Cosmetic penile enhancement surgery: a 3-year single-centre retrospective clinical evaluation of 355 cases

Alessandro Littara1, Roberto Melone1, Julio Cesar Morales-Medina2, Tommaso Iannitti3 & Beniamino Palmieri4

Men’s satisfaction and sexual function is influenced by discomfort over genital size which leads to seek surgical and non-surgical solutions for penis alteration. In this article we report the results of a retrospective study of 355 cases of cosmetic elongation, enlargement and combined elongation and enlargement phalloplasty. We found a significant improvement in length at rest, stretched length and circumference at rest at 2, 6 and 12 months post-surgical procedure (all \( p < 0.0001 \)). 5-item International Index of Erectile Function (IIEF-5) was also increased at 12 months post-surgery compared to baseline (\( p < 0.0001 \)). This was consistent with an IIEF-5 improvement of 6.74% compared to baseline. This study is clinically relevant due to the large cohort of patients included and because it is the first study to use an inverse periosteal-fascial suture not described previously as part of the surgical methodology.

Male genital image is correlated, albeit not in a necessarily linear manner\(^1\), to overall body image, psychosocial variables and sexual health\(^2\); in turn, sexual health is correlated to genital image\(^3\). Concern over genital endowment has archaic roots\(^4,5\). It typically emerges during adolescence\(^6,7\) and is triggered more by comparison among men than by the fear of not satisfying the partner\(^8\). Discomfort over genital size can influence satisfaction and man’s sexual function and push him to look for surgical and non-surgical solutions for penis alteration. We present a retrospective study of 355 cases of phalloplasty performed between 2012 and 2014.

Penile size. The remarkable differences in the penile measurements reported by various authors can be explained by the methodological differences and the variety of the characteristics, even ethnic, of the populations studied (Tables 1 and 2). Furthermore, these measurements were rarely conducted on statistically adequate samples. The availability of regulatory data per defined population would be essential not only for diagnostic and therapeutic purposes, but also to reassure patients who display feelings of inadequacy\(^1,7,9,10\) and to manufacture correctly sized prophylactics\(^11\). Penis size is an anthropometric measurement\(^12\) and is correlated to anthropometric measurements such as height, weight and body mass index (BMI)\(^12,13\). These measurements are intercorrelated\(^13\) and they are polygenic traits subject to multifactorial influences\(^4\).

Materials and Methods

All methods and procedures were carried out in accordance with the principles contained in the Declaration of Helsinki.

Patients. This study was registered on 04/04/2017 (ISRCTN number: ISRCTN60774878). 355 men participated in this retrospective clinical study. They came to our centre in Milan (Italy) for a cosmetic phalloplasty between 2012 and 2014 [cosmetic elongation (21), enlargement (33) and combined elongation and enlargement (301)]. The patients’ medical history was gathered and they underwent a medical examination that included
an objective examination of the external genitals and the prostate, routine blood tests, basal penile ultrasound scan to verify the presence of nodules, plaques or lesions in the internal tissues of the penis and measurement of the length and circumference of the penis at rest (flaccid) and stretched. The stretched penis length (SPL) is

| First author, year | Country         | N   | Age (years; range) | FPL (cm) | SPL (cm) | EPL (cm) | FPG (cm) | EPG (cm) |
|------------------|----------------|-----|-------------------|----------|----------|----------|----------|----------|
| Loeb, 1899       | Germany        | 50  | 17–35             | 9.41     |          |          |          |          |
| Schönfeld, 1942  | USA            | 71  | 18–19             | 13.11    | 13.02    |          |          |          |
| Kinsey, 1948     | USA            | 2,770| 20–59             | 9.07     | 15.05    |          |          |          |
| Aimani, 1985     | Nigeria        | 320 | 17–23             | 8.16     |          |          |          |          |
| Bondil, 1992     | France         | 905 | 17–91             | 10.07    | 16.74    |          |          |          |
| Da Ros, 1994     | Brasil         | 150 |                   | 14.05    |          |          |          | 11.92 proximal 11.05 distal |
| Wessells, 1996   | USA            | 80  | 21–82             | 8.85     | 12.45    | 12.89    | 9.71     | 12.3     |
| Smith, 1998      | Australia      | 184 |                   |          |          |          |          | 15.71    |
| Chen, 2000       | Israel         | 55  | 21–78             | 8.03     | 12.05    | 13.06    |          |          |
| Ponchietti, 2001 | Italy          | 3,300| 17–19             | 9.0      | 12.5     | 10.0     |          |          |
| Schneider, 2001  | Germany        | 111 | 18–19             | 8.60     | 14.48    | 9.68     |          |          |
| Sengerer, 2002   | Turkey         | 200 | 20–22             |          | 9.22     | 14.48    | 9.02     |          |
| Shah, 2002       | UK             | 104 | 17–84             |          |          |          |          | 13.0     |
| Spyropoulos, 2002| Greece         | 52  | 19–38             |          |          |          |          | 12.18    |
| Son, 2003        | Korea          | 123 | 19–27             | 6.9      | 9.6      |          |          | 8.5      |
| Savone, 2003     | USA            | 124 | 59.1 (avg.)       | 9.0      | 13.0     |          |          |          |
| Pereira, 2004    | Portugal       | 496 | 20–26             | 9.85     | 15.14    | 9.39     |          |          |
| Aswad, 2005      | Jordan         | 271 | 17–83             | 9.3      | 13.5     |          |          | 9.98     |
| Mehraban, 2007   | Iran           | 92  | 20–40             | 11.58    |          |          |          | 8.66     |
| Promodu, 2007    | India          | 500 | 18–60             | 8.21     | 10.88    | 13.01    | 9.14     |          |
| Kamel, 2009      | Egypt          | 949 |                   | 12.9     |          |          |          | 8.9      |
| Nasar, 2011      | Egypt          | 1,000|                 | 8.37     | 13.77    |          |          | 10.48    |
| Khan, 2012       | Scotland       | 609 | 16–90             | 10.2     | 14.3     |          |          |          |
| Soylermez, 2012  | Turkey         | 2,276| 18–39             | 8.95     | 13.98    |          |          | 8.89     |
| Chen, 2014       | China          | 5,196|                 | 6.5      | 12.9     |          |          | 8.0      |
| Shalabi, 2015    | Egypt          | 2,000| 22–40             | 13.84    |          |          |          |          |
| Veale, 2015      | UK             | 15,521| 17–91             | 9.16     | 13.12    | 9.31     | 11.66    |          |
| Habous, 2015     | Saudi Arabia   | 778 | 20–82             |          | 12.53/14.34 | 11.50  |          |          |
| Salama, 2016     | Egypt          | 239 | 7.4               | 11.8     | 8.7      | 11.3     |          |          |
| Hussein, 2017    | Afghanistan    | 223 | 9.8               | 12.6     |          |          |          |          |

Table 1. Global published data of mean penile size (excluding self-reported measurements). FPL = Flaccid Penile Length; SPL = Stretched Penile Length; EPL = Erect Penile Length; FPG = Flaccid Penile Girth; EPG = Erect Penile Girth; (avg.) = average.

| First author, year | Country         | N   | Age (range) | FPL (cm) | SPL (cm) | EPL (cm) | FPG (cm) | EPG (cm) |
|------------------|----------------|-----|-------------|----------|----------|----------|----------|----------|
| Richters, 1995   | Australia      | 156 |             | 15.99    |          |          |          |          |
| Bogaert, 1999    | USA            | 935 | 30 (avg.)   | 10.41    | 16.4     | 16.4     | 9.65     | 12.57    |
| 4,187            | 9.83           | 15.6 | 9.40       | 12.19    |
| Harding, 2002    | UK             | 312 |             | 15.25    | 12.55    |          |          |          |
| Schaeer, 2012    | Middle East    | 804 |             | 15.6     |          |          |          |          |
| Herbenick, 2013  | USA            | 1,661| 17–91       | 14.15    |          |          |          | 12.23    |
| Shaeer, 2013     | USA            | 1,133| 52.38 (avg.)| 13.1     | 15.6     | 16.3     | 10.6     |          |

Table 2. Global published data of mean penile size (self-reported measurements only). FPL = Flaccid Penile Length; SPL = Stretched Penile Length; EPL = Erect Penile Length; FPG = Flaccid Penile Girth; EPG = Erect Penile Girth; (avg.) = average.
considered a trustworthy approximation of the penis length during erection\(^1\). The 5-item International Index of Erectile Function (IIEF-5) is a validated diagnostic test that we administered to all the patients included in this study. All patients signed the informed consent to undergo the procedure and for the video to be published.

Measurement was always performed in the same room, by the same operator and using the same flexible measure after a brief introductory interview, performed to put the patient at ease. The measurement was performed before the ultrasound scan to avoid variations caused by changes in temperature. The measurement of the length was performed according to Mondaini \textit{et al.}\(^7\). The length of the penis is defined as the linear distance along the dorsal side of the penis between the pubo-penile junction and the tip of the glans, either in the flaccid or stretched states. The circumference of the penis was measured at rest at mid-shaft. In all cases we found that the measurements were coherent with the morphometric values of reference of adult men according to Wessels and Ponchietti\(^9,12\) and this information was shared with the patients. After measuring height and weight using methods routinely employed in the clinical setting, the general medical examination continued with an in-depth interview conducted in order to investigate the patients’ motivations and expectations, discuss the foreseen method and the results and provide in-depth answers to the patients’ questions. A meeting between the patients and the anaesthetist occurred separately. At the end of the general examination, patients received instructions to be followed the night before and the morning prior to the surgical operation. In addition, we gave our availability to answer the patients’ questions at any time until the procedure took place. The information summarised in Table 3 was then discussed with all the patients during the general medical examination.

The cosmetic phalloplasty candidate is a healthy and potent man with no congenital or acquired abnormalities or urogenital diseases. In this study, exclusion criteria were:

(a) coagulopathies, cardiopathies, neoplasies, chemo–radiotherapy, infections in progress, prior pelvic surgeries for urogenital conditions or trauma, severe systemic conditions and psychiatric conditions;

(b) unrealistic expectations; patients who requested results superior to those declared by the centre or who felt entitled to obtain the maximum penile increase within our historic series were excluded;

(c) revision surgery; patients requesting a re-operation because of the failure of a previous cosmetic phalloplasty were excluded;

(d) true hypoplasia (micropenis) defined as length < 2.5 percentile points according to Mondaini\(^6\) (these patients were referred to an andrology centre);

(e) significant anxiety, distorted body image, a history of suicidal thoughts and/or attempted suicide linked to presumed genital inadequacy with psychogenic sexual dysfunction.

In line with data shown in the literature\(^2,5,7\), penis dimensions at rest were the most critical (78%) for patients but the circumference of the penis was more determinant than length (69%). This may depend, at least in part, on the concept that enlargement phalloplasty is less invasive than lengthening phalloplasty. The desire to increase both dimensions was the most frequent (82%); in many cases it was conditioned by the fear of losing the right penile proportions by intervening in only one aspect (66%) and it was probably facilitated by the advantages in terms of down-time connected with performing the two procedures simultaneously. The time that elapsed between the first examination and the surgical procedure was 2–6 months. Among the motivations for seeking this surgical procedure, the most frequently cited by patients were psychological discomfort in homosocial situations, discomfort towards women – almost always linked to one or more devaluing observations made during intimacy, the desire to “dazzle” women, the well-founded perception that genital size was incoherent with their body, the desire to improve an already generous natural endowment for narcissistic or professional reasons, the desire for better correlation or proportions between dimensions at rest and during erection and between length and girth and the desire to move from the lowest limits of the normal range towards the morphometric median. The most common concerns relative to the operation, which coincided with the patient's expectations from the procedure, were: (a) the surgery being imperceptible (b) the preservation of the quality of erection and local sensitivity; (c) achievement of the mathematical average of the declared results, in terms of penis length and/or of the circumference and (d) the results being aesthetically impeccable.

**Table 3. Information regarding the phalloplasty discussed with the patients during their general examination.**
Anaesthesia.  The choice of anaesthesia for cosmetic phalloplasty must be in line with the criteria of clinical adequacy, minimum invasiveness and rapid discharge. Among the different choices of anaesthesia, a vast array of scientific documentation exists to support the decided clinical advantages of sedation methods associated with local and loco-regional anaesthesia techniques. On the basis of such scientific support, we have opted for the following anaesthesia protocol:

Sedation.  Premedication: Midazolam 0.04–0.05 mg/kg
Induction: Fentanyl 0.7–0.8 g/kg + Propofol 0.8–1.6 mg/kg
Maintenance: Propofol 0.3–0.5 mg/kg/hour
Only in rare cases (n = 6) it was necessary to use additional amounts of Propofol (0.5–0.8 mg/kg) and/or Fentanyl (0.4–0.8 g/kg) to guarantee adequate sedation.

Local anaesthesia.  Anaesthesia in the pubic and penile region was executed by the surgeon using deep infiltration in the zone of the suspensory ligament of the penis and the cutaneous/sub-cutaneous zone affected by the surgical aggression:

- Lidocaine 2%, 20 ml
- Mepivacaine/carbocaine 2%, 10 ml (total solution 30 ml)

10 ml of the above mentioned solution was used in its pure form for cutaneous and deep peri-nervous infiltration, while the same was diluted in 230 ml of 0.9% sodium chloride with 1 mg epinephrine (1/250,000) for infiltration in the subcutaneous region where adipocytes will be harvested. In our experience, such procedure resulted to be fully ideal to allow surgical treatment, devoid of complications and major side effects, widely liked by patients and guaranteed brief protected discharge times (180 ± 30 minutes).

Surgical procedure.  Fat Harvesting and Purification.  Prior to the operation, the patients were photographed while standing. The operation began after disinfection of the skin, with the harvesting of the adipose tissue. This was performed by explanting fat bilaterally from the thighs if the patient was tendentially thin and from the periumbilical region if the patient was normo-weight or overweight and from the suprapubic region if there was any localised adiposity. This latter area of harvesting permitted, in certain cases, the reduction of the suprapubic adipose panniculus (suprapubic lipectomy) rendering the point of insertion of the penis deeper and visually increasing the length of the external portion of the penis (see supplementary file).

Thereafter infiltration of the donor site was performed with a tumescent solution. After a few minutes of waiting, necessary to consolidate the vasoconstrictor effect of the epinephrine, adipose explant was performed using a thin cannula (2 mm) and a 10 cc Luer-lock syringe. The quantity of fat explanted varied from subject to subject on the basis of the volume to be filled, but it was never less than 80 ml. That volume was comprised of infiltration material which was then removed by decantation first and centrifugation later. Such a process of purification is of primary importance since it determines the percentage integration of fat in the penis. In our surgical centre we first performed the decantation through sedimentation of each 10 cc syringe in such a way as to put the harvested material through an initial process of purification. Each syringe was filled with fat again and each time the infiltration material was removed, repeating the decantation by sedimentation process many times. Once a seemingly stable mixture was obtained, the syringes of crudely purified fat underwent centrifugation for two minutes at 1000 rpm. Reducing the time and the number of rpms, with respect to the original Coleman’s technique which involves centrifugation for 3 minutes at 3000 rpm, the integrity of the adipose globules, whose integrity is in turn responsible for the good integration of the fat, was safeguarded. In the meantime, for the patients who received elongation phalloplasty, a 980 nm diode laser was used.

V-Y Plasty and Dissection of the Suspensory Ligament.  The suprapubic area was incised using the inverted V technique (V-Y Plasty), which is more preferable than the Z technique or other techniques since it guarantees a better aesthetic result and is widely used in plastic surgery (Fig. 1). This was followed by a complete section of the suspensory ligament of the penis, taking care to adequately section the lateral ligaments as well. Only in this way it is possible to obtain the best achievable results. The suspensory ligament of the penis is a deep structure that joins the cavernous bodies of the penis to the pubic symphysis; its section entails the forward translation of the internal portion of the penis with the consequent increase in the length of the visible penile volume. In order to avoid post-surgical scar retraction of the ligament, inverse periostal-fascial sutures were used. This technique ensured that the most superficial ligamentous tissues, which had been sectioned, were inverted into the newly formed cavity and then anchored with 2-0 nylon stitches in the deepest portion of the periosteam of the pubic symphysis. A first deep layer of suture was performed using a 3-0 slow resorption material suturing the ligament in a longitudinal direction. In effect, the ligament was initially sectioned horizontally and then sutured longitudinally thereby obtaining a postero-anterior increment in length that supported the increment obtained through the section of the deep ligaments. We used a technique similar to that employed by Brisson, 2001. His technique allowed him to obtain a valid increase in the length of the external part of the penis and, at the same time, avoid scar-retraction phenomena that in the past nullified the increase obtained after a few weeks. Moreover, this quick and simple technique avoided the use of materials foreign to the organism, such as spacers of various kinds. A second layer of sutures was then performed always longitudinally using resorbable 3-0 sutures. Finally, the cosmetic closure of the cutaneous cut was performed using resorbable intradermal 4-0 sutures (V-Y plasty).

Fat Transfer.  Once the penile elongation operation had been performed, the test-tubes containing the purified adipose material were extracted. They typically contained three layers: the most superficial was oily, the middle contained the purified fat and the lower was made up of blood and infiltration material. The inferior and
Circumference at rest significantly increased at 2 (11.6 ± 0.08), 6 (11.5 ± 0.09) and 12 months (11.4 ± 0.1), compared to baseline (8.8 ± 0.07) (all p < 0.0001, respectively) (Fig. 2A). Stretched length significantly increased at 2 (14.02 ± 0.07), 6 (13.7 ± 0.08) and 12 (13.5 ± 0.09) months, compared to baseline (12.4 ± 0.06) (all p < 0.0001) (Fig. 2B). Circumference at rest significantly increased at 2 (11.5 ± 0.09), 6 (11.36 ± 0.09) and 12 (11.06 ± 0.1) months, compared to baseline (8.3 ± 0.06) (all p < 0.0001) (Fig. 2C). IIEF-5 increased at 12 months (23 ± 0.08) compared to baseline (21.5 ± 0.08) (p < 0.0001; 6.74% improvement) (Fig. 2D).

Discussion

We found that cosmetic phalloplasty significantly improves length at rest, stretched length, circumference at rest and IIEF-5 score at 2, 6 and 12 months post-surgery.

Hypoplasia of the penis is associated with medical conditions which include low flow priapism20, Peyronie’s disease21, congenital abnormalities22, erectile dysfunction23 and surgical conditions such as radical prostatectomy/radiotherapy for prostatic carcinoma24-26 and surgical correction of Peyronie’s disease27. Evidence shows cases of apparent hypoplasia distinguishing it from (a) “hidden” penis, secondary to the presence of abdominal fat or the cutaneous relaxation of the abdomen28 and (b) a “buried” penis where the penis shaft is beneath the suprapubic skin as a result of obesity and/or radical circumcision29.
Associated with a cutaneous V-Y plasty, ligamentolysis is the main and most common method of surgical elongation of the penis. Omission of the cutaneous plasty contrasts the result achieved from the release of the ligament because it impedes the advancement of the shaft. Detachment of the suspensory ligament and the pubic symphysis, which is obtained through ligamentolysis, causes a forward movement of the cavernous bodies and allows the penis to reach its maximum extracorporeal projection. The elongation is considered purely apparent (“apparent lengthening” vs “genuine lengthening”) since the length of the penis remains unvaried; such elongation is in fact significantly more visible at rest than during erection. Nevertheless, the operation produces a visible and available increase in the length of the penis as expected by the patient.

Several techniques have been proposed in order to impede retraction of the sectioned ligament and therefore nullify the surgical result. They include positioning of the fat obtained from the spermatic funnici between the

| Adverse events                              | PL + GE (N = 301) (n) | PL (N = 21) (n) | GE (N = 33) (n) | (N = 355) Total (%) |
|---------------------------------------------|-----------------------|----------------|----------------|---------------------|
| Loss of erectile function                  | 0                     | 0              | 0              | 0                   |
| Decrease of erectile function (temporary)  | 2                     | 1              | 0              | 0.008               |
| Penile oedema                               | 0                     | 0              | 0              | 0                   |
| Long-standing haematoma                     | 2                     | 1              | 1              | 0.011               |
| Seroma                                      | 2                     | 0              | 0              | 0.005               |
| Dehiscence                                  | 0                     | 0              | N/A            |                     |
| No increase in girth                        | 0                     | N/A            | 0              |                     |
| Fat loss (>30%)                             | 15                    | N/A            | 6              | 0.059               |
| Fat nodules, fat lumps                       | 1                     | N/A            | 1              | 0.005               |
| Fat migration                               | 1                     | N/A            | 0              | 0.003               |
| Sclerosing lipogranuloma                    | 0                     | N/A            | 0              |                     |
| Loss of sensation (mild)                    | 3                     | 0              | 2              | 0.011               |
| Fibrosis                                    | 0                     | 0              | 0              |                     |
| Superficial infection                       | 1                     | 0              | 1              | 0.005               |
| Deep infection                              | 0                     | 0              | 0              |                     |
| Paradoxical penile shortening               | 0                     | 0              | N/A            |                     |
| No increase in length                       | 0                     | 0              | N/A            |                     |
| Delayed wound healing                       | 3                     | 1              | N/A            | 0.011               |
| Penile deformity                            | 0                     | 0              | 0              |                     |
| Penile asymmetry                            | 1                     | N/A            | 1              | 0.005               |
| Penile curvature                            | 0                     | 0              | N/A            |                     |
| Decreased erection angle (penile instability)| 1                    | 1              | N/A            | 0.005               |
| Hypertrophic wound scarring                 | 2                     | 1              | N/A            | 0.008               |
| Keloid                                      | 1                     | 0              | 0              | 0.003               |
| Scrotalization                              | 0                     | 0              | 0              |                     |
| Disfiguring advancement of suprapubic hairy skin | 2                | 0              | N/A            | 0.005               |

Table 4. Summary of adverse events. PL = Penile Lengthening; GE = Girth Enhancement; N/A = not applicable.

| Age (years) | Weight (kg) | Height (cm) | Baseline IIEF-5 | Baseline length at rest (cm) | Baseline stretched length (cm) | Baseline circumference at rest (cm) |
|-------------|-------------|-------------|-----------------|-----------------------------|-------------------------------|------------------------------------|
| Number of values | 355 | 355 | 355 | 327 | 354 | 355 | 354 |
| Minimum | 19 | 56 | 167 | 14 | 5.4 | 8.9 | 5 |
| 25% Percentile | 29 | 68 | 173 | 20 | 7.9 | 11.7 | 7.5 |
| Median | 36 | 74 | 178 | 22 | 8.9 | 12.5 | 8.3 |
| 75% Percentile | 46 | 81 | 181 | 23 | 9.8 | 13.4 | 9.1 |
| Maximum | 63 | 99 | 192 | 25 | 12.4 | 16.3 | 13.3 |
| Mean | 38.08 | 75.13 | 177.4 | 21.5 | 8.882 | 12.45 | 8.377 |
| Std. Deviation | 10.81 | 8.969 | 5.126 | 2.41 | 1.362 | 1.314 | 1.213 |
| Std. Error of Mean | 0.5737 | 0.476 | 0.2721 | 0.1333 | 0.07237 | 0.06974 | 0.06445 |
| Lower 95% CI of mean | 36.95 | 74.2 | 176.8 | 21.24 | 8.739 | 12.31 | 8.25 |
| Upper 95% CI of mean | 39.21 | 76.07 | 177.9 | 21.76 | 9.024 | 12.58 | 8.504 |
| Sum | 13519 | 26672 | 62962 | 7031 | 3144 | 4419 | 2965 |

Table 5. Baseline descriptive statistics of patients’ demographics. IIEF-5 = 5-item International Index of Erectile Function.
suspensory ligament and the pubic symphysis, use of silicone spacers, the application of weights and post-surgical penile stretching. In a previous study, the post-surgical use of extensors, for at least three consecutive months, resulted in an increase of length of no more than 1.3 cm.

The growing demand for autologous fat transplant (AFT) beginning at the end of the 80s is linked to the advent of liposuction. The current methods of fat transfer were popularised and extensively described by Sydney Coleman, who in 1986 began to transplant fat in iatrogenic deformities from liposuction and subsequently in the face. AFT is today a widely tested procedure, appreciated by patients and very widespread among plastic surgeons even for reconstructive surgery despite no consensus has been reached regarding the best technique or its success rate.

The fat injection is the most common technique of penile girth enhancement. The fat harvested from the patient is implanted into the subdartoic space with the objective to symmetrically and uniformly increase the circumference of the penis.

The inhomogeneities of the surgical techniques and the selection criteria of the patients render it difficult to compare the results obtained by our centre with those found in the literature and reported from other clinics (an overview of surgical techniques employed for phalloplasty and results obtained is summarised in Table 6).

In our experience, cosmetic phalloplasty has evolved in time moving in a direction of increased safety. The substitution of silicone spacers with inverse periosteal fascial sutures, which we have already described, and the use of autologous fat have marked the end of rare but significant complications that in the past led to reoperation. At the moment, we employ a surgical technique that keeps complications to a minimum and results in great patients’ satisfaction. Patients who undergo combined elongation and girth enhancement phalloplasty are particularly satisfied compared to those who undergo a single operation which is probably linked to the availability of an overall greater penile volume.

In line with other authors, we believe that, even in its relative simplicity, cosmetic phalloplasty requires a profound knowledge of anatomy and surgical technique and that the selection of candidates is a fundamental and essential element together with scrupulous gathering of information regarding not only the operation and the obtainable results, but also post-surgical conduct since resuming of sexual activity prior to 60 days after the operation can compromise the results.

While confirming that cosmetic phalloplasty very rarely produces spectacular results and that there is an objective necessity to improve the stability of the fat in time, we retain that the data from our centre show that the surgical technique we utilise is safe, repeatable and produces concrete and measurable results. Finally, the operation, last resort to improve the patient’s discomfort, can considerably improve the patient’s self-esteem and improve the quality of his sex life and, in turn, his relationships.
Table 6. Overview of surgical techniques employed for phalloplasty and results obtained. DFF = dermal fat flap; DFT = dermal fat transfer; FI = fat injection; SBL = suprapubic lpectomy; SLD = suspensory ligament dissection; VYP = V-Y plasty. *Data obtained from questionnaires administered in several surgical centers by at least 10 different surgeons. Total number of procedures: 275.

Conclusions
The limited literature regarding cosmetic phalloplasty consists of studies performed using diverse surgical techniques and candidate selection criteria which include patients who should in fact be excluded (e.g. men with psychiatric conditions, namely body dysmorphic disorder) or whose existing conditions (e.g. failure of previous phalloplasty and trauma) make it impossible to compare results. If we consider the lack of universally shared morphometric values, we see how this niche of cosmetic surgery suffers from an inevitable lack of methodological rigour. In the present study we show the efficacy of cosmetic phalloplasty in a large cohort of patients up to 1-year follow-up. In addition, we describe in detail inclusion and exclusion criteria for patient selection and technical aspects of our surgical procedure which ensure reproducibility of our findings and should be adopted in future clinical studies of cosmetic phalloplasty. We are confident that this study will encourage other authors to publish their experiences with cosmetic phalloplasty and that the method we have described in this article will contribute to the consolidation of a standard for this type of surgery.

References
1. Lever, J., Frederick, D. & Peplau, L. Does size matter? Men’s and women’s views on penis size across the lifespan. *Psychology of Men & Masculinity* 7, 129–143 (2006).
2. Davis, S. N., Binik, Y. M., Amsel, R. & Carrier, S. The Index of Male Genital Image: a new scale to assess male genital satisfaction. *The Journal of urology* 190, 1335–1339 (2013).
3. Shaer, O. & Shaer, K. Impact of penis size on male sexual function and role of penile augmentation surgery. *Current urology reports* 13, 285–289 (2012).
4. Franconeur, R. T. & Perper, T. A descriptive dictionary and atlas of sexology. (Greenwood Press, 1991).
5. Cleveland, P., Ali, Z., Parham, A. & Pearce, I. The history of penis enhancement – to cut a short story long. *Bju International* 115, 33 (2015).
6. Klein, R. Penile augmentation surgery. San Francisco. CA: *Electronic Journal of Human Sexuality* (1999).
7. Mondaini, N. et al. Penile length is normal in most men seeking penile lengthening procedures. *International Journal of Impotence Research* 14, 283 (2002).
8. Roos, H. & Lissoos, I. Penis lengthening. *Int J Aesthetic Restorative Surg* 2, 89–96 (1994).
9. Wessells, H., Lue, T. F. & McAninch, J. W. Penile length in the flaccid and erect states: guidelines for penile augmentation. *The Journal of urology* 156, 995–997 (1996).
10. Alter, G. J. Penile enhancement. *Aesthetic Surgery Journal* 16, 226–230 (1996).
61. Son, H., Lee, H., Huh, J. S., Kim, S. W. & Paick, J. S. Studies on self-esteem of penile size in young Korean military men. Asian J Androl 5, 185–189 (2003).
62. Savoie, M., Kim, S. S. & Soloway, M. S. A prospective study measuring penile length in men treated with radical prostatectomy for prostate cancer. J Urol 169, 1462–1464, https://doi.org/10.1097/01.ju.0000053720.93303.33 (2003).
63. Pereira, N. Estudio do tamanho do pénis na população portuguesa. Rev Int Androl 2, 15–21 (2004).
64. Ayuwad, Z. et al. Penile measurements in normal adult Jordanians and in patients with erectile dysfunction. Int J Impot Res 17, 191–195, https://doi.org/10.1016/j.ijir.2001.09.027 (2005).
65. Kamel, I., Gadalla, A., Ghanem, H. & Oraby, M. Comparing penile measurements in normal and erectile dysfunction subjects. J Sex Med 6, 2305–2310, https://doi.org/10.1111/j.1743-6109.2009.01305.x (2009).
66. Soleyman, H. et al. Relationship between penile size and somatometric parameters in 2276 healthy young men. Int J Impot Res 24, 126–129, https://doi.org/10.1038/ijir.2011.33 (2012).
67. Chen, X. R., Li, R. X., Yang, H. N. & Dai, J. C. A comprehensive, prospective study of penile dimensions in Chinese men of multiple ethnicities. Int J Impot Res 26, 172–176, https://doi.org/10.1038/ijir.2014.9 (2014).
68. Shalaby, M. E., Almohsen, A. E., El Shahid, A. R., Abd Al-Sameeaa, M. T. & Mostafa, T. Penile length-somatometric parameters relationship in healthy Egyptian men. Andrologia 47, 402–406, https://doi.org/10.1111/and.12275 (2015).
69. Veale, D., Miles, S., Bralney, S., Muir, G. & Hodossi, J. Am I normal? A systematic review and construction of nomograms for flaccid and erect penis length and circumference in up to 15,521 men. BJU Int 115, 978–986, https://doi.org/10.1111/bju.13010 (2015).
70. Habous, M. et al. Erect penile dimensions in a cohort of 778 Middle Eastern men: establishment of a nomogram. J Sex Med 12, 1402–1406, https://doi.org/10.1111/1743-8289.12845 (2015).
71. Salama, N. Consultation for Small-Sized Penis in the Egyptian Males: A Case Control Study. Am J Mens Health 10, 220–227, https://doi.org/10.1177/1557988314565167 (2016).
72. Hussein, N. S., Abid, A. F. & Alnuaimi, A. S. Reference range of flaccid and stretched penile lengths of adult males in Baghdad: A cross-sectional study. Arab J Urol 15, 68–73, https://doi.org/10.1016/j.aju.2017.01.001 (2017).
73. Richters, J., Gerof, J. & Donovan, B. Are condoms the right size? A method for self-measurement of the erect penis. Veneurology 8, 77–81 (1995).
74. Bogaert, A. F. & Hershberger, S. The relation between sexual orientation and penile size. Arch Sex Behav 28, 213–221 (1999).
75. Harding, R. & Golombok, S. E. Test-retest reliability of the measurement of penile dimensions in a sample of gay men. Arch Sex Behav 31, 351–357 (2002).
76. Shafer, O. & Shafer, K. The Global Online Sexuality Survey (GOSS): ejaculatory function, penile anatomy, and contraceptive usage among Arabic-speaking Internet users in the Middle East. J Sex Med 9, 425–433, https://doi.org/10.1111/j.1743-6109.2012.02338.x (2012).
77. Herbenick, D., Reece, M., Schick, V. & Sanders, S. A. Erect penile length and circumference dimensions of 1,661 sexually active men in the United States. J Sex Med 11, 93–101, https://doi.org/10.1111/j.1743-6109.2013.03441.x (2014).
78. Shafer, O. & Shafer, K. The Global Online Sexuality Survey (GOSS): The United States of America in 2011 penile size and form among English speakers. Human Andrology 3, 46–53 (2013).
79. Austoni, E., Guarneri, A. & Cazzaniga, A. A New Technique for Augmentation Phalloplasty: Albugineal Surgery with Bilateral Saphenous Grafts—Three Years of Experience. 42, 245–253 (2002).
80. Hussein, N. S., Abid, A. F. & Alnuaimi, A. S. Relationship between penile size and somatometric parameters in 2276 healthy young men. Int J Impot Res 17, 191–195, https://doi.org/10.1016/j.ijir.2001.09.027 (2005).
81. Bin, Y. A comparative study on two kinds of surgical procedures of penile corpora cavernosa augmentation. Journal of Plastic, Reconstructive & Aesthetic Surgery 62, 357–364 (2009).
82. Jia, Z. et al. Tissue engineering penoplasty with biodegradable scaffold Maxpol-T cografted autologous fibroblasts for small penis syndrome. J Androl 32, 491–495, https://doi.org/10.2164/jandrol.110.011247 (2011).
83. Alei, G. et al. Original technique for penile girth augmentation through porcine dermal acellular grafts: results in a 69-patient series. J Sex Med 9, 1462–1468, https://doi.org/10.1111/j.1743-6109.2012.02744.x (2012).
84. Wessells, H., Tom, F. L. & Jack, W. M. A. Complications of penile lengthening and augmentation seen at 1 referral center. The Journal of urology 155, 1617–1620 (1996).
85. Altmann, G. Reconstruction of deformities resulting from penile enlargement surgery. The Journal of urology 158, 2153–2157 (1997).
86. Shirong, L. et al. Modified penis lengthening surgery: review of 52 cases. Plast Reconstr Surg 105, 596–599 (2000).
87. Mertz, Z., Kozyrakis, D. & Bogris, E. Is V-Y plasty necessary for penile lengthening? Girth enhancement and increased length solely through circumcision: description of a novel technique. Asian J Androl 15, 819–823, https://doi.org/10.1111/ajaa.2013.38 (2013).
88. Xu, L. et al. Augmentation Phalloplasty With Autologous Dermal Fat Graft in the Treatment of “Small Penis”. Ann Plast Surg 77(Suppl 1), S60–65, https://doi.org/10.1097/SAP.0000000000000782 (2016).

Author Contributions
A.L. performed procedures and wrote the manuscript. R.M. performed procedures. T.I. performed statistical analysis, created tables and figures and wrote the manuscript. T.I., J.C.M.M., A.L. and B.P. participated in acquisition of relevant literature and revised the manuscript critically for intellectual content. A.L. and B.P. participated in conception and design of the work. All the authors approved the final version of the manuscript.

Additional Information
Supplementary information accompanies this paper at https://doi.org/10.1038/s41598-019-41652-w.

Competing Interests: The authors declare no competing interests.

Publisher’s note: Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.