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ORIGINAL ARTICLE

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The subjective and objective outcomes of endoscopic sinus surgery for nasal polyposis using microdebrider versus conventional instruments: a randomized controlled trial

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Abstract

Background Since the evolution of the microdebrider technology and its modulations to be suitable for rhinology, many attempts were carried out to replace the conventional instruments with microdebrider especially in cases of nasal polyposis. Also, many studies were conducted to compare the efficacy of both tools in functional endoscopic sinus surgery. Those studies focused on objective outcomes as the duration of surgery and the amount of blood loss.

Aim of the study Comparing the efficacy of microdebrider in cases of resistant chronic rhinosinusitis with nasal polyposis to conventional instruments. Analysis of subjective outcomes is mainly the *quality of life* of our patients, and not neglecting the objective outcomes but analyzing them thoroughly.

Method This is a randomized controlled clinical trial, conducted on 100 patients which were diagnosed to have resistant chronic rhinosinusitis with polyposis. We used the microdebrider in functional endoscopic sinus surgery for 50 patients and conventional instruments for the other 50 cases. We compared the operative time, amount of blood loss, and postoperative improvement of *quality of life*, the presence of adhesions, crustations, and complications, or recurrence of nasal polyposis in both groups.

Results We found significant differences in favor of microdebrider mainly in the duration of surgery and the amount of blood loss. Patient satisfaction was better in the microdebrider group, especially in the short-term follow-up, while the postoperative clinical scores were better in the long run.

Conclusion Using the microdebrider in dealing with nasal polyposis is much preferable to conventional instruments. For patients, they feel much better in a shorter duration postoperatively. For surgeons, the manipulations are easier, and the operative field is bloodless and clear.

Keywords Shaver, Polyps, Microdebrider, Resistant rhinosinusitis

Background

Nasal polyps are distinguished as benign lesions consisting of edematous nasal mucosa occupying the nasal cavity [1]. Nasal polyposis is considered a common phenotype of chronic rhinosinusitis [2]. In turn, it is subdivided according to the etiology into various endotypes, which are important to determine to achieve successful management [3]. Environmental exposures and genetic

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predisposition participate in the pathogenesis of polyposis, but an accurate inheritance model cannot be identified [4]. The overall prevalence of chronic rhinosinusitis varies greatly from 5.5 to 28% depending on multiple factors, including smoking status and associated comorbidities such as asthma [5].

The European Position Paper on Rhinosinusitis and Nasal Polyps 2020 (EPOS 2020) adopted oral steroids as the first line for treatment for nasal polyps. Failure of the medical treatment for 12 weeks is an indication for functional endoscopic sinus surgery, as it is considered a case of resistant chronic rhinosinusitis with polyposis [6]. The main purpose of surgical intervention is improving the *quality of life* of patients, which makes the symptomatic scores as the sinonasal outcome test (SNOT22) useful predictors of success when comparing the preoperative scores with the postoperative ones [7].

The microdebrider has been used in rhinology since 1990s. The availability of various designs of shavers has aided their widespread use, especially for nasal polyps [8]. The concurrent suction and irrigation during the removal of the polyps with less clogging improve field clarity and decrease the blood loss [9]. The microdebrider, as a power-assisted instrument, needs well-rounded training and regular and meticulous device checks to avoid serious complications. Injury to the skull base and/or the orbit is rare in well-experienced hands. The most common adverse effects of device failure are overheating, which may lead to tissue burns, material separation, and inappropriate device activation [10].

Our challenge in this study was the presence of many studies about the difference between the microdebrider and the conventional instruments. But we found that nearly all these studies focused on objective outcomes such as the operative time, amount of blood loss, and development of recurrent polyposis. So we used a detailed symptomatic scoring system to accurately detect whether the subjective outcomes coincided with the objective ones. And also, we used suitable and documented scores for the postoperative objective outcomes.

Methods

This study was a prospective randomized controlled trial. After the approval of the ethics committee in our institution number 286/9/18 in September 2018, conducted on 100 adult (no children or geriatrics were included) patients visited our outpatient clinic diagnosed resistant chronic rhinosinusitis with nasal polyposis and pansinusitis in CT nose and paranasal sinuses. We considered this diagnosis after failure of medical treatment in the form of systemic steroids for 12 weeks, as recommended by EPOS 2020. The randomization in our study was made simply by using odd numbers for patients in the microdebrider group (A) and even numbers for patients in the conventional group (B).

We excluded patients with complicated presentations, fungal rhinosinusitis, recurrent polyposis, and other system comorbidities, did not commit to their schedule of follow-up visits, refused surgery, or had contraindications for surgery, from our study.

Every patient was subjected to basic history taking, including the personal history, history of present illness with special attention to the validated Arabic version of the Sino-Nasal Outcome Test (SNOT-22) [11], full ENT examination including Meltzer polyp scoring (Additional file 1: Appendix A), CT nose and paranasal sinuses with calculation of the Lund and McKay CT score (Additional file 1: Appendix B), preoperative detailed informed consent and routine laboratory investigations, and ophthalmic consultation.

Regarding group (A) patients, we used a Storz microdebrider with the straight 4-mm blade, while in group (B), we used the conventional instruments in the form of Storz Blakesley's and cutting forceps (straight and angled ones).

Every patient underwent stepwise basic FESS including polypectomy, middle meatal antrostomy, anterior ethmoidectomy, posterior ethmoidectomy, sphenoidotomy, and clearance of the frontal recess according to the disease extension. Our goals were to eliminate the polyps, restore the natural ostia patent for sinuses aeration, and easy delivery of local steroid sprays.

Intraoperatively, we estimated the operative time since introducing the vasoconstrictor cottonoids until the end of surgery. The amount of blood loss was calculated by subtracting the amount of irrigation fluid from the fluid volume in the suction.

Postoperatively, we followed up our patients after 1 month, 6 months, and 1 year, using the Arabic SNOT-22 and the modified Lund-Kennedy endoscopic scores (Additional file 1: Appendix C) in each visit.

The patient's flow chart from introduction into the study until the end of follow-up is illustrated in Fig. 1.

Statistical analysis

Statistical analyses of the collected data were performed using SPSS software version 22. The prevalence was analyzed according to gender and age class. For the description of the studied population in terms of demographics, disease history, and smoking status, descriptive statistics were used. Qualitative variables were presented as percentages and quantitative data as mean ± standard deviation (SD). Differences between the two operative techniques were tested for statistical significance using the chi-square (or Fisher exact test) for qualitative variables and the Student's *t*-test (or Wilcoxon test) for

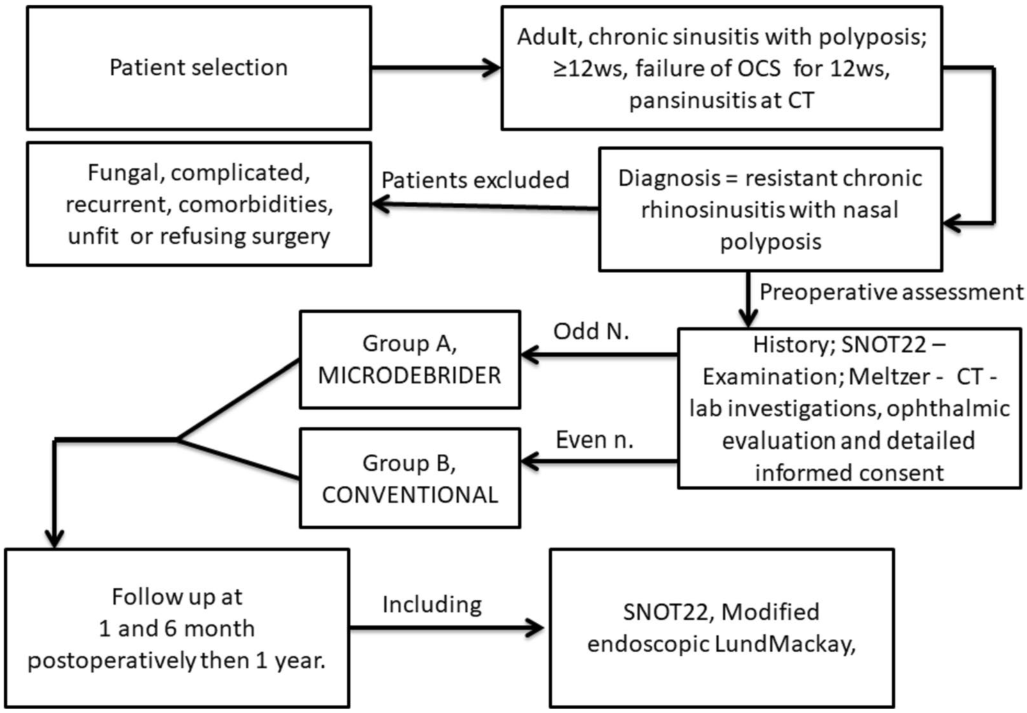

Fig. 1 Patient's flow chart in the study. OCS, oral corticosteroids

Table 1 Summary of patients' age, preoperative SNOT-22, Meltzer and Lund-Mackay CT scores

Item	Range	Mean ± SD
Age	16–65 y	35.9 ± 12.3
SNOT-22	25–65	48.6 ± 8.3
Meltzer score	6–8	7.1 ± 0.9
Lund-Mackay CT score	16–24	19.5 ± 2.6

quantitative variables. Model validity was analyzed using Pearson's method. A *P*-value of 0.05 or less was considered significant.

Results

The study was conducted on 100 patients with bilateral nasal polyposis not responding to medical treatment from May 2018 until March 2020. They were 55 males and 45 females. The preoperative numerical variables are summarized in Table 1.

Forty-one patients were smokers, 25 were passive smokers, and 34 were nonsmokers. We found 26 patients were frequently exposed to irritating chemicals whether through working in factories or living nearby. Twenty-four patients were intimately exposed to birds and/or animals, while 8 patients were exposed to wood or wool dusts. All the preoperative variables distribution in both groups were statistically analyzed with no significant difference reflecting effective randomization, as shown in Table 2.

Figure 2 shows a CT nose and paranasal sinuses, axial view of one our cases with bilateral nasal polypi, pansinusitis, and Lund-Mackay CT score 24.

The duration of the operative procedure and the amount of blood loss were significantly less in the microdebrider group, as illustrated in Table 3.

Five patients were exposed (whether intraoperatively or within 24 h postoperatively) to grade 1 endoscopic sinus surgery complications as classified in EPOS 2020 [2]. Three cases developed eyelid emphysema, while the other two cases developed periorbital ecchymosis. The five patients improved without any surgical intervention or development of any other sequlae. Three cases were in the microdebrider group, while the other two cases were in the conventional group, with *P*-value of 0.9.

The follow-up schedule was at 1 month, 6 months, and 1 year postoperative, evaluating the SNOT-22 and the modified endoscopic Lund-Kennedy scores at every visit. The results are summarized in Table 4.

We noticed that patients complained of postoperative facial pain frequently, which was markedly worse in the conventional group with a highly significant *P*-value *(less than 0.001)* in the 3 visits of follow-up. Postoperative

Table 2 The distribution of the preoperative variables in both groups

	Microdebrider	Conventional	*p*-value
Age			
Mean ± SD	34.5 ± 11.7	37.3 ± 12.9	0.26
Sex			
Male	27	28	0.8
Female	23	22	
Smoking			
Smokers	19	22	
Passive smokers	15	10	0.7
Nonsmokers	16	18	
Exposure risk			
Factory	12	14	
Animals/birds	14	10	0.8
Wool/wood	4	4	
Non	20	22	
Preoperative SNOT-22			
Mean ± SD	49.8 ± 8.9	47.4 ± 7.5	0.5
Preoperative Lund-Mackay CT score			
Mean ± SD	19.3 ± 2.7	19.5 ± 2.4	0.2
Preoperative Meltzer score			
Mean ± SD	7.2 ± 0.8	7 ± 0.9	0.4

adhesions and/or scarring was found more frequently in patients in the conventional group, with a *P*-value at the 1st month visit of 0.012, *P*-value at the 6th months, and 1st year of 0.003.

Despite the fact that the severity of postoperative crustations was less in the microdebrider group, the *P*-value was not significant at any follow-up visit (Figs. 3, 4, and 5). Six patients developed recurrent nasal polyposis within the 1-year follow- up. Five of them were detected at the 1-year follow-up visit, while 1 case was detected at the 6-month visit. Five cases of recurrence were from the conventional group, while 1 case was from the microdebrider group with a *P*-value of 0.2.

Discussion

The previous studies discussed the efficacy of the microdebrider and conventional instruments, varied in number of patients, duration of postoperative follow-up, study design, and mainly aspects of comparison. Our study tried to cover all the subjective and objective aspects to compare both procedures accurately. The number of patients in our study was 100, with 50 patients in each group. The most recent studies from 2016 until 2019 used 30 to 60 patients [12–20]. Honestly, there were some studies used in 300 to 500 patients. But they were retrospective studies focused mainly on the difference in the operative time and amount of blood loss, which made obtaining more details related to the study not applicable [21, 22]. Table 5 summarizes the numbers of patients included in most of those studies.

Nearly all the previous studies used the visual analogue score (VAS) to assess the complaints of patients preoperatively and compare them with the postoperative ones. But they used the VAS for certain complaints, such as nasal obstruction and smell affection, with a maximum of 5 complains only [16–20]. In our study, we preferred the use of the validated Arabic version of SNOT-22, which includes 22 items involving nasal, aural, sleep difficulties and physical and social performance, so we could evaluate thoroughly our patients' quality of life postoperatively.

The previous studies either did not mention the clinical and/or the radiological staging of operated cases or their studies included various stages clinically and/or radiologically [16–20]. Our cases had the same clinical and radiological staging (clinically: Meltzer score was from 6 to 8), and radiologically, all cases had pansinusitis, with Lund-MacKay CT score of 16–24.

Most of those studies found that there was a significant reduction in both the operative duration and the amount of blood loss with the use of microdebriders in comparison with the conventional instruments, as our study proved [22, 23].

The duration and schedule of postoperative follow-up visits varied between the different studies. Bellad S. A. et al. followed their patients at 1, 3, and 6 months [20]. Ghera B. et al.'s follow-up regimen was 1 week and 3 and 6 months [17], while the follow-up duration adopted by Kaipuzha R. R. et al. was 6 months postoperative without a definite schedule for the follow-up visits [19]. Due to the chronic nature of condition we deal with and its tendency to recur, we have made our schedule of follow-up visits at 1, 6, and 12 months postoperative.

Most of the studies conducted to compare the microdebrider and conventional instruments found more symptomatic improvement in favor of the microdebrider. Sellivanova et al. in a study on 24 patients found the symptomatic improvement was better at the 3rd and 6th months postoperatively but with no statistical significance [12]. The same was reported by Sauer et al., Kursat et al., and Magdy et al. [13, 14, 24]. But there was a significant symptomatic improvement in the study of Singh R. et al. [16]. Using SNOT-22 in our study, we found significant symptomatic improvement in the microdebrider

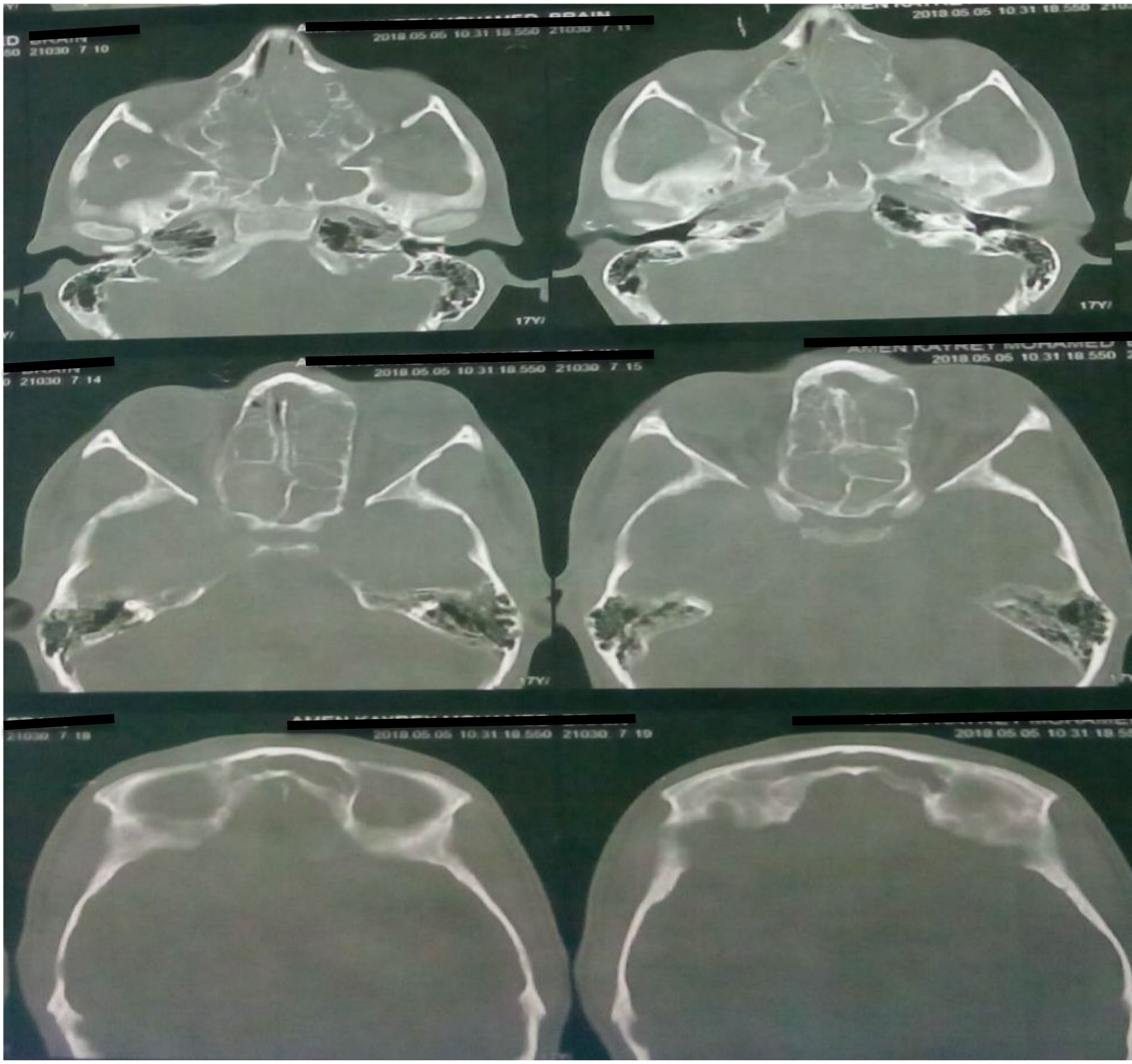

Fig. 2 CT nose and paranasal sinuses, axial view. Lund-MacKay CT score, 24

Table 3 The duration of surgery and amount of blood loss in both groups

	Range	Mean ± SD	*p*-value
Operative time			
Microdebrider	60–120 m	88.8 ± 15.3	**0.001**
Conventional	90–160 m	110.4 ± 16.2	
Blood loss			
Microdebrider	100–250 ml	175.2 ± 29	**0.001**
Conventional	150–300 ml	206.8 ± 38.8	

group of patients at 6 month and 1 year follow-up visits. At 1-month follow-up visit, there was no significant difference between both groups. We noticed that the most constant postoperative complaint was facial pain, which was overlooked by other studies. There was significant difference in the severity of postoperative facial pain at the 1-month, 6-month, and 1-year follow-up visits in favor of microdebrider use.

The total postoperative modified Lund-Kennedy endoscopic score in our study was significantly lower in the microdebrider group only at the 1-month follow up-visit. Sauer et al. [13] also noted that the total score at 3 weeks after surgery was significantly better in the microdebrider

Table 4 The postoperative SNOT-22 and modified Lund-Kennedy endoscopic scores in the follow up-visits

	SNOT-22	Modified Lund-Kennedy score
1 month	Mean ± SD	Mean ± SD
Microdebrider	18.9 ± 4.2	27 ± 6
Conventional	19.8 ± 5	29.9 ± 5.2
P-value	0.11	**0.01**
6 months		
Microdebrider	10.2 ± 2.6	20.6 ± 4.5
Conventional	11.4 ± 2.6	21.1 ± 6.8
P-value	**0.004**	0.78
1 year		
Microdebrider	5.7 ± 3.5	12.4 ± 6.9
Conventional	7.3 ± 3.6	13.5 ± 8.6
P-value	**0.002**	0.23

group, with no significant difference found at any other time point.

We found that scarring/adhesions formation was more common in the conventional group, with high statistical significance at 1-month, 6-month, and 1-year follow-up visits. While crustations were more common in the conventional group in all follow-up visits than the microdebrider group with no significant difference, these findings are similar to most of the previous studies [16–18]. That is logically explained by mucosal preservation, minimal tissue trauma, and avoiding grasping and stripping of mucosa.

Manipulations of the electrical instrument might be complicated and require training for the surgeon. In fact, unlike the Blakesley forceps, the microdebrider does not transmit tactile feedback to the surgeon. Because of its cutting efficiency against hard tissues, the microdebrider used by less-skilled surgeons might cause injury to the lamina cribrosa or the lamina papyracea with consequent orbital complications [25]. Ephraim et al. reported 1.37% minor and 0.31% major complications in adults with the use of microdebriders [26]. In our cases, 5% of cases have been complicated by grade 1 complications (according to EPOS 2020), with no statistical difference between the two groups.

Kaipuzha R. R. et al. found that recurrence rates at the 6-month follow-up were slightly higher in conventional group (6.67%) as compared to microdebrider group (5%), but this difference was not found to be statistically significant [19]. Six percent of patients in our study developed recurrent nasal polypi: 1 patient in the microdebrider group and 5 in the conventional group, with no significant difference.

The major limitation in this study was Covid-19 pandemic, which delayed our progress and hindered the commitment of follow-up visits in many cases. Those cases were omitted from the study to ensure the validity

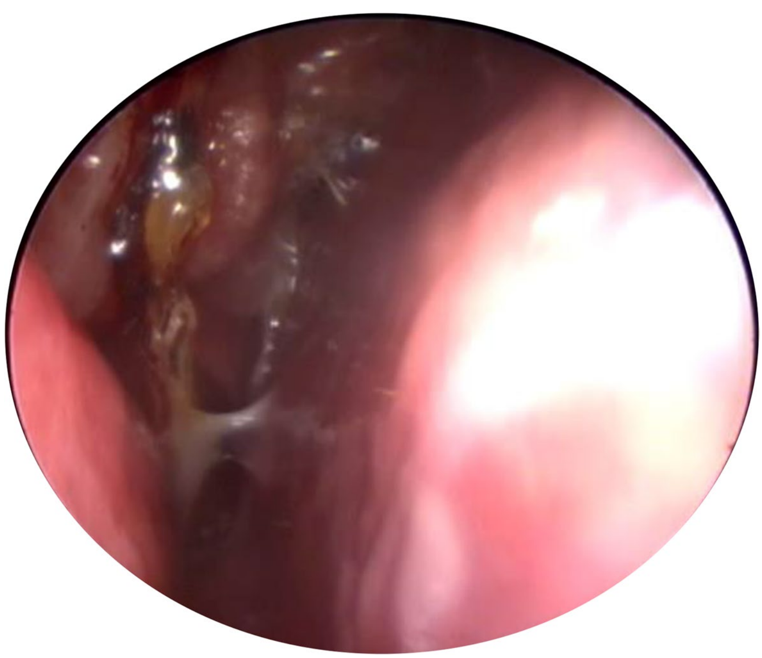

Fig. 3 Sinoscopic follow-up after 1 month (conventional group). Showing mild crustations, mild edema, and thin discharge

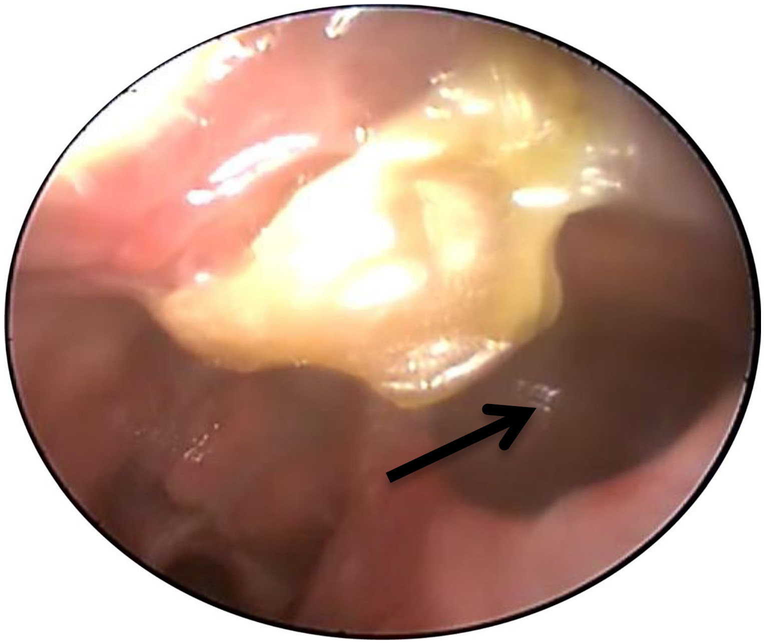

Fig. 4 Sinoscopic follow-up after 6 months (conventional group). Showing mild crustations and patent maxillary sinus ostium (black arrow)

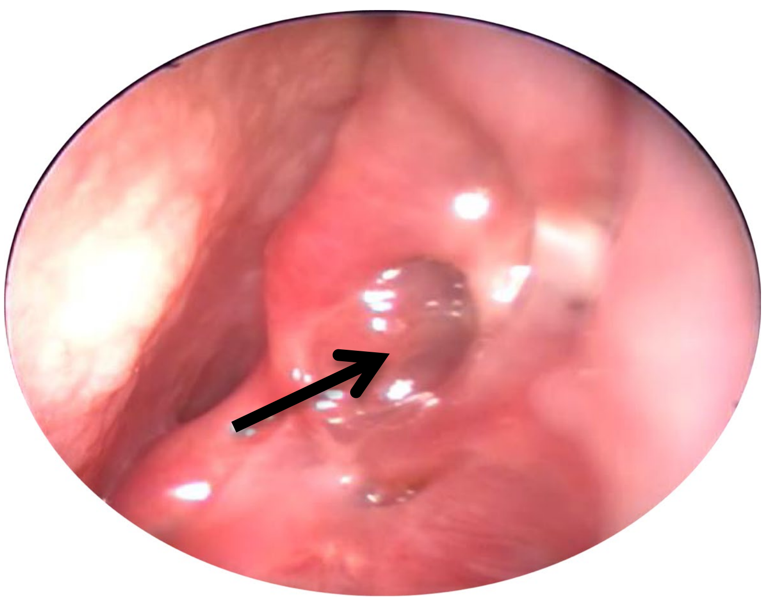

Fig. 5 Sinoscopic follow-up after 6 months (microdebrider group). Showing good epithelialization, no crustations, and patent bulla ethmoidalis (black arrow)

of our study design and its results. We recommend continuing follow-up after the first year postoperatively in patients with nasal polyposis due to their tendency to recur.

Conclusion

Our study proved the significant differences in many aspects in favor of using the microdebrider rather than conventional instruments in dealing with chronic

Table 5 Number of patients in previous studies comparing the microdebrider and the conventional instruments

Study/year	Numbers of patients
Sellivanova et al. (2003) [12]	**24**
Sauer et al. (2007) [13]	**50**
Kursat et al. (2007) [14]	**97**
Cornet et al. (2012) [15]	**60**
Singh R. et al. (2013) [16]	**40**
Ghera B. et al. (2014) [17]	**30**
Kakkar V. et al. (2014) [18]	**40**
Kaipuzha R. R. et al. (2019) [19]	**60**
Bellad S. A. et al. (2019) [20]	**30**

rhinosinusitis with nasal polyposis. The most important items in our comparison were the operative time, the amount of blood loss, the symptomatic improvement at 6 months, and 1 year postoperative; the facial pain improvement at 1 month, 6 months, and 1 year postoperative; the modified Lund-Kennedy endoscopic score at 1 month postoperative; and the severity of postoperative scarring/adhesions.

Abbreviations

EPOS 2020	The European Position Paper on Rhinosinusitis and Nasal Polyps 2020
FESS	Functional endoscopic sinus surgery
OCS	Oral corticosteroids
OMC	Osteomeatal complex
SNOT-22	Sino-Nasal Outcome Test 22
VAS	Visual analogue score

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s43163-023-00514-z.

Additional file 1: Appendix A. Meltzer polyp scoring (Meltzer et al, 2006)*. **Appendix B.** Lund and McKay radiological scoring system. For the 4 groups of sinuses; 0= no opacification, 1= partial opacification and 2= complete opacification. For the osteomeatal complex (OMC); 0= not obstructed and 2= obstructed. The total score is from 0 to 24. (Lund V, Mackay I, 1993)**. **Appendix C.** The modified Lund-Kennedy endoscopic score. (Psaltis AJ, et al, 2014)***.

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Authors' contributions

AA, main supervisor and revision of the scientific writing. EA, supervisor of research and data review. AE, idea modulation and surgery supervision. EH, principal investigator, conduct of study, data collection, statistical analysis, and corresponding author.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The study was approved by the Aswan University Institutional Review Board (IRB) (code no. 286/9/18 in September 2018). An informed written consent to participate in the study was provided by all participants.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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