Autologous Fat Augmentation of the Vocal Folds

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Autologous fat augmentation of the vocal folds has become widely adopted as a means of vocal rehabilitation in patients with deficient glottal closure. In general, the injection method using autologous tissues has no problems regarding safety issues such as infection of unknown cause, but the period of continuous effect is not constant because absorption may occur after injection.
In 99 cases during the 8-years from August 2003 to April 2011. The details of postoperative course were reported. In a cases, maximum phonation time was improved.

Key words: autologous fat, augmentation of the vocal folds

INTRODUCTION

Intracordal autologous fat injection was first reported by Mikaelian [1] in 1991 in three patients with vocal cord paralysis, and has subsequently been the subject of various papers. However, the problem of predicting the degree of reduction in fat volume after injection has not yet been solved.

Intracordal autologous fat injection offers the advantage of safety, since the procedure does not use foreign material that could cause a foreign body reaction or infection. The disadvantages of this procedure are that post-operative absorption diminishes the effectiveness of surgery in some patients, and the material to be injected must first be obtained.

We report herein on the indications, surgical methods and postoperative outcomes for intracordal autologous fat injection performed in our facility.

MATERIALS AND METHODS

1) Fat harvesting

We used abdominal subcutaneous adipose tissue for injection in 33 patients over the 4 years from 2003 to 2006, but have used buccal fat pads in 66 patients from 2006 to the present.

2) Injection method

We use an electric injector for fat injection, allowing the fat to be injected steadily at a fixed rate, so that the depth and direction of the needle can be adjusted while confirming that the vocal cords are expanding [2].

When injecting, we take the precaution of limiting the insertion points to one site wherever possible, to prevent backflow after injection. In unilateral vocal cord paralysis, fat is injected in an amount that increases the overall volume of the vocal cord muscles. In cases of sulcus vocalis or atrophy, we withdraw the needle slightly and inject into the superficial layer after first injecting some of the fat into the muscle layer. This is because fat flows back out from the insertion site after needle withdrawal when injecting into the superficial layer first.

3) Subjects

Over the 8 years from August 2003 to April 2011, a total of 99 patients underwent intracordal autologous fat injection at the Tokai University Hospital group. Patients aged 60-69 years were the most common, comprising nearly half of the total (42 patients), and 70 patients (70%) were men (Fig. 1).

Sixty-four patients (65%) showed vocal cord paralysis, 24 (24%) had sulcus vocalis and 11 (11%) had injury. Results relating to the 64 patients (65%) with vocal cord paralysis are given below. Of these 64 patients, 53 (86%) showed postoperative paralysis, with paralysis after esophageal cancer surgery in 22 patients, after thyroid surgery in 10 patients, after aortic aneurysm surgery in 8 patients, after nerve sheath tumor surgery in 3 patients, and after surgery for the parathyroid gland, lung cancer or spondylosis in the remaining patients (Fig. 2).

All postoperative vocal cord paralysis was unilateral, on the right side in 27/64 and on the left side in 37/64 patients.

RESULTS

1) Adipose tissue

We investigated these two types of adipose tissue, and found no significant difference in fat cell diameters, but discovered that abdominal fat cells tended to show slightly greater variation in size (Fig. 3).

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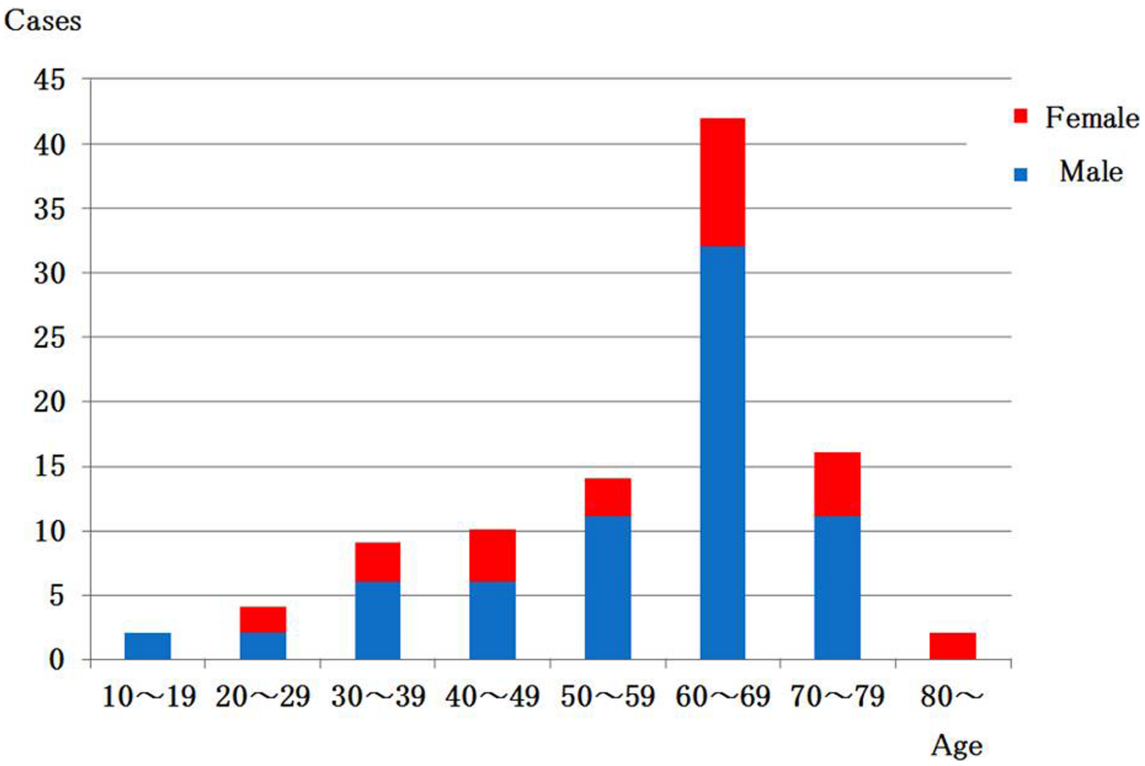

Fig. 1 Patients
Over the 8 years from August 2003 to April 2011, 99 patients underwent autologous fat injection at institutions of the Tokai University Hospital group. Patients aged 60-69 years were the most common, comprising nearly half of the total (42 patients). Seventy patients (70%) were men.

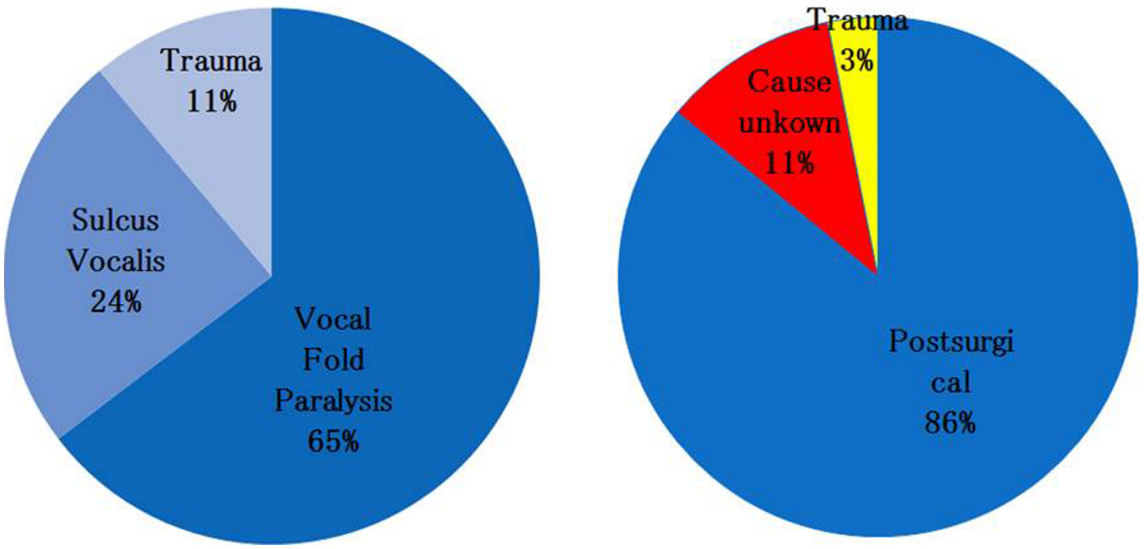

Fig. 2 Subjects (left) and cause of vocal cord paralysis (right)
Left: 65% had vocal cord paralysis, 24% had sulcus vocalis, 11% had injury.
Right: Among patients with vocal cord paralysis, 53 (86%) experienced postoperative paralysis, of whom 22 had undergone esophageal cancer surgery, 10 had undergone thyroid surgery, 8 had undergone aortic aneurysm surgery, 3 had undergone nerve sheath tumor surgery, and the rest had undergone surgery for the parathyroid gland, lung cancer or spondylosis.

2) Amounts of fat injected

Mean amounts of fat injected were 1.29 ± 0.45 ml of abdominal fat and 1.22 ± 0.45 ml of buccal fat in severe cases and 1.00 ± 0.5 ml and 1.02 ± 0.5 ml, respectively, in mild cases. When preparing adipose tissue for injection, blood components must be washed when using abdominal fat, but this is unnecessary when using buccal fat, which contains almost no blood components. Therefore, although wash water is removed after washing, some wash water remains in adipose tissue for injection when using abdominal fat. As a result, the absolute volume of adipose tissue for

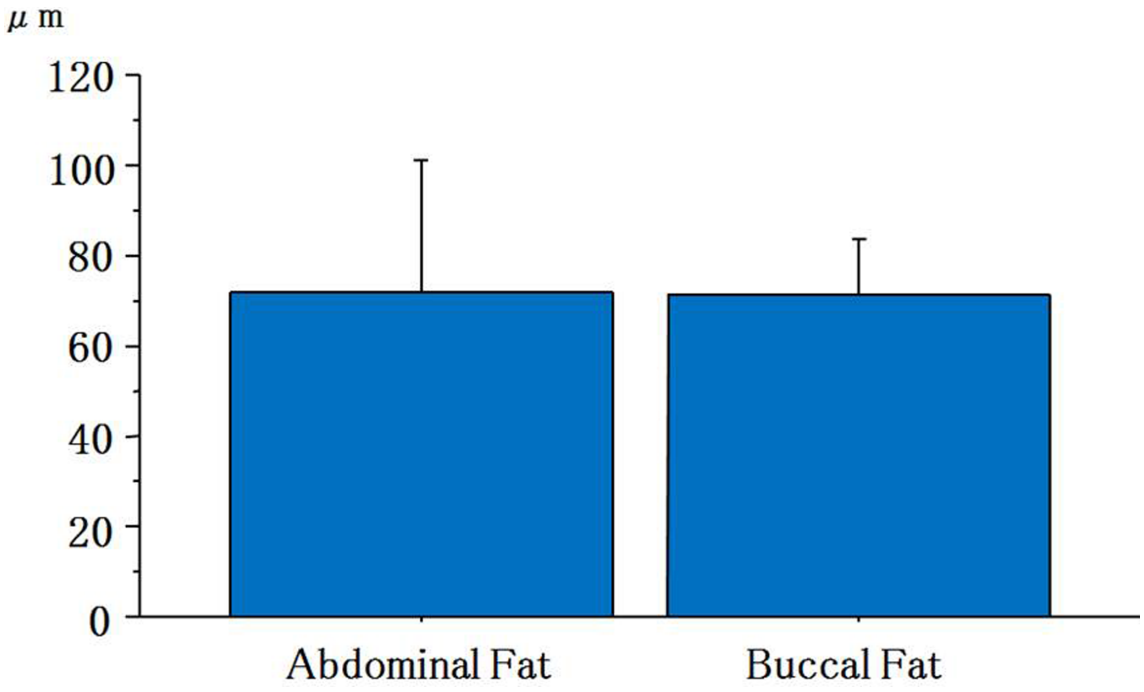

Fig. 3 Comparison of size of fat cells
We compared the size of abdominal and buccal fat cells used for injection. Mean size did not differ, but abdominal fat cells tended to show a greater variation in size.

injection could be lower than the amount when using buccal fat.

3) Postoperative outcomes

We compared the postoperative clinical course in patients with vocal cord paralysis divided into those injected with abdominal fat and those injected with buccal fat, based on the maximum pre- and postoperative phonation times. All patients exhibited a longer phonation time and improved symptoms postoperatively. However, no significant differences in the degree of improvement were evident between using abdominal or buccal fat cells (Fig. 4).

We also divided patients into severe cases with preoperative phonation time <5 s and mild cases with ≥5 s, and compared mean phonation time preoperatively and 12 weeks postoperatively. In mild cases, mean phonation time was shorter in the buccal fat group than in the abdominal fat group preoperatively, but became longer when measured at 12 weeks postoperatively. In other words, the improvement in phonation time tended to be greater in the buccal fat group than in the abdominal fat group (Fig. 5). No significant difference was detected, possibly due to the small number of patients using abdominal fat. Also, no notable intergroup differences were seen between severe cases.

DISUCUSSION

Autologous adipose tissue is considered to have a viscoelasticity resembling the lamina propria of the vocal cords [3]. Intracordal autologous fat injection thus has little negative impact on mucosal vibration during postoperative phonation, and is generally indicated for disorders involving imperfect closure of the glottis. This approach is particularly effective in sulcus vocalis, vocal cord atrophy and unilateral vocal cord paralysis with paramedian-to-median immobilization. Among patients with unilateral vocal cord paralysis, if the glottal gap is wide or the left and right vocal cords are at different levels, surgery is sometimes insufficiently effective, but adequate benefits can still be obtained when combined with speech therapy [4].

On the other hand, in patients with postoperative scarring after laser surgery for laryngeal cancer, or with sulcus vocalis with deep sulci, the scarred areas cannot be injected and the benefits are insufficient. Such patients are therefore not indicated for this procedure.

Abdominal fat has been widely used from the early 1990s until today. However, harvest of sufficient adipose tissue is not always possible in thin patients with only small amounts of subcutaneous fat. Since 2003, we have therefore used buccal fat pads, which are also used in the field of plastic surgery [5].

These fat pads have a mean volume of 9.6 ml, assist in sucking [6] and function as cushioning during contraction of the masticatory and mimetic muscles [7], although the details of these functions remain unclear.

CONCLUSION

We discussed intracordal autologous fat injections conducted with different adipose tissues and postoperative outcomes in patients with unilateral vocal cord paralysis. However, differences in injection volumes with different types of adipose tissue were difficult to study because of the small number of patients injected with abdominal fat.

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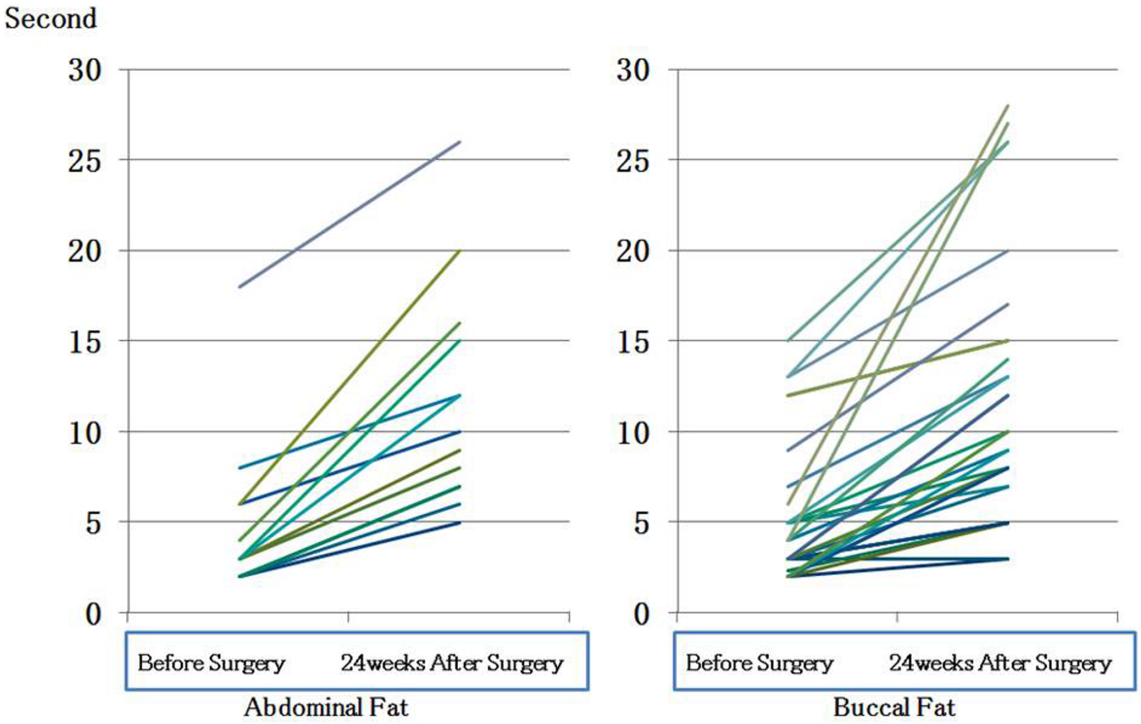

Fig. 4 Patients with paralysis: changes in phonation time
Postoperative course is shown with patients classified according to type of adipose tissue used. All patients exhibited a longer phonation time and improved symptoms.

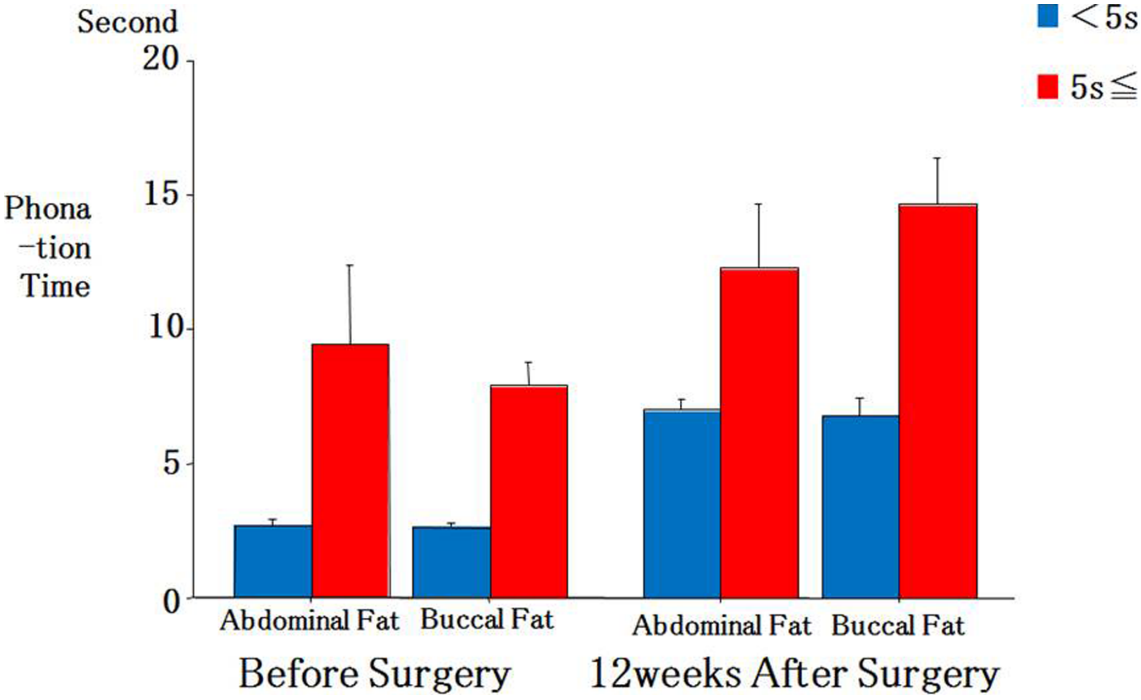

Fig. 5 Comparison of phonation time by disease severity
Patients were divided into severe cases with preoperative phonation time <5 s and mild cases with preoperative phonation time ≥5 s. Mean phonation times preoperatively and at 12 weeks postoperatively were compared. Mean phonation time in mild cases was shorter in the buccal fat group than in the abdominal fat group preoperatively, but became longer postoperatively.

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