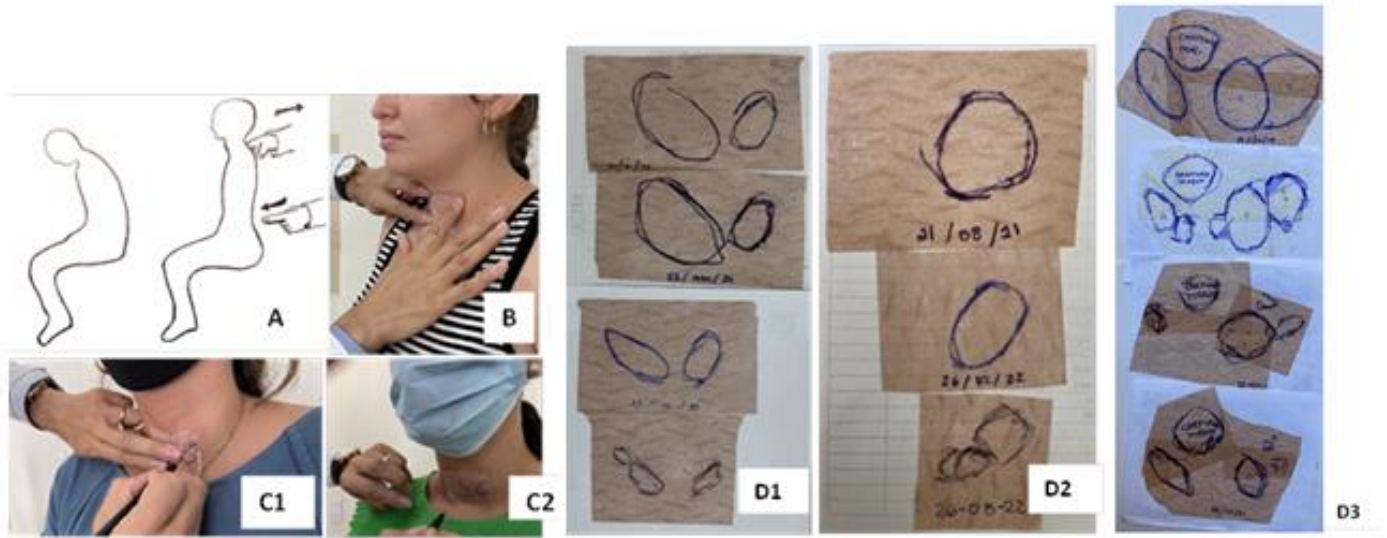
The patient should be seated in an upright position, avoiding the common tendency to sit in a position that increases the kyphosis of their spine. To do this, the examiner may gently push or guide the patient's spine slightly above the lumbosacral joint to promote some lordosis of the lumbar spine (Figure 1A).

Once the patient is in a suitable position, micropore paper tape (3M™ Micropore™ Medical Tape 1533) is adhered to the skin surface of the neck, specifically in the area that corresponds to the place where the presence of the thyroid gland has been identified (Figure 1B). It is recommended that the micropore paper tape be at least one inch wide with which most morphological alterations can be plotted.

Subsequently, with a pen with soft or blunt tip, the outer edges of the thyroid gland are gently outlined (Figure 1C). To adequately delineate the anatomical borders, palpation is necessary using the second and third fingers of the left hand, while outlining with the pen held in the right hand. In the case of left-handed people, the exploring hand and the one that outlines the anatomical figure are reversed. Thus, a palpation – delineation sequence must be followed, progressively, until all the thyroid elements are delineated. In this way, an anatomical figure of the explored gland is obtained (Figure 1D). The delineation is made as the thyroid border is palpated, on the surface of the micropore paper tape. Care must be taken that such an outlining procedure is performed in a gentle manner to avoid causing discomfort to the patient.

When the situation allows it, it is possible to delineate not only the periphery of the thyroid gland or its lobes, but also the presence of specific thyroid nodules, which can then be labeled with numbers or letters for follow-up, after removing the micropore paper tape. Sometimes other anatomical structures such as the thyroid cartilage can also be outlined for the proper location of the gland. In some specific, more complex cases, it may be necessary to instruct the patient to make a swallowing movement, interrupting the sequence of this act, at a certain moment in order to delineate a nodule that is only present with the aforementioned movement.

Once the periphery of the thyroid gland has been delineated and possibly some anatomical elements that could be identified in it, the micropore paper tape is gently removed from the skin surface of the patient's neck. Care must be taken to bring the entire paper



**Figure 1.** Thyroid delineation technique. (a) The patient should be seated in a straight position. To do this, the examiner can gently push or guide the patient's spine, at the site located slightly above the lumbosacral joint to promote some lordosis of the lumbar spine. (b) The examiner is adhering the micropore paper tape to the skin surface of the neck. (c) The examiner is drawing on the micropore paper tape to outline the borders of the thyroid gland y (d) Several anatomical figures obtained through the thyroid delineation technique, which correspond to the same patient on different dates (goiter -D1- nodule -D2- and multinodular goiter -D3-). In the latter case, the graphic representation of the thyroid cartilage can be appreciated (\*).  
Source: Author

surface, not in separate segments, so as not to lose the fidelity of the outlined image with respect to variables such as size, proportion, and thyroid anatomical structure.

Subsequently, the micropore paper tape is glued to a clinical examination sheet, duly identified with the patient's personal data (Figure 1D). Notes regarding the evaluation date can be made on the micropore paper tape, as well as the specific identification of some elements included in the thyroid image, such as nodules or cysts. It is recommended that these elements be identified for later monitoring, with numbers or letters (Figure 1 D3). In some cases in which the thyroid has a large size or volume, the convexity of the gland requires making cuts in the micropore paper tape, with scissors, to facilitate its correct adhesion to the sheet of paper, in order to avoid folds or roughness.

## RESULTS

After establishing a diagnosis of thyroid disease, clinical and therapeutic follow-up was given in the conventional manner, as required by the cases. As an example, the results of applying the thyroid delineation technique in three cases that were followed up in consultation by at least one year are shown. Figures D1, D2 and D3 shows the anatomical figures obtained by the proposed technique.

### Case of goiter

The anatomical figures shown in Figure D1 correspond to the graphic evolution of a case of goiter. It is a woman

(CPG, 20 years old) who was given follow-up and conventional treatment (Eutirox in variable doses according to evolution, nine months of follow-up between the first and last anatomical figure). The anatomical figures obtained by the proposed technique show the progressive decrease in thyroid size.

### Case of thyroid nodule

Figure D2 shows the graphic evolution of a case of thyroid nodule in a woman (MRRA, 28 years old, one year of follow-up between the first and last anatomical figure, nodule classified as TiRads 2 on ultrasonogram) who received suppressive treatment (Levothyroxine).

### Case of Plummer's disease (toxic multinodular goiter)

The anatomical figures shown in Figure D3 correspond to the graphic evolution of a case of Plummer's disease (toxic multinodular goiter). This is a man (TBM, 80 years old, thirty-five months of follow-up between the first and last anatomical figure) who was given follow-up and conventional treatment (Methimazole in variable doses according to evolution, and finally therapy with radioiodine). The anatomical figures obtained by the proposed technique show the progressive decrease in thyroid size.

## DISCUSSION

The proposal to draw anatomical figures of the thyroid using the delineation technique is an additional and independent procedure from the rest of the elements of a traditional physical examination (inspection, palpation and occasionally auscultation). Therefore, this proposed technique does not replace nor is it intended to replace the traditional clinical evaluation or the available imaging techniques, such as ultrasound or thyroid tomography, all of which have indisputable diagnostic value.

Traditionally, clinical evaluation of the thyroid involves inspection, palpation, and imaging examination. The technique that is proposed would be an additional strategy and a fourth element of clinical evaluation that consists of drawing an image from the delineation of the thyroid. The proposed thyroid delineation technique integrates two important elements of the traditional clinical evaluation of the thyroid: inspection and palpation. The anatomical figures obtained from the proposed delineation technique can be an additional useful strategy for the evaluation of the size and morphological characteristics of the gland. The author has performed this procedure in the office for 22 years, as an additional strategy to that established for cases of diseases that alter thyroid morphology.

The anatomical figures obtained from the proposed delineation technique allows long-term follow-up, not only of the entire thyroid gland, but also of specific sites of it. Thus, the identification of nodulations or cysts, by means of letters or numbers, allows the specific and punctual follow-up of the evolution of each of these elements, independently. This is valuable, especially in cases of multinodular goiter where several nodules may be present. With its long-term identification, it is possible to detect the one or those that seem to be left behind in the progressive decrease in size, as the corresponding treatment has been established. In this way, such lagging nodules may be the ideal morphological elements of greater attention for follow-up by imaging techniques or to be aspirated or biopsied for therapeutic or diagnostic purposes.

An important benefit, derived from the anatomical figures obtained from the proposed delineation technique as an additional exploratory intervention, is that it is easy to interpret by the patient, who can witness -together with the doctor- the clinical evolution of their condition. Thus, these anatomical figures obtained from the proposed delineation technique have allowed the author to have an additional element to show the patient his own clinical evolution of the disease. In this way, the anatomical figures proposed can be considered an additional element that strengthens the established traditional clinical evaluation and in which the patient himself can also witness the evolution of his own condition. The evaluation of the anatomical figures of the thyroid, obtained from the delineation technique, is of

great help to reduce the anxiety of patients undergoing pharmacological treatment due to the presence of morphological diseases of the thyroid. On many occasions, patients may show concern or doubts about the result of their treatment, because they continue to perceive, in their neck, the presence of thyroid nodules or morphological alterations of their thyroid gland. When the doctor shows the sequence of thyroid anatomical figures of the patient, obtained in the long term, it is easier for them to perceive the cases of success or progress of their own disease. A good part of the perception of therapeutic success that patients have of their own disease comes from the objective comparison of these images.

The proposed technique contributes to improve the emotional and behavioral aspects of the patients, as well as a strengthening of the interaction with the health provider personnel. Thus, when anatomical figures are presented to patients, it helps to reduce their anxiety because they can appreciate, in a more objective way, the therapeutic response they are achieving. In addition, it strengthens therapeutic adherence because patients objectively appreciate both the decrease in thyroid size (for example in cases of nodules or goiter) and the delay in their therapeutic response when they interrupt treatment due to indolence. Frequently, patients may report that, despite treatment, there has been no reduction in the size of their goiter or their thyroid nodules and it is not uncommon for them to show their surprise when they personally compare current anatomical figures with those they had before to start your suppressive treatment.

Another important aspect is that the use of this technique has contributed to the strengthening of an adequate interaction of the patients with the health provider staff, because it allows these anatomical figures to be discussed and evaluated in an open manner between the patient and the doctor. This allows patients an open discussion to express doubts or convictions about the results obtained, because they have a better perception of the evolution of their own disease. Such interaction favors a better collaboration of the patients, both for the therapeutic adherence with drugs or the acceptance of an eventual performance of biopsy-aspiration procedures, if certain elements shown in the anatomical figures so warrant. All of the above strengthens a better interaction with the health provider staff, a behavior of better therapeutic adherence and an informed co-participation, about their condition.

The physical conditions of the patients to whom this additional thyroid evaluation strategy has been applied have been diverse, since children, young people, and the elderly have been evaluated in this way.

At the moment, the author does not consider it advisable that these anatomical figures be used in formal clinical history reports because they are evaluation elements that would lack the hardness or precision of

imaging studies, which are the gold standard. However, they would be useful as an additional part of the doctor's clinical evaluations, for the clinical records of these cases kept in his own office. Thus, it would not be recommended to provide these anatomical figures to patients, since those who require a clinical history of their case must have the imaging techniques already established and tested over time. It must be made clear to the patient that this technique cannot be considered as hard data, with the same level of sensitivity or specificity as the morphological evaluation carried out by imaging studies, where it is possible to measure with millimeter precision and determine the eventual presence of other elements in the gland that are of great value to make therapeutic decisions (such as calcification findings, shape, vascularity, among others). As is known thyroid ultrasonography is the most common, useful, safe, and cost-effective way to image the thyroid gland and its pathology (Blum, 2020).

In the author's experience, the anatomical figures obtained from the thyroid delineation technique have been useful, not only for the punctual evaluation of thyroid anatomical alteration (with its consequent impact on pharmacological treatment, decision-making for follow-up with imaging studies and specific selection of sites for an eventual biopsy), but also for long-term follow-up (decision-making about changing therapeutic strategy, timing of biopsy-aspiration and selection of specific sites for it, as well as follow-up of the case with studies of image).

## **Conclusion**

The proposed technique is not intended -in any way- to replace the valuable role of imaging studies, and on the contrary, it may be the element to consider for the early performance of imaging studies such as ultrasound or tomographic images in the event that the evolution of the case, so determines. In addition, it is proposed that research be continued on the possible application of this delineation technique in other conditions, where the author has proven its usefulness, such as enlarged lymph nodes and any anatomical alteration in which clinical follow-up is considered pertinent and important or where the economic-social context, make the frequent request for imaging studies relatively inaccessible. Three advantages of clinical evaluation using the proposed thyroid delineation technique are detailed below

### ***Support in diagnostic decisions***

This technique can be a useful additional strategy in the clinical evaluation of the size and morphological characteristics of the glands in cases of simple or toxic goiter (Plummer's disease), thyroid nodules or

multinodular goiter. This technique also allows long-term monitoring, not only of the entire thyroid gland, but also the monitoring of the punctual evolution of specific sites, such as nodules or cysts, independently. This is very useful because it allows the clinician to identify, for example, those nodules that show a delay in their therapeutic response. In this way, the anatomical images obtained by means of the proposed technique allow the specific identification of those nodules in which greater attention would be paid during follow-up with imaging techniques or for aspiration for therapeutic purposes (thyroid cysts) or diagnostics, such as when perform thyroid biopsies to define an eventual treatment with surgical procedures.

### ***Support in therapeutic decisions***

With the proposed technique, one more element of diagnostic support is added to the initial clinical examination. The foregoing contributes to establishing the necessary therapeutic proposal, for example, complementary treatment with thyroid hormones for cases of simple goiter or multinodular goiter; replacement therapy with thyroid hormone for cases of hypothyroidism associated with goiter; or suppressive hormone treatment for some cases of multinodular goiter and thyroid nodules (Haugen et al., 2016). With the thyroid delineation technique, both thyroid cysts and nodules suspected of being malignant become evident due to the lack of response to treatment with thyroid hormones and, therefore, no reduction in their size during clinical follow-up. Logically, these cases have usually already been diagnosed early by biopsy procedures and the imaging studies indicated when finding them with suggestive clinical characteristics, during their physical examination. It is currently possible to assess the risk of malignancy of the nodules, as well as the need for biopsy using ultrasound risk stratification systems (eg, Thyroid Imaging Reporting) (Grani et al., 2020).

### ***Strengthening therapeutic adherence***

This technique makes it easier for the patient to have a better perception of the evolution of their own disease.

The anatomical figures obtained by this technique are easy to interpret for the patient, who can objectively compare these images and appreciate -together with the doctor- the therapeutic success or the clinical evolution of their own condition and thereby reduce their anxiety.

In conclusion: the anatomical figures obtained from thyroid delineation technique should be considered as an additional strategy in clinical examination, which can be of great value for the therapeutic approach and long-term follow-up of thyroid diseases characterized by morphological abnormalities, such as goiter or presence

of nodules.

## CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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## REFERENCES

- Blum M (2020). Ultrasonography of the Thyroid. Feingold KR, Anawalt B, Boyce A, et al., editors. Endotext [Internet]. South Dartmouth (MA): MDText.com, Inc.; 2000  
<https://www.ncbi.nlm.nih.gov/books/NBK285555/>
- Domenech E, Avilés FJ, Figuerola E (2006). Exploración cervical: inspección, palpación, examen por la imagen. *Seorl Pcf. Libro virtual de formación en ORL*.
- Gil Carcedo-Sañudo E, Heras-Flórez P, Herrero-Calvo D, Fernández-Cascón S, Vallejo-Valdezate L (2020). Anatomía quirúrgica de las glándulas tiroideas y paratiroides. *Rev. ORL [Internet]*. Jun [citado 2022 Ago 25]; 11(2):161-178. Disponible en: [http://scielo.isciii.es/scielo.php?script=sci\\_arttext&pid=S2444-798620200002000006&lng=es](http://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S2444-798620200002000006&lng=es). Epub 13-Oct-2020.
- Grani G, Sponziello M, Pecce V, Ramundo V, Durante C (2020). Contemporary Thyroid Nodule Evaluation and Management. *The Journal of Clinical Endocrinology and Metabolism* 105(9):2869-2883. <https://doi.org/10.1210/clinem/dgaa322>
- Haugen BR, Alexander EK, Bible KC, Doherty GM, Mandel SJ, Nikiforov YE, Pacini F, Randolph GW, Sawka AM, Schlumberger M, Schuff KG, Sherman SI, Sosa JA, Steward DL, Tuttle RM, Wartofsky L (2016). 2015 American Thyroid Association Management Guidelines for Adult Patients with Thyroid Nodules and Differentiated Thyroid Cancer: The American Thyroid Association Guidelines Task Force on Thyroid Nodules and Differentiated Thyroid Cancer. *Thyroid Official Journal of the American Thyroid Association* 26(1):1-133. <https://doi.org/10.1089/thy.2015.0020>
- Hegedüs L (2001). Thyroid ultrasound. *Endocrinology and metabolism Clinics of North America* 30(2):339. [https://doi.org/10.1016/s0889-8529\(05\)70190-0](https://doi.org/10.1016/s0889-8529(05)70190-0)
- Keyes GR, Tenta LT (1980) Diagnostic Parameters in thyroid Disorders. *Otolaryngologic Clinics of North America* 13(1):3-12.
- Laurberg P, Inge Bülow P (2011). Clinical assessment of the thyroid patient. In: John AH, Wass and others (eds), *Oxford Textbook of Endocrinology and Diabetes*, 2 ed. Oxford Textbooks (Oxford);, online edn, Oxford Academic, <https://doi.org/10.1093/med/9780199235292.003.3026>, accessed 25 Aug. 2022.
- Pattashanee SK, Puri G, Kataria K, Ranjan P, Dhar A, Srivastava A, Vyas S, Gupta Y, Pandey RM (2022). Comparison of Modified Rose Method of Thyroid Palpation Versus Other Methods for the Detection of Retrosternal and Nodular Goitre. *Journal of the ASEAN Federation of Endocrine Societies* 37(1):4-13. <https://doi.org/10.15605/jafes.037.01.02>
- Pinto A, Glick M (2002). Management of patients with thyroid disease - Oral health considerations. *The Journal of the American Dental Association* 133(7):849-858.
- Rajani S (2020). Surgical Anatomy of Thyroid Gland - A Comprehensive Review. *Basic Sciences of Medicine* 9(1):10-14  
 DOI: 10.5923/j.medicine.20200901.03
- Smith JR., Oates E (2004). Radionuclide imaging of the thyroid gland: patterns, pearls, and pitfalls. *Clinical Nuclear Medicine* 29(3):181-193. <https://doi.org/10.1097/01.rlu.0000114530.12565.5b>
- Stockigt J (2003). Assessment of thyroid function: towards an integrated laboratory--clinical approach. *The Clinical Biochemist Reviews* 24(4):109-122.
- Stockigt JR (1996). Guidelines for diagnosis and monitoring of thyroid disease: nonthyroidal illness. *Clinical Chemistry* 42(1):188-192.