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Effectiveness of orbital decompression for endocrine orbitopathy and impact on quality of life: A retrospective study

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ABSTRACT

Objective

To evaluate the effectiveness of orbital decompression intervention in terms of variation of the exophthalmos and to highlight its association with changes in quality of life before and after surgery.

Methods

Medical records of patients with moderate-severe GO who underwent orbital decompression surgery were retrospectively reviewed.
Clinical parameters, including demographic characteristics, surgical technique, exophthalmos values, and QoL using the GO-QoL questionnaire were studied before and after orbital decompression and analyzed.

Results

Thirty patients were included in the study. Surgery was bilateral 26 patients and unilateral in 4 patients (56 operated orbits). Before surgery the average value of exophthalmometry was 24.96 (± 2.68) mm. The questionnaires submitted for assessment of the quality of life (GO-QoL) yielded average values of 43.3 for the visual function (VF) and 44.03 for the appearance (AP). 20 patients (64.3%) underwent combined bone and fat decompression surgery, 9 underwent fat decompression, and 1 underwent bone decompression. After surgery, the average values of exophthalmometry were 21.8 (± 2.34) mm, with an average reduction of 3.20 (± 2.35) mm. ($p < 0.0001$) GO-QoL questionnaires administered after surgery showed a mean VF score of 76.73 (± 26.75), and AP score of 73.71 (± 21.89). ($p < 0.001$, paired t-test)

Conclusions

Orbital decompressive surgery is not only effective on GO, but also on a long-term improvement in overall well-being, self-confidence and QoL.

Key words: orbital decompression; Graves Ophthalmopathy, Graves hyperthyroidism, exophthalmos, quality of life

INTRODUCTION

Graves Ophthalmopathy (GO) is the most frequent extrathyroidal clinical presentation of Graves-Basedow disease.

GO is characterized by inflammation of the orbital tissues leading to eyelid retraction, proptosis, edema and erythema of the conjunctiva and periorbital tissues (Iacobæus and Sahlin, 2016). GO is often mild and self-limiting (Bartalena *et al*., 2008), and only 3–5% of the patients exhibit a severe sight-threatening form of the disease due to corneal exposure or compressive optic neuropathy (Barrio-Barrio *et al.*, 2015; Iacobæus and Sahlin, 2016).

GO causes somatic alterations of the palpebral region and alterations in visual function of different severity, which can be the basis for a loss of self-esteem, psychosocial stability, and working capacity. Patients with GO report feeling stared at by others and socially isolated as a consequence of their changed appearance and this has a significant impact on mood (Coulter *et al.*, 2007). There is also growing evidence that GO has a detrimental impact on daily-living activities. People with GO have been found to have a poorer quality of life than patients with other chronic conditions including diabetes, emphysema, and heart failure (Wickwar *et al.*, 2015). Psychological aspects of GO are important determinants of quality of life (QoL), which is a major outcome of disease management, and therefore of interest to clinicians treating these patients (Coulter *et al.,* 2007).

GO follows a biphasic course with an initial phase of active and progressive disease followed by a 'burnt out' phase in which alterations such as proptosis and motility restrictions remain stable (Mourits *et al.*, 1997). An appropriate assessment of both activity (the inflammatory process) and severity (the quality of life or the risk of vision loss) of the disease warrants an adequate treatment (Barrio-Barrio *et al.*, 2015).

Choosing the most suitable treatment for individual patients depends on the activity and severity of the disease.

Disease activity is assessed through the Clinical Activity Score (CAS). (**Error! Reference source not found.**) This score is based on four of the five well-known classical signs of inflammation (pain, redness, (warmth), swelling, and impaired function). For each of the 10 items present, one point is given. The sum of these points is the CAS, which ranges from 0 to 10 (Barrio-Barrio *et al.*, 2015) . A high clinical activity score helps to select patients who will benefit from immunosuppressive treatment.(Mourits *et al.*, 1997)). A CAS ≥3/7 is indicative of active GO.

The management of patients with GO depends on the degree of severity of the ophthalmopathy, which is established according to the impact of the disease on the patient's quality of life and the risk of vision loss. The disease is classified, according to EUGOGO, as mild, moderate, severe, or sight-threatening. (**Error! Reference source not found.**) (Barrio-Barrio *et al.*, 2015; Bartalena *et al.*, 2016)

According to ETA/EUGOGO guidelines (Bartalena *et al.*, 2016), the role of surgery in GO is restricted - in addition to the conditions that require an intervention for preserving visual function (such as optic neuropathy or exposure keratopathies) - to cases of moderate-to-severe pathology in the post-inflammatory phase with the aim of correcting those alterations of the orbito-palpebral region caused by the pathology, that are often responsible for deterioration of quality of life.

The aim of the study was to evaluate the effectiveness of orbital decompression intervention in terms of reduction of exophthalmos and to highlight its association with changes in quality of life before and after surgery.

MATERIALS AND METHODS

As part of the multidisciplinary project for the treatment of GO, as stated by ETA/EUGOGO guidelines,(Bartalena *et al.*, 2016) all patients included in the study came under our observation with a diagnosis of moderate to severe inactive Graves Ophthalmopathy, after having undergone radiometabolic therapy and/or thyroidectomy and cortisone therapy, with complete monitoring of the pathology for at least 6 months.

All patients underwent computed tomography and magnetic resonance imaging of the orbits and a complete ophthalmological and orthoptic evaluation. GO was classified according to the Clinical Activity Score (CAS) and the severity score proposed by the EUGOGO consensus.

Patient inclusion criteria for the study were as follows:

- Men and women over the age of 18 years
- Diagnosis of moderate-severe Graves Ophthalmopathy and CAS < 3/7
- Exophthalmos duration greater than 2 years
- Treated surgically (thyroidectomy) and/or pharmacologically (radiometabolic therapy)
- Stability of clinical conditions for at least 6 months
- Undergoing orbital decompression surgery for the first time

Exclusion criteria:

- Patients with optic neuropathy
- Patients already undergone orbital decompression surgery
- Presence of keratopathies at the time of the study
- Postoperative follow-up of less than 3 months

Data were retrospectively collected and then analyzed regarding demographic characteristics, surgical technique, exophthalmos values, and QoL using the GO-QoL questionnaire.

The GO-QoL is the reference questionnaire used to assess the quality of life of patients with thyroid ophthalmopathy. Developed in 1998 by Terwee et al,(Terwee *et al.*, 2001) it is available in several languages. (Figure 1) Eight questions refer to the consequences of double vision and decreased visual acuity on visual functioning (e.g., problems with driving, reading or hobbies), and eight questions refer to the psychosocial consequences of changed appearance (e.g., feeling of social isolation and influence on self- confidence), all due to GO. (Iacobæus and Sahlin, 2016) All GO-QoL questions were scored as `severely limited' (one point), `a little limited' (two points), or `not limited at all' (three points). The questions 1-8 and questions 9-16 were added up to two raw scores from 8 to

24 points, and then transformed to two total scores from 0 to 100 by the following formula: total score=(raw score - 8)/16 × 100. For both total scores holds that higher scores indicate better health. For questions 1 and 2 the answers `no drivers' license' or `never learned to ride a bike' were scored as a missing value. When there were missing values for some items, total scores were calculated for the remaining completed items. The transformation was then adjusted to: total score = (raw score - #) / 2 × # × 100 (# is the number of completed items).(Terwee *et al.*, 2001)

Hertel's exophthalmometer was used to measure exophthalmos before and at least 3 months after the intervention. A single operator made the measurements using a single instrument.

Information about quality of life was obtained by preoperatively submitting the GO-QoL questionnaire (Terwee *et al.*, 2001; Delfino *et al.*, 2017) to the patients and at least 3 months after the decompression before any other secondary procedure (squint surgery, ancillary procedures), separately taking into account visual function (VF) and appearance (AP).

Surgical techniques

All patients underwent general anesthesia and orbital decompression surgery with the following surgical techniques:

• Bone decompression (medial, lower and lateral walls)

• Fat decompression

• Combined bone and fat decompression

All the procedures were performed by a single operator, who had expertise in orbital surgery. The parameters (exophthamometry, GO-QoL values) studied before and after orbital decompression were analyzed using the Student's t-test.

RESULTS

We conducted a study on 30 patients with inactive moderate-severe GO who underwent orbital decompression surgery from October 2017 to October 2019 at the Maxillofacial Surgery Operative Unit of Ferrara Hospital.

Thirty patients (56 orbits) were included in the study.
Of the 30 patients studied, 10 were males and 20 females. The average age at the time of surgery was 54.7 years (range 33-79); 57.7 for women (range 40-79), 50.4 for men (range 33-67); 73.3% of patients underwent thyroidectomy and 33.3% underwent radiometabolic therapy. All patients underwent corticosteroid therapy.

Surgery was performed on both orbits in 26 patients and was unilateral in 4 patients with a total of 56 operated orbits. 18 underwent combined bone and fat decompression surgery, 9 patients underwent fat decompression, and 1 patient underwent bone decompression. 18 bony decompression were inferomedial walls, 18 inferior, medial and lateral walls, 2 medial wall only. Among all the performed medial wall decompression, 12 where via endoscopic approach (FESS). Before surgery the average value of exophthalmometry was 24.96 (± 2.68) mm. The questionnaires submitted for assessment of the quality of life (GO-QoL) yielded average values of 43.3 for the visual function (VF) and 44.03 for the appearance (AP). 20 patients underwent combined bone and fat decompression surgery, 9 patients underwent fat decompression, and 1 patient underwent bone decompression. (Table 3)

After orbital decompression surgery, the average values of exophthalmometry were 21.8 (± 2.34) mm, with an average reduction of 3.20 (± 2.35) mm. (Figure 2) These differences turned out to be statistically significant at the 0.05 level. (Table 4)

GO-QoL questionnaires administered after surgery showed a statistically significant increase in mean values of VF, with a score of 76.73 (± 26.75), and in mean values of AP, with a score of 73.71 (± 21.89). The average difference between pre- and post-operative scores is 33.4 (± 37.2) for VF and 29.7 (± 22.7) for AP. A significant improvement in health- related quality of life after orbital decompression was noted ($p < 0.001$, paired t-test) for both subscales. Multivariate analysis showed no statistically significant differences in QoL according to the different used techniques (Table 5-7, Figure 3)

When divided into subgroups, males had higher GO-QoL preoperative values, both for VF 58,1 (±32,0) and AP 59,4 (±23,4), than females (VF 35,9 (±23,9), AP 36,4 (±23,0). However, post-operative improvement was less remarkable in this population, with a mean difference in VF 19,4 (±44,5) and AP 25 (±25,5), versus female population (VF 40,4 (±32.0) and AP 32 (±21,5)). Nevertheless, the average values of AP in the women's group were lower (68,4 (±23,2) versus 84,4 (±14,8) for men). Smokers had higher GO-QoL preoperative values for VF 48,1 (±28,0) versus 36,3 (±28,7) for non-smokers and quite similar values for AP (43,8 (±27,0) versus 44,4 (±23,5)). Moreover, post-operative improvement was less marked in smoker population with a mean difference in VF (20,9 (±30,1) and AP 27,7 (±25,7), versus non-smoker population (VF 52,1 (±40,2) and AP 32,6 (±17,9)). (Table 8, Figure 4-6)

DISCUSSION

GO is a relatively rare disease and, in patients with Graves' Disease the incidence of moderate to severe forms of GO, including cases of optic neuropathy, is approximately 5%.(Wiersinga and Kahaly, 2017) This is a debilitating disease that includes alterations of the vision, morphology and function of the orbito-palpebral region and thus may negatively affect the quality of life of patients in terms of reduced self-confidence, vital relationships, and psychosocial stability.(Wickwar *et al.*, 2015)

Surgery has a primary role in the treatment of moderate to severe forms of GO in cases in which medical treatments (steroids, non-steroid immunosuppressant) are ineffective in reducing the fibrosis caused by chronic inflammatory processes.

Decompression surgery was initially used exclusively for the treatment of conditions such as optic neuropathy unresponsive to medical therapy or in keratopathies due to exposure non-responsive to local treatments or to eyelid surgery (Wiersinga and Kahaly, 2017). Subsequently, these indications were extended to the treatment of cases characterized by residual alterations of the orbito-palpebral region in the inactive post-inflammatory phase at the end of medical treatment (steroids, non-steroid immunosuppressant), ineffective in reducing the fibrosis caused by chronic inflammatory processes. Therefore, this is considered a rehabilitative surgery.(Wiersinga and Kahaly, 2017)

Orbital decompression entails expansion of the bony boundaries of the orbits, removal of orbital fat, or both, thereby reducing the effects of expanded orbital fibroadipose and muscle tissue.

There are different techniques available for orbital decompression.(Clauser and Tieghi, 2010; Tieghi *et al.*, 2010) The choice of decompression procedure depends on the prevalence of fat tissue and/or enlarged extraocular muscles and the desired amount of proptosis reduction.(Werner *et al.*, 2005)

An algorithm of treatment was followed:

- In case of exophthalmos with a prevalence of fat tissue, fat decompression was performed;
- In case of exophthalmos with a prevalence of enlarged extraocular muscles (crowded apex syndrome), bony decompression was performed;
- In case of exophthalmos with prevalence of fat tissue and enlarged extraocular muscles, fat removal and bony decompression combined were performed (Clauser *et al.*, 2012)

However, due to multiple factors, mainly the heterogeneity of GO clinical manifestations and the different anatomical conformations of the orbit, to date there is no consensus on what is the best type of treatment. (Clauser *et al.*, 2012)

Thus, decompression surgery is the mainstay method to treat stable disfiguring alterations and/or symptoms that can typify the inactive post-inflammatory phase of the disease.(Wiersinga and Kahaly, 2017)

The primary objectives in orbital decompression are the reduction of exophthalmos and resolution of its symptoms.(Clauser *et al.*, 2012b; Wiersinga and Kahaly, 2017) Several studies show the possibilities of reducing the exophthalmos depending on the technique being used. (Pieroni Gonçalves *et al.*, 2005; Tieghi *et al.*, 2010; Clauser *et al.*, 2012; Cubuk *et al.*, 2018; Jefferis *et al.*, 2018) In our experience, the techniques of bone, fat, and combined decompression all turn out to be effective in decreasing proptosis. In our sample, GO patients showed a statistically significant decrease of the average values of exophthalmometry after the surgical treatment.

However, although assessment of therapeutic outcome in GO patients is usually done by measurements of objectively quantifiable data (e.g. exophthalmometry, etc.), the primary goal of treatment should be to improve functioning and general health, and therapeutic outcome should be evaluated in terms of benefits from the patient's perspective. (Wiersinga and Kahaly, 2017) .

Patients with GO report feeling stared at by others and socially isolated because of their changed appearance and this has a significant impact on mood. There is also growing evidence that GO has a detrimental impact on vision-related daily functioning including reading, watching TV, driving and hobbies. People with GO have been found to have a poorer quality of life than patients with other chronic conditions including diabetes, emphysema, and heart failure.(Coulter *et al.*, 2007; Wickwar *et al.*, 2015)

The GO-QoL questionnaire was designed for self-assessment by the patient and is recommended as a measurement of therapeutic results.(Terwee *et al.*, 2001; Iacobæus and Sahlin, 2016; Wiersinga and Kahaly, 2017)

In this study, changes in quality of life by administering the GO-QoL questionnaire before and after surgery were assessed. We found statistically significant differences in terms of quality of life improvement after the treatment, both in terms of VF and AP, with average variations between pre- and postoperative scores of 33.4 (± 37.2) and 29.7 (± 22.7), respectively. It has been suggested that a minimum difference of 6 points in one or both subscales of the GO-QoL questionnaire should be considered as an important change in the patient's daily life. For more invasive therapies, a change of at least 10 points is recommended as a minimal clinical difference.(Terwee *et al.*, 2001; Wiersinga and Kahaly, 2017)

Tobacco smoking is associated with orbitopathy in general and it is related with worse disease outcome (Wiersinga, 2007; Burch and Cooper, 2015). Oxidative stress has been suggested to play a role on the deleterious impact of smoking in GO. In our sample, post-operative improvement was less marked in smoker population than in non-smoker population. In the smokers population, although the preoperative QoL values were not worse than those of non-smokers, they were lower in post-operative, with a lower mean difference.

In our sample, appearance-related quality of life was significantly associated with gender. Women had lesser AP values after the treatment than men (68,4 versus 84,4). Probably for women, the eyes could be considered crucial to perceived attractiveness, and changes in ocular appearance could have a detrimental influence on self-confidence and willingness to appear in photographs (Wickwar *et al.*, 2015). Recent studies have suggested that women with visible differences may experience higher levels of appearance-related distress than men, which in turn could have an impact on QoL.(Wickwar *et al.*, 2015)

QOL-scores improved ≥10 points in 83% of the patients in this study.

This study confirms that GO-QoL questionnaire is an excellent assessment tool in patients undergoing decompressive surgery for GO. Furthermore, although decompressive surgery is only one step in the rehabilitation of GO patients, it has a significant impact on patients' quality of life. Patients undergoing orbital surgery, like most of the general population, have emotional and social concerns specific to aspects of facial appearance, albeit to a greater degree.

Our study is limited by the small sample size and the fact that other chronic conditions and their resultant symptoms may have influenced the perceived QoL.

CONCLUSIONS

Decompressive surgery is a tool of primary importance in the management of moderate to severe forms of GO when medical treatments are found to be ineffective in reducing the fibrosis caused by chronic inflammatory processes, in terms of reduction of exophthalmos and improvement of the quality of life.

The progressive importance given to the patient and his perception of quality of life has been an opportunity to investigate the effects of orbital decompressive surgery. Orbital decompressive surgery is not only effective on GO, but also on a long-term improvement in overall well-being, self-confidence and QoL.

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TABLE 1

Clinical Activity Score (CAS). 1 point is given for the presence of each of the parameters assessed. The sum of all points defines clinical activity: active GO if the score is above 3/7 at the first examination or above 4/10 in successive examinations.

	For initial CAS, only score items 1–7
1	Spontaneous orbital pain
2	Gaze evoked orbital pain
3	Eyelid swelling that is considered to be due to active GO
4	Eyelid erythema
5	Conjunctival redness that is considered to be due to active GO
6	Chemosis
7	Inflammation of caruncle OR plica
	Patients assessed after follow-up (1–3 months) can be scored out of 10 by including items 8–10
8	Increase of >2 mm in proptosis
9	Decrease in uniocular ocular excursion in any one direction of >8°
10	Decrease of acuity equivalent to 1 Snellen line

TABLE 2

EUGOGO Classification of the Severity of the Ophthalmopathy.

Mild	Characteristics of GO have a minimum impact on the patient's life. They usually present one or more of the following signs: • Minor lid retraction (<2 mm). • Mild soft tissue involvement. • Exophthalmos <3mm (above the normal range for the race and gender). • Transient or no diplopia. • Corneal exposure responsive to lubricants.
Moderate to severe	Patients without sight-threatening GO whose eye disease has sufficient impact on daily life to justify the risks of immunosuppression (if active) or surgical intervention (if inactive). Patients usually present one or more of the following signs: • Lid retraction (>2 mm). • Moderate or severe soft tissue involvement. • Exophthalmos ≥3mm (above the normal range for the race and gender) • Inconstant, or constant diplopia.
Sight-threatening GO	Patients with dysthyroid optic neuropathy or cornealbreakdown duetosevere exposure. Other infrequent cases are ocular globe subluxation, severe forms of frozen eye, choroidal folds, and postural visual darkenings. This category warrants immediate intervention.

TABLE 3

Baseline characteristics of the sample

Variable		**Patients (30)**
Gender		
	Male	10 (33.3%)
	Female	20 (66.7%)
Age *(mean) (sd)*		54.7 (11.33)
Thyroidectomy		
	Yes	22 (73.3%)
	No	8 (26.7%)
Radiometabolic therapy		
	Yes	10 (33.3%)
	No	20 (66.7%)
Operated orbits		
	1	4 (13.3%)
	2	26 (86.7%)
Smoker		
	Yes	18 (60%)
	No	12 (40%)
Pre-operative Quality of life * *(mean) (sd)*		
	VF	43.3 (28.36)
	AP	44.03 (25.26)
Pre-operative exophthalmometry *(mean) (sd)*		24.96 (2.68)

Decompression	**Orbits (56)**
Bone decompression	2 (3.6%)
Fat decompression	18 (32.1%)
Combined decompression	36 (64%)

TABLE 4

Pre- and post-operative exophthalmometry

Exophthalmometry (mm)			
Pre	Post	Mean difference	*P* value
24.96 (2.68)	21.8 (2.34)	3.2 (2.35)	<0.0001

TABLE 5

Pre- and post-operative QoL scores

Variable	VF			AP		
	Pre	Post	*P* value	Pre	Post	*P* value
QoL *(mean) (sd)*	43.3 (28.36)	76.73 (26.75)	<0.0001	44.03 (25.26)	73.71 (21.89)	<0.0001
QoL *(median) [1Q 3Q]*	39.5 [25 68.75]	89.5 [62.5 100]	0.0002	43.75 [31.2 62.5]	71.87 [62.5 93.7]	<0.0001

TABLE 6

QoL mean difference (VF and AP)

QoL - Mean difference	
VF	AP
33,4 (±37,24)	29,7 (±22,7)

TABLE 7

Multivariate analysis showing AP and VF changes after fat and combined techniques

Quality of life (AP)

```
------------------------------------------------------------------------------
       differential_ap |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----------------------+------------------------------------------------------------
                       |
        Decompression  |
                  fat  |  -7.471594   19.40982    -0.38   0.704    -47.62386    32.68068
             combined  |  -25.81377   18.16187    -1.42   0.169    -63.38447    11.75692
                       |
                _cons  |   48.77674    20.0454     2.43   0.023     7.309659    90.24381
------------------------------------------------------------------------------
```

Quality of life (VF)

```
------------------------------------------------------------------------------
       differential_vf |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----------------------+------------------------------------------------------------
                       |
        Decompression  |
                  fat  |  -34.83419   28.65747    -1.22   0.236    -94.11668    24.44829
             combined  |  -49.08516   26.81495    -1.83   0.080    -104.5561    6.385785
                       |
                _cons  |   63.45741   29.59587     2.14   0.043     2.233681    124.6811
------------------------------------------------------------------------------
```

TABLE 8

GO-QoL by subgroup

	Pre-operative VF	Post-operative VF	Pre-operative AP	Post-operative AP	Mean difference VF	Mean difference AP
Male	58,1 (±32,0)	77,5 (±31,1)	59,4 (±23,4)	84,4 (±14,8)	19,4 (±44,5)	25 (±25,5)
Female	35,9 (±23,9)	76,4 (±25,2)	36,4 (±23,0)	68,4 (±23,2)	40,4 (±32,0)	32 (±21,5)
Smokers	48,1 (±28,0)	69,0 (±27,7)	43,8 (±27,0)	71,5 (±24,4)	20,9 (±30,1)	27,7 (±25,7)
Non smokers	36,3 (±28,7)	88,4 (±21,3)	44,4 (±23,5)	77,1 (±17,9)	52,1 (±40,2)	32,6 (±17,9)

FIGURE 1

GO-QoL questionnaire

GO-Quality Of Life Questionnaire

☐ initial ☐ follow-up Date

The following questions deal specifically with your thyroid eye disease. Please focus on the past week while answering these questions.

During the past week, to what extent were you limited in carrying out the following activities, because of your thyroid eye disease?

Tick the box that matches your answer. The boxes correspond with the answers above them.
Please tick only one box for each question.

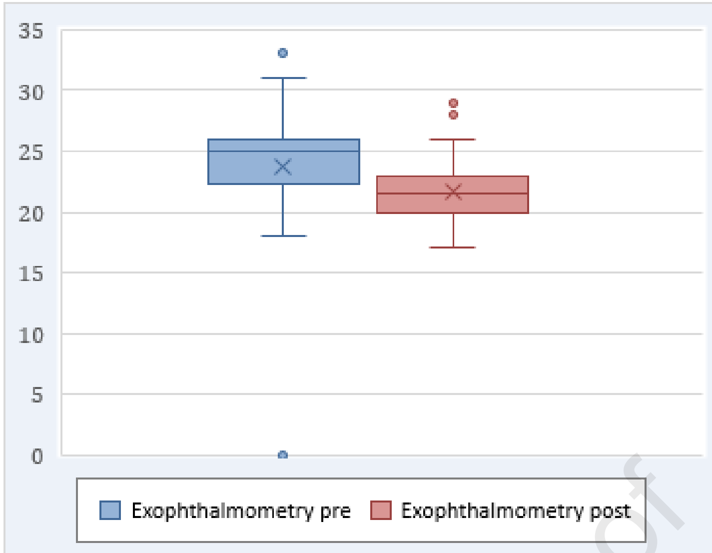
	Yes seriously limited	Yes a little limited	No not at all limited
1) Bicycling (never learned to ride a bike ☐)	☐	☐	☐
2) Driving (no driver's licence ☐)	☐	☐	☐
3) Moving around the house	☐	☐	☐
4) Walking outdoors	☐	☐	☐
5) Reading	☐	☐	☐
6) Watching TV	☐	☐	☐
7) Hobby or pastime, i.e.	☐	☐	☐

	Yes severely hindered	Yes a little hindered	No not at all hindered	
8) During the past week, did you feel hindered from something that you wanted to do because of your thyroid eye disease?	☐	☐	☐	Score

The following questions deal with your thyroid eye disease <u>in general</u>

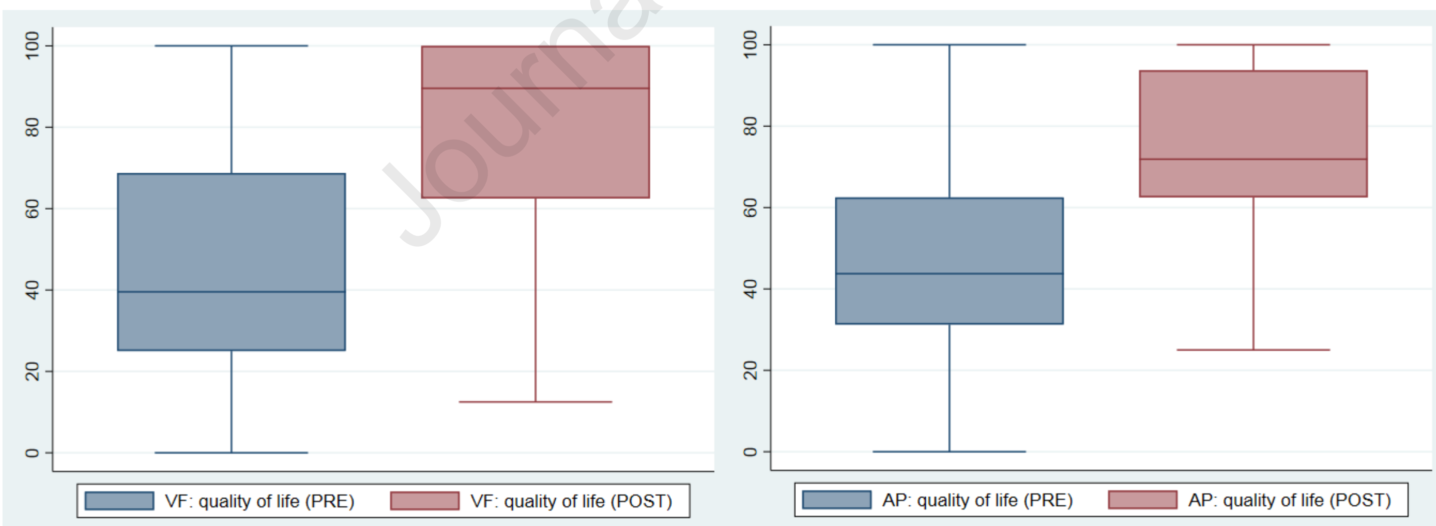
	Yes, very much so	Yes a little	No not at all	
9) Do you feel that you appearance has changed because of your thyroid eye disease?	☐	☐	☐	
10) Do you feel that you are stared at in the streets because of thyroid eye disease	☐	☐	☐	
11) Do you feel that people react unpleasantly because of your thyroid eye disease?	☐	☐	☐	
12) Do you feel that your thyroid eye disease has an influence on your self-confidence?	☐	☐	☐	
13) Do you feel socially isolated because of your thyroid eye disease	☐	☐	☐	
14) Do you feel that your thyroid eye disease has an influence on making friends?	☐	☐	☐	
15) Do you feel that you appear less often on photos than before you had thyroid eye disease?	☐	☐	☐	
16) Do you try mask changes in appearance caused by your thyroid eye disease?	☐	☐	☐	Score

FIGURE 2



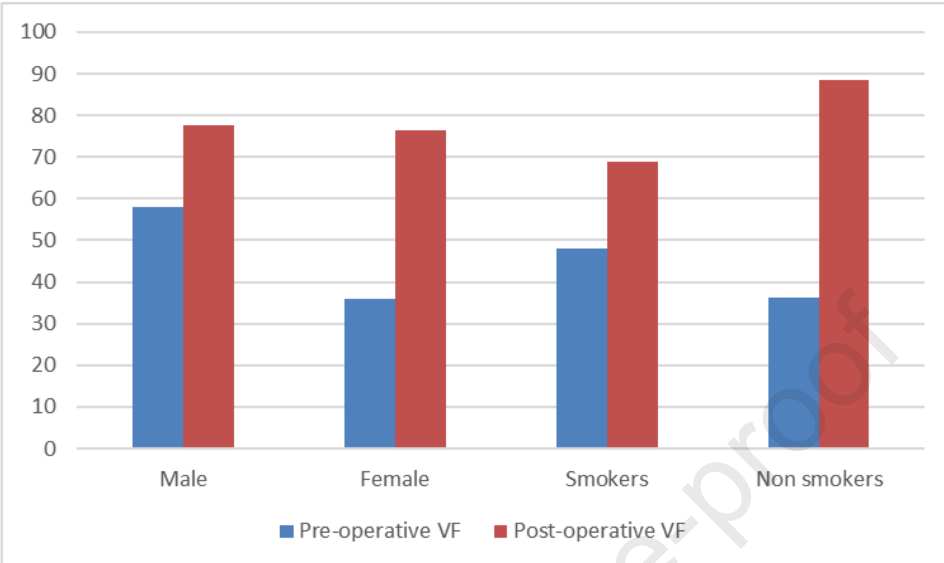
Box plot showing median, first and third quartiles of exophthalmometry (mm) before and after orbital decompression

FIGURE 3



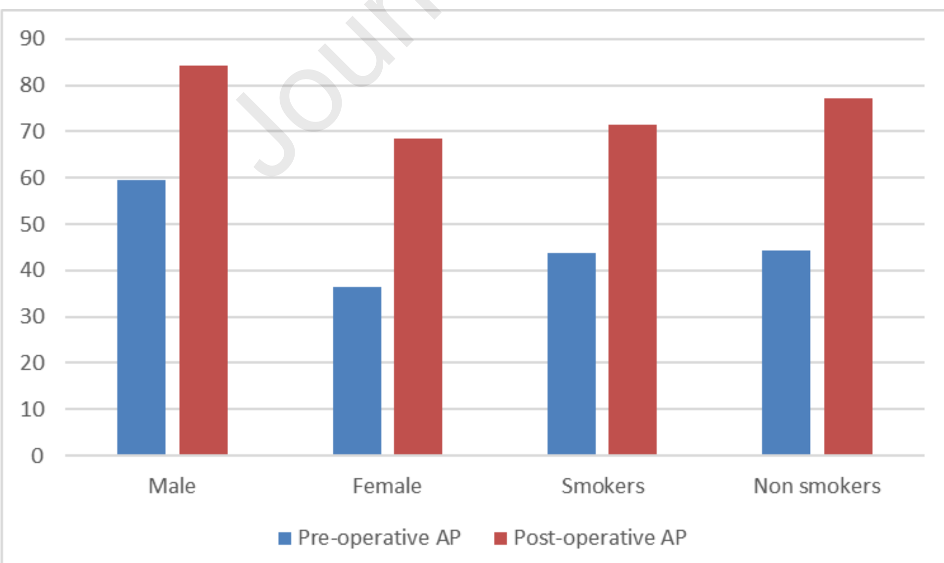
Box plot showing median, first and third quartiles of GO-QoL before and after orbital decompression

FIGURE 4



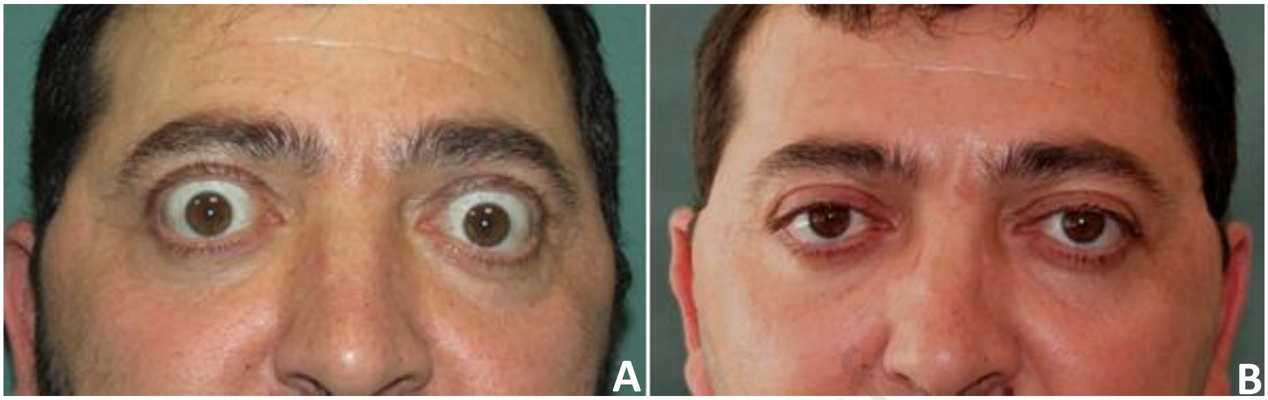
GO-QoL by subgroup: before and after treatment VF

FIGURE 5



GO-QoL by subgroup: before and after treatment AP

FIGURE 6



Before (A) and after (B) bilateral fat and bony orbital decompression