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Human glans penis augmentation using injectable hyaluronic acid gel

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Although augmentation phalloplasty is not an established procedure, some patients still need enlargement of their penis. Current penile augmentation is girth enhancement of penile body by dermofat graft. We performed this study to identify the efficacy and the patient's satisfaction of human glans penis augmentation with injectable hyaluronic acid gel. In 100 patients of subjective small penis (Group I) and 87 patients of small glans after dermofat graft (Group II), 2 cm^3 of hyaluronic acid gel was injected into the glans penis, subcutaneously. At 1 y after injection, changes of glandular diameter were measured by tapeline. Patient's visual estimation of glandular size (Gr 0–4) and patient's satisfaction (Grade (Gr) 0–4) were evaluated, respectively. Any adverse reactions were also evaluated. The mean age of patients was 42.2 (30–70) y in Group I and 42.13 (28–61) y in Group II. The maximal glandular circumference was significantly increased compared to basal circumference of 9.13 $\pm$ 0.64 cm in Group I ($P<0.01$) and 9.49 $\pm$ 1.05 cm in Group II ($P<0.01$) at 1 y after injection. Net increase of maximal glandular circumference after glans augmentation was 14.93 $\pm$ 0.80 mm in Group I and 14.78 $\pm$ 0.89 mm in Group II. In patient's visual estimation, more than 50% of injected volume was maintained in 95% of Group 1 and 100% of Group II. The percentage of postoperative satisfaction (Gr 4, 5) was 77% in Group 1 and 69% in Group II. There was no abnormal reaction in area feeling, texture, and color. In most cases, initial discoloration by glandular swelling recovered to normal within 2 weeks. There were no signs of inflammation and no serious adverse reactions in all cases. These results suggest that injectable hyaluronic acid gel is a safe and effective material for augmentation of glans penis.
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Keywords: hyaluronic acid; glans penis; augmentation

Introduction

Although augmentation phalloplasty is not an established procedure, some patients still need enlargment of their penis. Current main procedures for augmentation phalloplasty are penile lengthening and girth enhancement by dermofat graft. There is no established procedure for glans penis augmentation. The limitations of glans penis augmentation are poor understanding of glans penis anatomy, technical shortness, and lack of adequate material. In the last decade, hyaluronic acid has been shown to possess many properties that suggest its value in several medical applications, particularly in ophthalmology, orthopedics, and soft-tissue augmentation with proven efficacy and safety.[1–3] Recently, we also reported the feasibility of injectable hyaluronic acid gel in augmentation of glans penis *in vivo*.[4]

We performed this study to identify the efficacy of injectable hyaluronic acid gel in augmentation of the human glans penis.

Materials and methods

Patients

A total of 187 patients were recruited to this study. Patients of Group I were not satisfied with their penis, had a sense of inferiority because of their small penis and suffered from sexual dysfunction owing to decreased self-esteem. In all, 87 patients of Group II were dissatisfied with their relative small glans after augmentation phalloplasty with girth enhancement by dermofat graft. In both groups, 2 cm^3 of hyaluronic acid gel was injected into the glans penis, subcutaneously.

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Injection method

Under local anesthesia, 30 min after topical application of anesthetic cream Emla® (lidocaine 25 mg, prilocaine 25 mg, Astra Xeneca), 2 cm^3 of injectable hyaluronic acid gel (Perlane®, Q-med, Uppsala, Sweden) was injected via a 27 G needle. The injection needle was indwelled subcutaneously at proximal one-third from tip of glans to coronal sulcus; thereafter hyaluronic acid gel was injected by the Fan technique (Figure 1). After injection of Perlane®, the undulation of glandular surface was supplemented by injection of Restylane® (Hyaluronic acid gel, Q-med, Uppsala, Sweden) via a 30 G needle. Both Restylane® and Perlane® are injectable hyaluronic acid gel and have the same composition of 20 mg/ml of stabilized hyaluronic acid gel. The difference between the products is the size of the gel particles. The molecular weight of hyaluronic acid in its pure form can be determined. However, hyaluronic acid in its pure form is not stabilized. Injectable hyaluronic acid gel is chemically modified hyaluronic acid product to increase its longevity in the tissue and to form a gel. It is not relevant to talk about molecular weight, as it cannot be determined for a stabilized gel. The approximate number of gel particles is 100 000/ml in Restylane® and 1000/ml in Perlane®. For this reason, Q-med recommends the 30 G needle to inject Restylane® into the mid- to upper part of the dermis and a 27 G needle to inject Perlane® into the deep layer of dermis.

Evaluation

At 1 y after injection, changes of glandular diameter were measured by tapeline to identify the net increase of maximal glandular circumference after augmentation of glans penis. Patient's subjective visual estimation of glandular size was requested to assess the residual volume of hyaluronic acid gel. The patients estimated the visual analogue scale from Grade (Gr) 0 to Gr 4: Gr 0, no residual volume; Gr 1, less than 25% of initial volume; Gr 2, less than 50%; Gr 3, less than 75%; Gr 4, more than 75% or nearly same as initial volume. Patient's satisfaction was also evaluated from Gr 0 to Gr 4: Gr 0, very dissatisfied; Gr 1, moderately dissatisfied; Gr 2, about equally satisfied and dissatisfied, Gr 3; moderately satisfied; Gr 4, very satisfied. Any adverse reactions were also evaluated.

Results

The mean age of patients was 42.2 (30–70) y in Group I and 42.13 (28-61) y in Group II. (Table 1). The maximal glandular circumference was significantly increased compared to basal circumference of 9.13 ± 0.64 cm in Group I ($P<0.01$) and 9.49 ± 1.05 cm in Group II ($P<0.01$) at 1 y after injection. The net increase of maximal glandular circumference after glans augmentation was 14.93 ± 0.80 mm in Group I and 14.78 ± 0.89 mm in Group II. (Table 1, Figure 2). There was no significant difference between both the groups. In patient's visual estimation of glandular volume after augmentation, Gr 3 (more than 50% of injected volume) and Gr 4 (more than 75% of injected volume) was 38, 57% in Group I and 29.9, 70.1% in Group II. (Figures 3 and 4). Mean grade of visual estimation was significantly high in Group II ($P=0.01$). The percentage of postoperative satisfaction (Gr 3, 4) was 77% in Group 1 and 69% in Group II. The mean grade of patient's satisfaction was significantly high in Group I ($P=0.003$). There was no abnormal reaction in area feeling, texture and color. In most cases, initial discoloration by glandular swelling recovered to normal within 2 weeks. Postoperative consistency of glans penis was natural without deformity and maintained through 1 y.

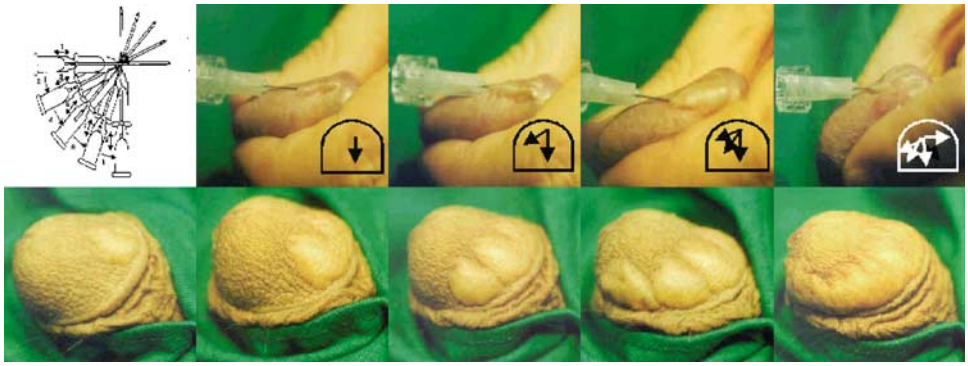

Figure 1 Injection needle was indwelled subcutaneously at proximal one-third from tip of glans to coronal sulcus; thereafter hyaluronic acid gel was injected by the Fan technique.

Table 1 Results of glandular augmentation by injectable hyaluronic acid gel

		Group I	*Group II*	
No. of patients		100	87	
Mean age (y)		42.22 (30–70)	42.13 (28–61)	
Basal circumference (cm)		9.13±0.64	9.49±1.05	
Net circumference (mm)[a]		14.93±0.80	14.78±0.89	
Patient's estimation	Gr 0	0 (0%)	0 (0%)	
	Gr 1	0 (0%)	0 (0%)	
	Gr 2	5 (5%)	0 (0%)	
	Gr 3	38 (38%)	26 (29.9%)	
	Gr 4	57 (57%)	61 (70.1%)	
	Mean	3.52	3.70	P=0.01
Patient's satisfaction	Gr 0	0 (0%)	0 (0%)	
	Gr 1	1 (1%)	0 (0%)	
	Gr 2	22 (22%)	27 (31%)	
	Gr 3	50 (50%)	53 (61%)	
	Gr 4	27 (27%)	7 (8%)	
	Mean	3.03	2.77	P=0.003

Group I: subjective small glans penis, Group II: relative small glans after augmentation phalloplasty with girth enhancement by dermofat graft. [a]Net increase of maximal glandular circumference 1 y after augmentation compared to before augmentation.

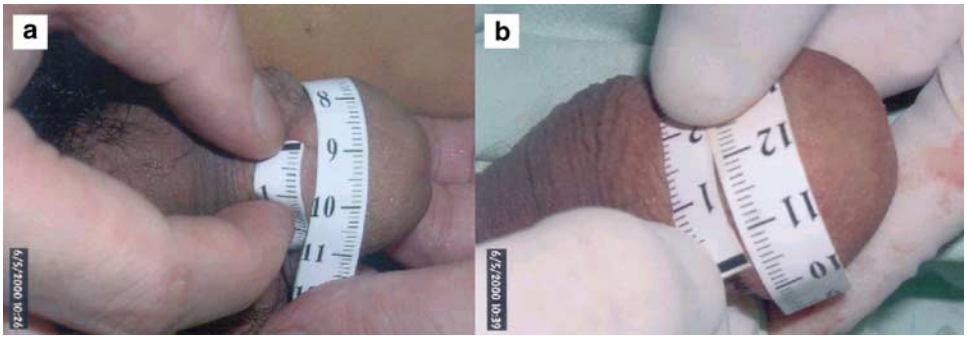

Figure 2 At 1 y after injection, changes of glandular diameter was measured by tapeline to identify net increase of maximal glandular circumference after augmentation of glans penis using injectable hyaluronic acid gel: (a) preaugmentation and (b) 1 y after augmentation.

There were no signs of inflammation and no serious adverse reactions in all cases.

Discussion

Injectable soft-tissue substitutes provide an affordable, nonsurgical alternative for correcting contour defects and soft-tissue augmentation. Several materials have been used for this purpose, including paraffin, silicone, and collagen[5,6] Paraffin and silicone create intense foreign body reactions and are known to migrate from injection sites. Collagen, including rapid degradation, necessitates frequent reinjection and infrequent but significant hypersensitivity reactions.[7] In recent years, implant materials have also been found to migrate to the lung and the brain.[8]

It is therefore advantageous to use degradable materials. The ideal filling substance for soft-tissue augmentation should be biocompatible, nonantigenic, nonpyrogenic, noninflammatory, nontoxic, easy to use, stable after injection, nonmigratory, long-lasting but reabsorbable, natural looking, and not too expensive.[9,10] A ubiquitous component of all mammalian connective tissue, hyaluronic acid (Hyaluronan), is a naturally occurring polysaccharide, in the same chemical and molecular composition in all species; in the intercellular matrix of dermal layers of the skin of all species; therefore, it is highly biocompatible to use animal sources in humans without creating foreign body reactions.[11–13] The material used in this study is based on hyaluronic acid, which has already been used in its native form as an implant for more than 20 y and in millions of individuals without causing adverse reactions. In this study, there were no serious adverse reactions in all cases.

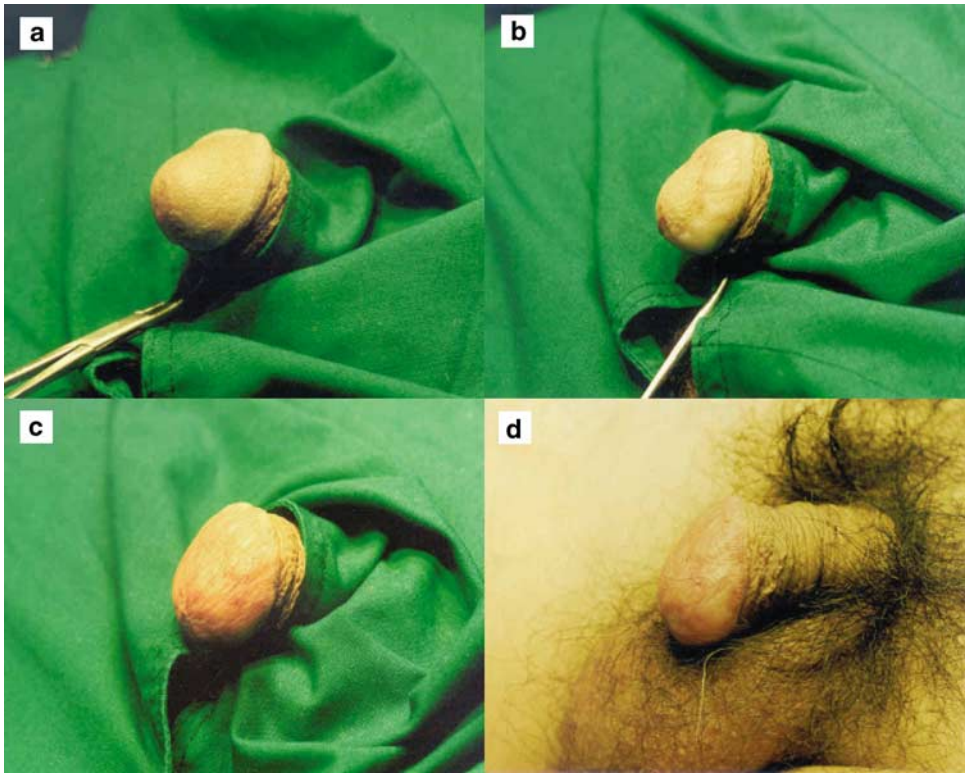

Figure 3 Representative figures of Group I of subjective small glans penis: (a) preaugmentation, (b) during augmentation; (c) immediately after augmentaion and (d) 1 y after augmentation.

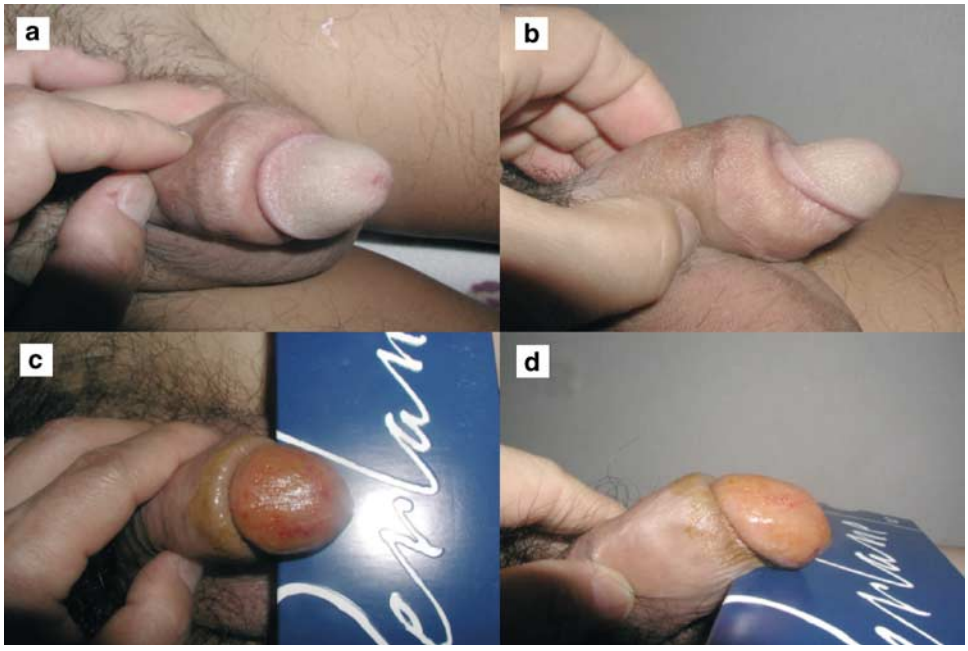

Figure 4 Representative figures of Group II of iatrogenic relative small glans penis after penile girth enhancement by dermofat graft. Before augmentation, multiple tiny skin fold and smooth indentation from the tip of the glans to proximal glans are clearly seen in the dorsal view (a) and lateral view (b). After augmentation, indentations at the back of the glans elevated and skin folds disappear in the dorsal view (c) and the lateral view (d).

Although the efficacy of hyaluronic acid was proved in various fields, the existence of potential space, technical feasibility, and long-term residence should be identified to use injectable hylauronic acid gel in the augmentation of glans penis. Previously, we reported the feasibility of glans penis

augmentation by injectable hyaluronic acid in an animal experiment. In our study, hyaluronic acid gel was easily injected into the Beagle dogs via 27 G needle for elastic glans and showed long-term residence in the lamina propria. In this human study, it was not so difficult to inject hyaluronic acid into the dermis of glans penis. The nature of human glans was elastic and we developed the Fan technique. Most surgeons are already familiar with this technique, which is frequently used to make subcutaneous bulla for skin test of hypersensitivity and for easy dissection of subcutaneous tissues. In our animal study, we already revealed the potential space of lamina propria in glans penis. Although the long-term residual volumes were not measured, the implants were well maintained until 1 y in this study. We used a five-grade scale system. For more accurate estimation of glandular volume, a 10-grade scale may be useful, but it is more demanding for patients. Through the five-grade scale, the patient's self-estimation of long-term residence was fairly good in both the groups. The slow digestion of this gel shows that stabilization of the material through cross-linkage is able to increase its longevity several hundred folds compared to the natural polymer, without decreased biocompatibility. The implant has a property of degradation, but has a characteristic of isovolemic degradation. The isovolemic degradation keeps the gel always in balance with water in the tissue, and this increased capacity to bind water of a less concentrated hyaluronan network allows maintaining the correction even in low presence of the materials. Another advantage is easy supplementation by reinjection in cases of long-term volume loss. Like other fields of soft-tissue augmentation, there was no serious adverse reaction in this study. There was no abnormal reaction in area feeling, texture, and color. In most cases, initial discoloration by glandular swelling recovered to normal within 2 weeks. In most patients, local application of an anesthetic cream was sufficient, but a few presented penile pains.

The demand for penile augmentation continues to increase as the media exposes normal male figures and advertisements create interest in corrective surgery. Penile augmentation is a necessary procedure for such patients: psychogenic impotence or depression for their small penis, congenital micropenis, and penile reconstruction. Current penile augmentation with a dermofat graft alone may produce an iatrogenic penile deformity of thick penile body with relatively small glans. Unlike the Western country, augmentation phalloplasty (dermofat graft for girth enhancement and/or penile lengthening) is very popular for subjective small penis in Asian countries. However, the postoperative patient's satisfaction is not so good. All the Group I patients were not small glans penis only but were composed of small glans penis, small penis, and some early ejaculation patients. After thorough information about phalloplasty, Group I patients consented to only glans penis augmentation instead of total penile enhancement. In this study, postoperative glandular volume was greater in Group II than in Group I. Despite greater volume, patient's satisfaction was higher in Group I of subjective small glans penis. It may be the result of increased self-esteem and decreased anxiety after augmentation. In Group II, a combination of dermofat graft with glandular enhancement by injectable hyaluronic acid gel could make a well-looking penis.

Conclusion

In human glans penis, injecting hyaluronic acid gel into the dermis was not so difficult and the implants showed long-term residence in the patient's visual estimation and resulted in high satisfaction rate of patients. These results suggest that injectable hyaluronic acid gel is a safe and effective material for soft-tissue augmentation in patients with small glans penis. Long-term efficacy of more than 1 y needs to be demonstrated.

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