European Archives of Oto-Rhino-Laryngology (2019) 276:1385–1390
https://doi.org/10.1007/s00405-019-05342-7

RHINOLOGY

A reliable method to avoid contamination during cartilage graft preparation in septorhinoplasty

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Received: 17 November 2018 / Accepted: 11 February 2019 / Published online: 15 February 2019

Abstract

Purpose The aim of the study is to determine the risk of contamination in the cartilage graft materials prepared on the swester table and those prepared in a sterile package, and to reveal a more reliable method by performing the microbiological examination of these materials.

Methods Cartilages removed from the nasal septum were divided into four pieces. The first part (Sample A) was directly placed into the medium. Sample B was prepared by being crushed in a sterile package. Sample C was prepared on the auxiliary swester table, and Sample D was prepared on the main swester table actively used by surgery team. All samples were transferred in a 1 ml brain heart(BH) liquid medium. From each BH medium, 100 µl culture was performed on blood agar, eosin–methylene blue–lactose–sucrose agar and chocolate agar.

Results Bacterial growth was detected in 2 of the samples A, in 4 of the samples B, in 24 of the samples C, and in 36 of the samples D. The number of patients with bacterial growth in the samples C and/or D despite no growth in the sample B was 35. When the samples A/B and C/D were compared in terms of bacterial growth, a significant difference was found in all matchings ($p < 0.001$ for all comparisons).

Conclusion These findings showed that preparation of the cartilage grafts on the swester table was extremely risky for microbiological contamination. Arslan and his colleagues suggest that preparing a graft material in a sterile package is extremely simple, cheap, and it also reduces contamination risk significantly.

Keywords Bacterial growth · Cartilage grafts · Microbiological contamination · Septorhinoplasty

Introduction

Dorsal contour irregularities, caused by various maneuvers, such as hump resection, are major concerns in patients undergoing rhinoplasty. Dorsal onlay grafts may be used to mask these contour irregularities and to achieve a better esthetic result. Various graft materials, including cartilage, resected nasal hump tissue, dermal grafts, temporoparietal fascia grafts, and alloplastic substances, have been used for this purpose [1–5]. Among these alternatives, the most commonly used materials are cartilage grafts prepared by being crushing or being sliced into small pieces from the nasal septums of the patients.

While septoplasty and rhinoplasty surgeries are clean-contaminated operations, post-operative infections can be relatively rarely seen, which could bring about a failure of the implant and severe scarring of the nose, resulting in possible cosmetic and functional disasters [5–7]. Therefore, it is extremely important avoiding contamination during the preparation of the material to be used as graft.

A sterile metal surgical instrument is often used to prepare dorsal onlay grafts from crushed cartilage during rhinoplasty. However, this instrument is not available in every surgical set and is not afforded by surgeons due to its cost (for example, Sar Song (14-384-000): 140 US dollars, Karl Storz 523,900 Cottle Bone Crusher: 150–230 US dollars). A swester table (Mayo desk) is usually used to prepare this graft. However, the cartilage prepared by this method is at risk of being contaminated. In addition, there is also the risk of loss of cartilage during the preparation of graft due

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to unexpected fly of cartilage from the sterile area to the non-sterile area, as well as risk of sticking of tiny parts of the tablecloth to the cartilage. To avoid these troublesome conditions, Arslan and his colleagues presented a practical solution in the literature that can be used in those cases when there is no sterile surgical instrument [8].

In our study, it was aimed to reveal the risk of contamination through a microbiological examination of the cartilage graft materials prepared in the swester table and in the sterile package (Arslan and his colleagues' suggest) to investigate which method is more reliable.

Materials and methods

The study was conducted with the approval of the local Ethics Committee (06.349.18/26.03.2018). Between the dates May 2018 and September 2018, patients scheduled to undergo an open septorhinoplasty due to their complaints of nose deformity and difficulty in breathing were informed about the study, and then were included in the study following their written informed consent. If there is no enough cartilage left on the table at the end of the surgical procedure, those patients were excluded from the study.

Surgical procedure and preparation of cartilage material

All patients underwent open septorhinoplasty under general anesthesia to correct septonasal deformity. In all surgeries, two tables were prepared, including the swester table (Mayo desk), which is actively used during the surgery, and the auxiliary table, which carries the auxiliary instruments and is kept away from the surgical site (about 1 m distance). The surgical site was sterilized with saline and povidine iodine (Betadine®). Povidone iodine-impregnated cottons were placed into both nasal passages, and kept in the passages for about 10 min. At this time, the surgical procedure was initiated. The nasal dorsal flap is elevated following the midcollumellar and marginal incisions. Subsequently, the anterior septal angle was found, and the submucopericondrial plan of the quadrangular cartilage of the septum was entered. On both sides, the mucopericondrial flap was elevated and the entire septum was revealed. Then, the base cartilage was separated from the maxillary crest. This base cartilage was removed in the form of a strip and maintained in sterile saline in a closed container until the end of surgery. The instruments used in both the elevation and removing cartilage were sterile instruments that were not used until then. The base cartilage, which was removed and kept in sterile saline, was used in various amounts according to the need of the patient. If the cartilage was totally used and no pieces were left, those patients were excluded from the study. The cartilage, which was kept in sterile saline and not needed at the end of surgery, was separated into four pieces while the patient was being awakened by the anesthesia team. The first part (sample A) was placed into the brain heart infusion (BHI) medium without any process. The second part (sample B) was prepared as described by Arslan et al. which the cartilage was crushed in a sterile package by any surgical instrument (Fig. 1). The third part (sample C) was prepared by being crushed on the auxiliary swester table (Fig. 2), and the fourth part (sample D) was prepared by being crushed on the main swester table, which was actively used during surgery (Fig. 3). All samples were transferred to the microbiology laboratory in 90 min in a 1 ml brain heart (BH) liquid medium and all these procedures were performed at room temperature. The dimensions of the samples were meticulously prepared to make them suitable for the microbiological study as for the size and the volume. During the final preparation, a sterile new surgical set was also used. All patients were given 1 g amoxicillin clavulonic acid tablet twice a day for 7 days. In addition to their routine follow-ups, the patients were examined in terms of infectious processes on the first week and first month.

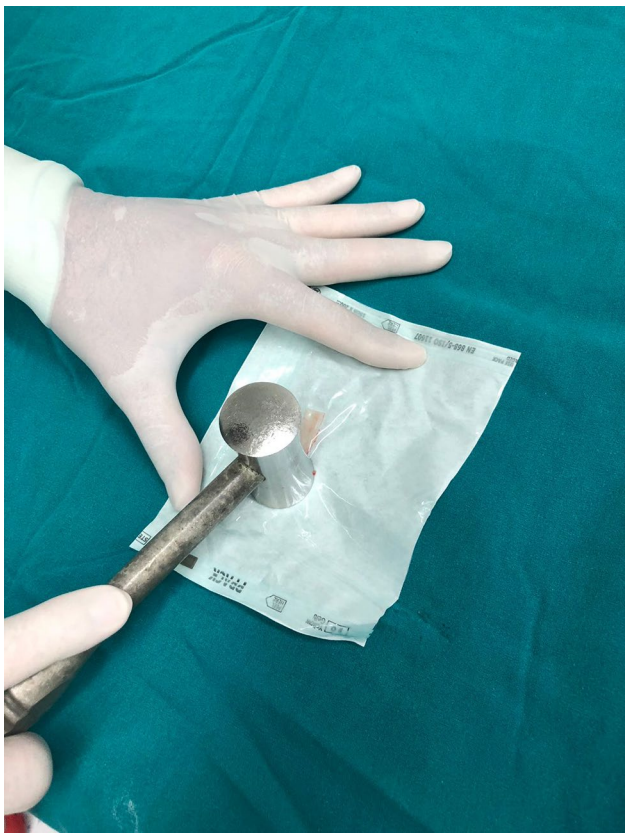

Fig. 1 Preparation of cartilage grafts in a sterile package

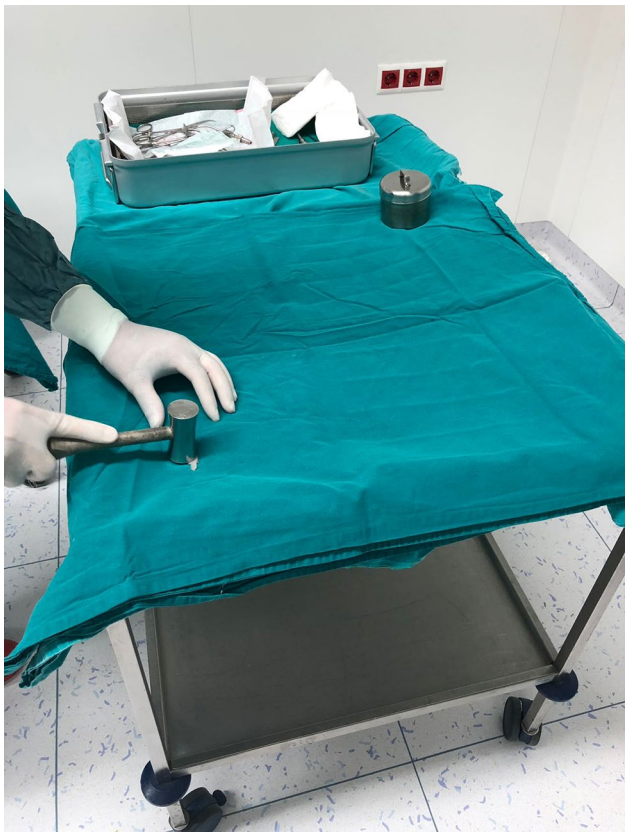

Fig. 2 Cartilage graft preparation on the auxiliary swester table

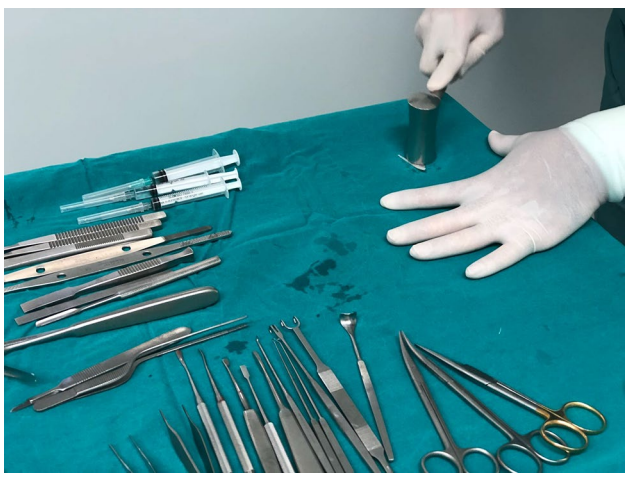

Fig. 3 Preparation of cartilage grafts on the active swester table

Microbiological analysis of the samples

The A, B, C, and D samples sent to the laboratory in BHI medium were kept in the oven at 35 °C for one night. From each BHI medium, 100 µl culture was performed on blood agar, Eosin–Methylene blue–Lactose–Sucrose (EMB) agar and chocolate agar. At the end of incubation, the medium was evaluated for microorganism growth. Conventional methods and BD Phoenix automated system (Becton–Dickinson, USA) were used for the identification of observed colonies and their antimicrobial susceptibilities. Antibiotic susceptibilities were evaluated according to EUCAST 2018 criteria [9].

The data were analyzed using SPSS for Win.Ver.15.0 (SPSS Inc., Chicago, IL, USA). Comparisons between groups were evaluated by the chi-square test. A value of $p < 0.05$ was considered statistically significant.

Results

A total of 50 male patients were included in the study, with a mean age of 20.13 ± 3.25 years (minimum 20, maximum 26). All patients underwent open septorhinoplasty under general anesthesia and the mean operation time was 124.48 ± 27.32 min.

No bacterial growth was occurred in 11 patients (22%). Bacterial growth was detected in 2 of the samples A (4%), in 4 of the samples B (8%), in 24 of the samples C (48%), and in 36 of the samples D (72%). The number of patients with bacterial growth in the samples C and/or D despite no growth in the sample B was 35. In the cases with bacterial growth in sample B, bacterial growth in samples C and/or D was detected, too. The number of cases with bacterial growth in sample B despite no growth in sample A was 2.

While there was no significant difference between the sample A group and the sample B group in terms of the frequency of bacterial growth ($p = 0.67$), there was a significant difference between the sample A and both the sample C and D groups ($p < 0.001$ for both comparisons). Also, a significant difference was found between the sample B group and both the sample C and D groups ($p < 0.001$ for both comparisons). There was no significant difference between the groups C and D in terms of bacterial growth frequency ($p = 0.10$).

Of the total 200 samples sent to the microbiology laboratory, Gram-positive bacterial growth occurred in 46, and Gram-negative growth occurred in 20. Therefore, bacterial contamination was observed in 66 of the total 200 samples (Table 1). *Staphylococcus epidermidis*, Gram-positive bacteria, and *Escherichia coli*, Gram-negative bacteria, were the most common bacteria (Table 1). The antimicrobial susceptibility rates of all bacteria are shown in Tables 2 and 3. When antimicrobial susceptibility rates were examined, it was found that 46% of staphylococcal species were resistant to methicillin (Table 2).

While there was no loss of cartilage during the preparation of the sample B, it was lost in three (6%) patients and

Table 1 Distribution of growing bacteria according to the sample groups

Samples	A (*n*:50)	B (*n*:50)	C (*n*:50)	D (*n*:50)	Total (*n*:200)
Gram-positive bacteria (*n* = 46)					
Staphylococcus aureus	1	1	–	2	4
Staphylococcus epidermidis	–	–	16	20	36
Staphylococcus capitis	–	–	2	3	5
Staphylococcus haemolyticus	–	–	–	1	1
Staphylococcus hominis	–	–	–	–	0
Gram-negative bacteria(*n* = 20)					
Escherichia coli	1	3	6	7	17
Enterobacter aerogenes	–	–	–	2	2
Klebsiella oxytoca	–	–	–	1	1
Total	2 (%4)	4 (%8)	24 (%48)	36 (%72)	66 (%33)

Sample A: cartilage placed on the medium without any process

Sample B: cartilage placed on the medium after being crushed in a sterile package

Sample C: cartilage placed on the medium after being crushed on the auxiliary swester table

Sample D: cartilage placed on the media after being crushed on the active swester table

Table 2 Antimicrobial susceptibility rates of Staphylococcus species

	S. aureus (*n* = 4)	*S. epidermidis* (*n* = 36)	*S. capitis* (*n* = 5)	*S. haemolyticus* (*n* = 1)
Amoxicillin–clavulanic acid	1/4	18/36	1/5	Not sensitive
Ampicillin	Not sensitive	7/36	Not sensitive	Not sensitive
Cefoxitin[a]	1/4	23/36	1/5	Not sensitive
Erythromycin	4/4	32/36	1/5	Not sensitive
Clindamycin	4/4	30/36	1/5	1/1
Trimethoprim sulfamethoxazole	4/4	36/36	5/5	1/1
Vancomycin	4/4	36/36	5/5	1/1
Teicoplanin	4/4	36/36	5/5	1/1
Fusidic acid	4/4	27/36	1/5	1/1

[a]Used to determine methicillin resistance

Table 3 Antimicrobial susceptibility rates of Enterobacteriaceae species

	E. aerogenes (*n* = 2)	*E. coli* (*n* = 17)	*K. oxytoca* (*n* = 1)
Amoxicillin–clavulanic acid	Not sensitive	17/17	1/1
Ampicillin	Not sensitive	Not sensitive	Not sensitive
Cefazolin	2/2	17/17	1/1
Gentamicin	2/2	17/17	1/1

five (10%) patients during the preparation of the sample C and the sample D, respectively.

In the post-operative first week and first month, there was no patient with the infective process.

Discussion

Rhinoplasty operation is a clean-contaminated surgery as known [10]. Although the preoperative operation site is cleaned with povidine iodine or chlorhexidine to provide skin sterilization, the area of rhinoplasty is frequently contaminated from both intranasal mucosa and perinasal skin. This contamination could result in failure of implant and graft material, as well as severe scarring of the nose, resulting in possible cosmetic and functional disaster [6].

The incidence of surgical site infection in rhinoplasty is about 1% or less, depending on several factors such as revision surgeries, using implant material, duration of surgery, and surgical technique [11–13]. Despite working in such a highly contaminated surgical site, the possible reason of this low rate is the use of pre-operative and post-operative antibiotics [11]. Our study showed that if

the cartilage obtained under sterile conditions is crushed on the active or inactive swester table, it will be exposed to high rates of bacterial contamination. Besides, it also demonstrated that almost all bacteria growing on the cartilage after contamination were susceptible to commonly preferred antibiotics post-operatively (Tables 2, 3). This explains why post-operative surgical site infection rate is so low despite the high contamination.

Dorsal onlay graft is an important graft used to camouflage irregularities that occur at the edges of the nose in rhinoplasty operations. This graft, mostly excised from the septal cartilage of the patient, is used by being sculpted, crushed, and sometimes divided into small cubic pieces [14, 15]. The crushing process is carried out with the help of sterile overwhelming material if it is present in the surgical set. The preparation of the graft by divided into cubic pieces is often performed on the operation tablecloth or on a sterile sponge. In our clinic, we have been prepared this procedure on the operation tablecloth as in many clinics. This was a question mark in the minds whether preparing a graft on the operation tablecloth could cause cartilage contamination. In addition, loss of cartilage from the sterile area to the non-sterile area due to the uncontrolled acts during the preparation of cartilage, and sticking of the tablecloth components to the cartilage were frequently encountered problems. For the purpose of solving these problems, a practical and cost-effective solution is introduced to the literature by Arslan et al. [8]. It is clear that this practical solution is inspired from aforementioned problems and presented to solve similar problems that many surgeons experience.

It is obvious that the graft preparation process should be given maximum attention to avoid the contamination reasons and frightening results mentioned above. A contaminated dorsal onlay graft can lead to surgical site infection, and then loss of cartilage, dorsum irregularity, skin necrosis, and new cosmetic deformities can occur, which may be extremely difficult to correct; and all of these are well known to all surgeons interested in rhinoplasty. Nonetheless, studies involving the microbiological examination of grafts and the graft preparation area during rhinoplasty are quite limited in the literature [5]. To point out the severity of this condition, we aimed to investigate the reliability of the practical suggestion of Arslan et al., to reveal the contamination status of the swester table which is traditionally used as a graft preparation area, and to show the most appropriate method for graft preparation. The results obtained from the study showed that the main swester table where the surgical instruments were set-up and actively used during operation was very susceptible to contamination; however, the auxiliary table, which carries other sterile replacement instruments and not actively used was also contaminated, even though not as severe as the main swester table was. This outcome is supported by the result that there was no significant difference between these two groups in terms of bacterial growth frequency ($p = 0.10$). The contamination rate in the cartilage prepared at the active table was 72%, and 48% at the auxiliary table, whereas the contamination rate of the cartilage prepared in the sterile package was only 8%. These results clearly revealed that the use of the swester table to prepare graft material is seriously risky in terms of post-operative surgical site infection and the problems that may be encountered in the follow-up period; instead, using a sterile package is an extremely simple, inexpensive and easy method for eliminating all the risks (when the sterile package compared with the active swester desk in terms of bacterial growth $p < 0.001$, when compared with auxiliary table $p < 0.001$).

Another disadvantage of preparing a graft on the swester table or on a sterile gas is sticking of the small particles to the cartilage, which is distressing. In addition, the loss of cartilage to the non-sterile area during crushing process is an unpleasant condition experienced by almost every surgeon. The graft preparation from the cartilage in the sterile package can be a solution for both conditions. As stated in the results of our study, no loss of cartilage occurred in the graft material prepared in this way. Moreover, no contamination was observed due to any component. Furthermore, the surgeon knows that there is no place for cartilage to go during the crushing process in a sterile package, and this provides a psychological comfort for the surgeon and gives a chance to use a surgical instrument with the desired strength and style. Otherwise, the level of power and hitting location of the cartilage during crushing process cannot be adjusted sometimes because the risk of losing the cartilage exists in the mind. If we evaluate from another perspective, since the cartilage cannot be seen during the graft preparation with the sterile cartilage crusher (costing around 200 US dollars), sometimes the process can result in more crushed cartilage than the desired consistency. However, since the sterile package is transparent, all stages of crushing can be seen and the process can be terminated when the desired consistency is observed. The preparation in the sterile package has such an advantage over the sterile surgical instrument.

Conclusion

Rhinoplasty surgery is not a sterile surgery and the surgical site is constantly contaminated from environmental factors such as intranasal mucosa and perinasal skin. This contamination also affects swester tables. Prepared cartilage grafts are also at risk of this contamination. Minimizing this risk should be of utmost importance to prevent complications that may be encountered as a result of surgical site infection. Preparing graft materials in a sterile package recommended by Arslan et al. is an extremely simple, easy, cheap and reliable method with minimal contamination risk. The use of

the swester tables for this purpose contains many undesired risks and should not be used. On the other hand, randomized controlled trials are needed to see that the mere presence of bacteria translates into actual infection or rejection.

The study began after the approval of the local ethics committee was obtained. There is no funding received for this work from any organizations or commercial associations. None of the authors has a financial interest in any of the products, devices, or drugs mentioned in this manuscript. All authors declare that they have no conflict of interest.

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