Precision Rhinoplasty Cylindric Burrs—Sidewall Aesthetics

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Abstract

The development of power instruments has led to great advances in rhinoplasty. It has helped to reduce operating time, minimize damage to the surrounding soft tissues, and allow precision bony modification compared with the use of manual rasps. Burrs help ensure precise results by (i) creating a smooth transition between the lateral nasal sidewall and the face, (ii) treating bony asymmetries, and (iii) producing homogeneous upper and middle thirds that softy translate into the upper lateral cartilages. The aim of this paper is to show applications of cylindrical burrs in rhinoplasty surgery to treat the dorsal upper and middle thirds as well as lateral sidewalls of the nose, regardless of whether the dorsal preservation or structure technique is used. This approach offers a safe, fast, and precise technique that can be used in conjunction with piezo osteotomy to obtain the optimal outcomes.

Keywords

- precision rhinoplasty
- power instruments
- cylindric burrs
- preservation precision rhinoplasty
- dorsal aesthetic lines

Rhinoplasty has been described by many authors as one of the most challenging Plastic Surgery Procedures. The ever-mounting societal pressure to be flawless has resulted in an increase in the number of patients seeking rhinoplasty. Moreover, a growing preference exists for interventions that are minimally traumatic, ensuring a swift recovery and achieving the highest precision in results. For decades, maxillofacial and ear, nose, and throat surgeons have successfully performed bone and cartilage reshaping for both functional concerns like trauma, congenital craniofacial disorders as well as aesthetic indications like otoplasty and osteoplasty of the chin, mandible, and zygoma with excellent results.[1–3] In rhinoplasty surgery, the upper and middle thirds of the nose have been remodeled with the help of various mechanical instruments like saws, chisels, rasps, and osteotomes[4–7] (►**Fig. 1**).

The development of power instruments has spurred significant advancements in rhinoplasty.[8–10] Use of these instruments have helped reduce surgical times, minimize damage to surrounding soft tissues, and enhance the precision of the procedure. In comparison, use of traditional tools like manual rasps are imprecise and difficult to control that may lead to an uneven and often, unsatisfactory result. Power instruments, especially burrs, can be used to resect, smoothen, and sculpt the bony pyramid with greater accuracy than the common rasp. The emergence of novel technologies has changed the paradigm for precise manipulation of key structures during rhinoplasty, particularly the bony sidewalls and osseocartilaginous dorsum.

The application of piezoelectric tools in rhinoplasty, pioneered by Robiony et al,[11] has proven to be a groundbreaking innovation, igniting widespread excitement among rhinoplasty surgeons. However, this new era in rhinoplasty has perhaps overshadowed the advantages offered by older generation of power instruments, such as burrs, for dorsal vault alterations in terms of speed, efficiency, and precision. This cheap and effective power instrument can complement the capabilities of piezoelectric devices and be used as a supplement to augment optimal outcomes.

The aim of this paper is to explore the application of cylindrical burrs for reshaping the dorsal upper and middle

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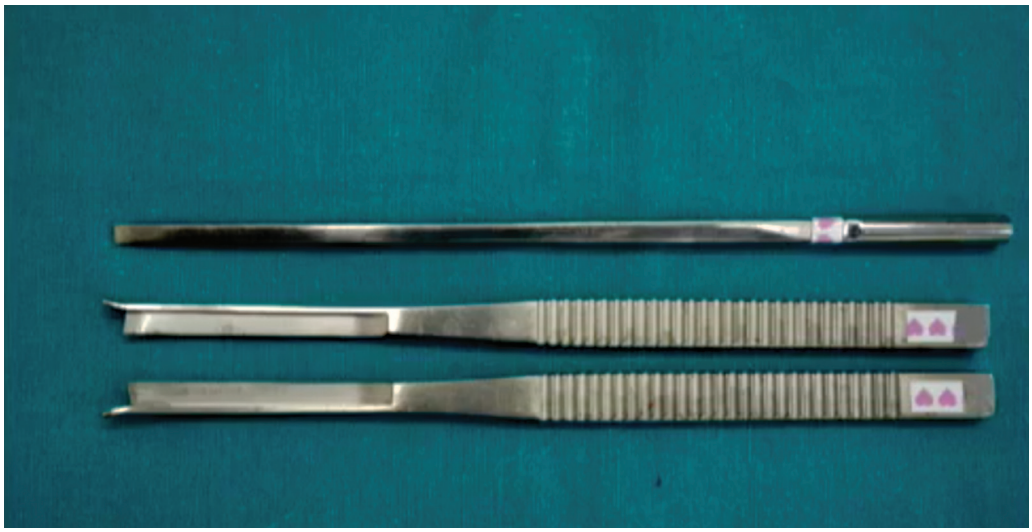

Fig. 1 Mechanical instruments used in rhinoplasty, such as chisels and osteotomes.

thirds, as well as the lateral sidewalls, of the nose in rhinoplasty surgery, regardless of the technique being dorsal preservation or structural. This gives us a safe, fast, and precise technique which when used in conjunction with piezo osteotomy provides the best possible surgical results.

Materials and Methods

We used the OSSEODOC control unit (Osseodoc, Bien-Air Surgery, Le Noirmont, Switzerland) with a micromotor (BASCH-1, Bien-Air Surgery, Le Noirmont, Switzerland) and handpiece (PM2, Bien-Air Surgery, Le Noirmont, Switzerland). It has four motor speeds, and offers a choice of rotational direction. All functions are also accessible for operation via the foot pedal. We prefer to use 4-mm and 6-mm cylindrical burrs at a rotation speed of $<$15,000 revolutions per minute. For irrigation, we opt for a simple saline solution (0.9% NaCl) rather than a specially prepared solution.

The senior author has successfully used burrs in rhinosculpture techniques for the last 10 years and the other writers have used them since 2019. More than 3,000 patients have been treated with cylindrical burrs at our facility. Our patients receive follow-up appointments every 3 months during the first year. After the first year, we follow-up annually. Systematic radiological evaluation in not a rule in our practice. We prioritize minimizing radiation exposure to our patients and utilize radiological evaluation selectively.

Aesthetic Brow Tip Lines

On the frontal view, in an attractive nasal dorsum, the bony and cartilaginous vaults fuse perfectly to produce a smooth and continuous dorsal sidewall represented by a slightly homogenous curve and a symmetric line between the brows and the supratip[10] (►**Fig. 2**).

The anatomy of the bony and cartilaginous vaults has some variation in width, the narrowest portion being at the nasion and a gradual widening going towards the rhinion in the bony vault. In the cartilaginous vault, the width decreases progressively from the rhinion to its final portion at the supratip. These anatomical variations create visual hallmarks in an attractive nasal dorsum in the frontal view. Symmetrical shadows emerge at the edge of the dorsal line and extend distally from its origin (the medial brow) towards the supratip in almost a vertical fashion, forming the so-called dorsal aesthetic lines (DALs). The result is a fusiform-shaped, bony–cartilaginous structure that we aim to recreate during surgery.[10]

Excessive dorsal width, an irregular bony vault (with convexities or concavities), asymmetric upper lateral cartilage or excessive splaying of the bony pyramid at the nasofacial groove ("X-points") are factors that can alter the DALs and thus disrupt the possibility of having a slender, symmetric and attractive nasal dorsum;[12] ►**Fig. 3**). To obtain a brow tip aesthetic line that is as symmetric as possible, we must

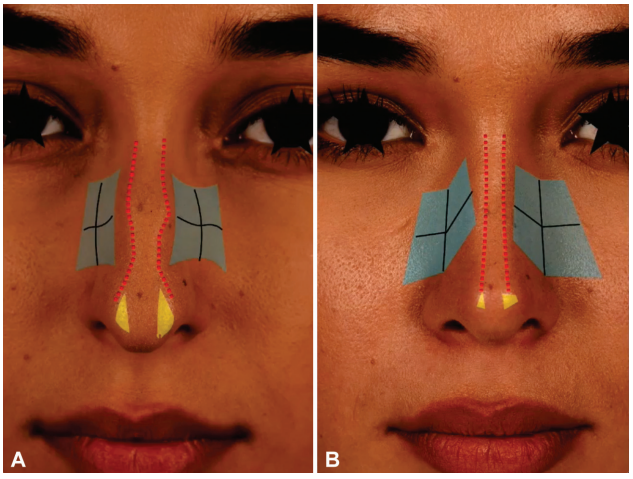

Fig. 2 (**A**) Irregular dorsal sidewalls and asymmetric lines between the brows and the supratip before rhinoplasty. (**B**) Smooth and continuous dorsal sidewalls and symmetric lines between the brows and the supratip after rhinoplasty.

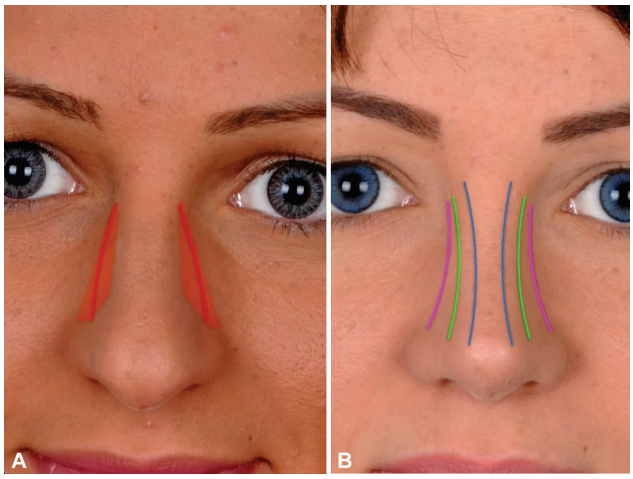

Fig. 3 (A) Dorsal width, irregular bony vault, asymmetric upper lateral cartilages. (B) Ideal dorsal aesthetic lines.

acknowledge that all noses are asymmetric and rest on asymmetric faces in the vast majority of cases.[13–17]

As described by Palhazi et al, in an unoperated nose, the DALs and profile are dictated by the cartilaginous vault. Postdorsal reduction, the dorsal lines are determined by the edges of the bony vault.[18] Regardless of the technique we choose to reconstruct the middle third when applying the structure method—spreader flaps or grafts—it is paramount that the dorsal sidewall be smoothened precisely to obtain a good transition between the bone and cartilage to ensure the best possible lines. We strongly believe that an attractive brow tip aesthetic line is quintessential for precise and controlled nasal bone position.[9]

Surgical Approach

Regardless of the chosen surgical approach—external, endonasal, supra- or subperichondrial—it is very important to do a full subperiosteal dissection with a wide exposure to avoid difficulties while using power instruments, such as burrs. The chosen approach depends on the surgeon's experience, but in the closed approach, we recommend the use of a retractor/aspirator to ensure better exposure.

We prefer to undertake a full subperiosteal dissection of the bony vault, from the keystone junction up to the cephalic part of the radix and transversely from one ascending frontal process of the maxilla to the other side, as described by Gerbault et al.[6] To obtain a wide exposure and compete access to the lateral sidewall, the lateral pyriform aperture ligaments are elongated or trimmed, if necessary.[6]

The wide exposure of bony and cartilaginous vaults has been considered perilous by many surgeons due to the possibility of causing inadvertent damage. However, research suggests that it was used as a routine in the 1950s to 1960s.[17,19] The reemergence of this extensive exposure not only gave us the opportunity to directly visually analyze the bony vault anatomy for its inherent deformities and asymmetries, but also gives us an excellent route through which power instruments can be applied to resect, smoothen, and sculpt the bony pyramid as is necessary.

Lateral Sidewall

It is important to obtain a wide exposure of the frontal process of the maxillary bone, beyond the nasofacial groove, so that we can find maxillary bulging, especially in its distal portion (bony "x points"; ►**Fig. 4**).

After exposing this area in a subperiosteal plane, we use the cylindrical burrs to reshape this "triangular" area (the distal base) and reconfigure the transition between the vertical and horizontal parts of the frontal process of the maxilla. By doing this, we create a smooth transition between the lateral sidewall of the nose and the face. We change the angle (making it more acute), debulk this area, and change it into a concave base before performing the osteotomy if necessary. This maneuver allows us to "accommodate" the skin in a more favorable position so that when we redrape it at the end of surgery, there is less loose skin (►**Fig. 5**).

If we encounter an excess of bone width or irregularities in the sidewall, it can be treated using cylindrical burrs before and after the osteotomy to smoothen, homogenize, and get rid of any residual asymmetries. The use of cylindrical burrs can, in a

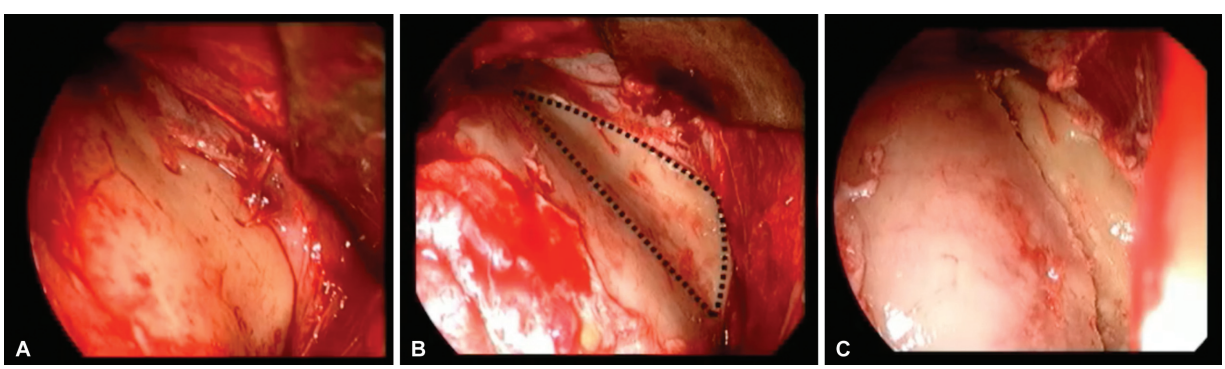

Fig. 4 (A) Left lateral nasal wall; maxillary bulging of frontal process of the maxillary bone. (B) New nasofacial groove after osteoplasty. (C) Lateral osteotomy line on new nasofacial groove.

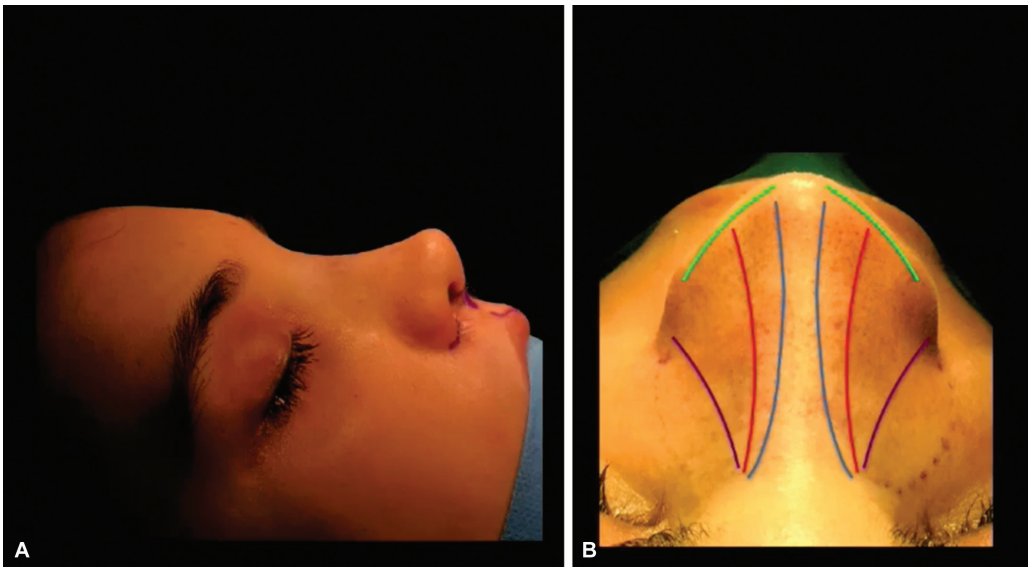

Fig. 5 (A) Skin redraping at the end of surgery. (B) Ideal dorsal aesthetic lines and smooth transition between the lateral sidewall of the nose and the face.

high percentage of convex lateral walls, negate the need for an asymmetric intermediate osteotomy (positioned at the point of maximum convexity between the medial and lateral osteotomy lines) to flatten it.[20]

It is very difficult to use conventional approaches to the correction and reshaping of irregularities on mobile or semimobile nasal bones following an osteotomy. The use of cylindrical burrs for reshaping makes a significant difference.

We use cylindrical burrs on the bone vault with four different maneuvers. (►**Videos 1**–**3).** All videos correspond to the first author surgeries.

1. Linear brush movements when shaping the bridge of the nose and creating the new nasofacial groove (►**Video 1**).
2. Circular brush movements when shaping the side walls in the osseocartilaginous vault (►**Videos 2** and **3).**
3. Oblique movements in the transition lines between the bone–cartilage structures and the osteotomy line–maxillary bone following the reconstruction of the middle vault (►**Video 2**).
4. Gentle touches without applying pressure to a single point on the mobile or semimobile nasal bones where we want to eliminate the irregularity.

Video 1

Linear brush movements when shaping the bridge of the nose and creating the new nasofacial groove. Online content including video sequences viewable at: https://www.thieme-connect.com/products/ejournals/html/10.1055/a-2318-1121.

Video 2

Circular brush movements when shaping the side walls in the osseocartilaginous vault. Online content including video sequences viewable at: https://www.thieme-connect.com/products/ejournals/html/10.1055/a-2318-1121.

Video 3

Oblique movements in the transition lines between the bone–cartilage structures and the osteotomy line–maxillary bone following the reconstruction of the middle vault. All videos correspond to the first author surgeries. Online content including video sequences viewable at: https://www.thieme-connect.com/products/ejournals/html/10.1055/a-2318-1121.

Osteotomy Level and Osteotomies

Lateral side walls are divided into three sections. The thickest portion of the lateral wall is indicated by the number 1. This bony thickness might occasionally approach 1 cm.[18] The number 1 also indicates the new nasofacial groove area we created by reshaping the frontal process of the maxillary bone with cylindrical burrs. The area indicated by the number 2 is the area where the bone is the thinnest, and thus, special attention should be paid. We start our osteotomy level at the newly formed

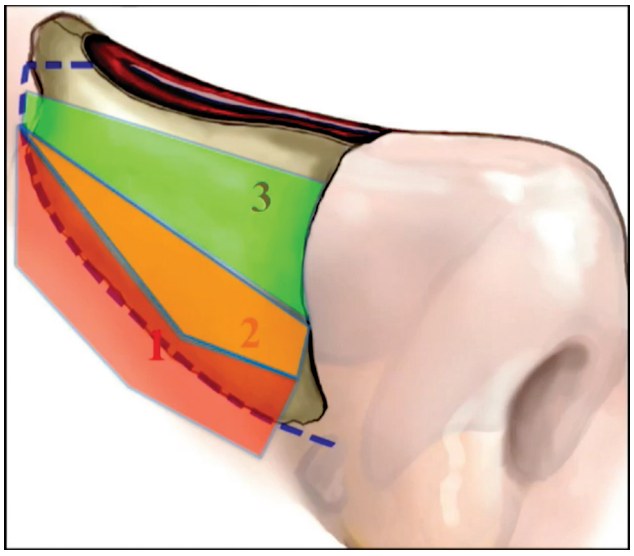

Fig. 6 Three sections of the lateral side walls.

nasofacial groove area to ensure ideal DALs and a sharp transition between the lateral wall and the maxillary bone (►**Fig. 6**).

For osteotomies, the authors prefer to use piezoelectric devices because of their speed, precision, and full preservation of the underlying periosteal support. If a piezoelectric device is not available, we can obtain a similar result using a very sharp 2-mm osteotome. Because of the wide exposure, we can perform the osteotomy directly using the microedge-specific osteotomy technique, described by J.C. Neves, and preserve the underlying periosteum, reducing the possibility of severe osteotomy complications, such as detachment, asymmetry, pinching, comminution or airway obstruction[9] (►**Fig. 7**).

By using the burrs, we change the position of the nasofacial groove. The new nasofacial groove is more lateral than the original. After the osteotomy, we can precisely control the bone position, as the bone level remains at the optimally low level we created in a controlled manner.

Use of Burrs Over Cartilage

Cylindrical burrs allow the removal of cartilage irregularities after a bony cap resection in the nasal dorsum and the reshaping of sharp transition lines after a middle vault reconstruction. When the cartilage tissue is not suitable to be treated using piezo, cylindrical burrs provide an important advantage for ease of reshaping.[6] Using cylindrical burrs on the septal cartilage in the nasal dorsum not only helps in adjusting the level of the dorsum but also provides protection for bilateral septal perichondrium, as careful use of the burr avoids any potential damage to the surrounding soft tissue. Bilateral septal perichondrium flaps obtained during middle vault reconstruction can be safely used when needed. Consistent with our philosophy of guaranteeing precision rhinoplasty, any additional reshaping of the cap grafts and shield grafts used for tip plasty can also be undertaken safely with burrs, especially in transition areas or for adjustment of the sharp edges after suturing.

Spinoplasty

During facial growth and before achieving complete anatomical development, the maxillary bone exerts force on the septal cartilage, occasionally resulting in septal deviations and septal spurs. In-line with our commitment to precision rhinoplasty, we prefer maxillary spine reshaping over septal cartilage resection. Cylindrical burrs can be used safely in areas causing irregularities and asymmetries. Particularly, in tension noses, cylindrical burrs make it easy to shape and reposition the anterior nasal spine region with gentle and subtle touches.

Radix

Because the radix area remains above the flap elevation, and due to the thickness of the bone structure, reshaping this area it is very difficult. It is challenging to achieve the desired level because the use of rasps in this area often results in more edema than anticipated. We use cylindrical burrs with retractor/aspirator (length: 17.5 cm; aspirator length: 6 cm). This offers wide exposure of the radix, dorsum, and nasal bones. The length and width of the retractor facilitates

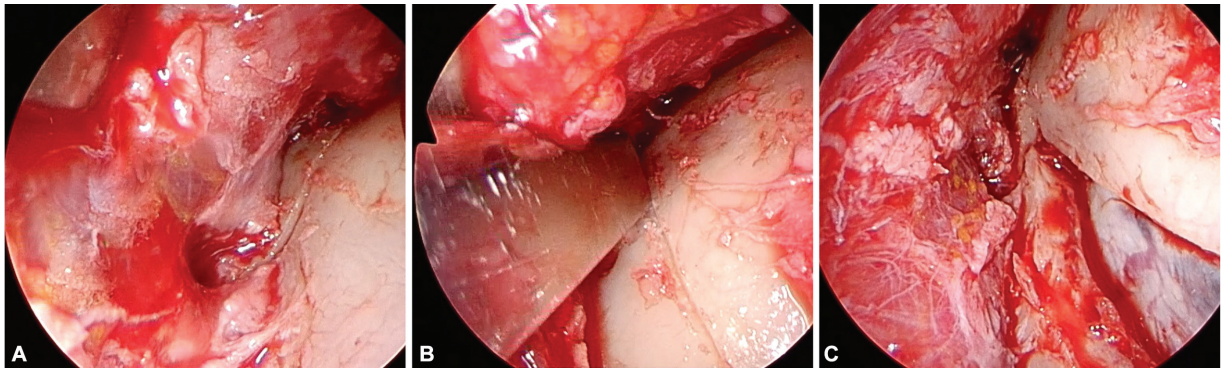

Fig. 7 Ostectomy with the microedge-specific osteotomy technique with a 2-mm osteotome. Dorsal preservation approach. (**A**) Horizontal osteotomy. (**B**) Superior lateral osteotomy. (**C**) After performing the superior and inferior lateral osteotomy. Ostectomy with the untouched underlying periosteum.

efficient work in the radix region with irrigation while preserving the surrounding tissue. By using cylindrical burrs, we can conduct precise reduction of the radix to the planned level quickly while protecting the skin flap and procerus muscle from soft tissue trauma.

K point

Sharp deviations at the keystone area may occur, which prevents the medial movement of one of the lateral walls after osteotomy. The sharp part of the deviation and the part that prevents its medial mobilization can be safely fixed with the cylindrical burrs without damaging the bone–cartilage junction.

Cylindrical Burrs versus Manual Rasps

If we compare cylindrical burrs (cutting and diamond) with the classic rasps, we encounter these key differences. The first and most obvious difference is the exposure needed for use. In the strictest sense, we can apply these burrs through sub superficial musculoaponeurotic system (SMAS)-periosteal tunnels, but it is not recommended because of (i) difficulty in maintaining control over the tip of the instrument and (ii) heightened risk of surrounding soft tissue damage. Power-assisted instruments facilitate meticulous bone removal, 3D sculpting, and reshaping of the bony and cartilaginous vaults without the soft tissue trauma characteristic of manual rasping.[9] Appropriate use of burrs can easily avoid this problem of soft tissue trauma while allowing unhindered exposure needed to precisely address the deformities we wish to correct.

The burrs can be used before and after performing the osteotomy (mobile nasal bones), without the risk of bone avulsion or irregularities.[17,21] The shearing force applied when using the rasp can injure the underlying cartilage, creating deformities, excessive weakening, and possible dysfunction of the inner valve.[21,22] The shape of the rasp is also important when deepening of the nasofrontal angle and contouring of the radix are needed.[17] We use the OSSEODOC control unit (Osseodoc, Bien-Air Surgery, Le Noirmont, Switzerland) with a micromotor (BASCH-1, Bien-Air Surgery, Le Noirmont, Switzerland) and handpiece (PM2, Bien-Air Surgery, Le Noirmont, Switzerland), with Komet Medical Cylindrical Burrs (Switzerland).

Cylindrical versus Spherical Burrs

Due to its larger contact area compared to the spherical burr, the cylindrical burr creates a smoother bony surface with less chance of producing grooves or irregularities. This makes the correction of irregularities or anatomical deformities much faster and in a homogeneous fashion.

Cylindrical Burrs versus Piezo

Upon comparison of the two instruments, we find that on account of the greater area of contact between the burr, bone and cartilage, there is minimal chance of producing grooves or irregularities. Cutting burrs can also treat irregularities on cartilage, while piezoelectric devices cannot. Moreover, burrs are also much faster to use. Unlike scrapper devices that create irregularities and tunnels, cylindrical burrs provide smoother transitions all along their length.

Piezoelectric Devices

The authors do not doubt the advantages of using piezoelectric devices instead of power burrs during osteotomies. Osteotomies performed with a piezoelectric device are safe, precise, and avoid osteonecrosis due to the micrometric and selective cut.[11] Because the piezoelectric device fully preserves the underlying periosteal support, intermediate and lateral osteotomies can be used to flatten sidewall convexity without unwanted bony fragmentation and with less risk of sidewall instability. However, if they are not used appropriately, the heat on the tips can damage soft tissue and produce skin burns.

Piezoelectric cutting tips have the ability to selectively cut bone and/or hard cartilage, such as rib, and are less likely to penetrate the surrounding soft tissues, such as skin, mucosa, or nasal cartilage.[10] Piezoelectric devices can also be used to sculpt or reshape the bony vault when necessary.

Power Instruments in Dorsal Preservation

The use of power instruments in dorsal preservation is of paramount importance and has become a vital step to refine the nasal pyramid and deliver a precisely designed dorsum, aesthetic dorsal lines, and smooth lateral walls. Both power devices, piezo and burrs, may be used to shave the nasal dorsum. Even rasps are effective for reducing the bony dorsum. We mainly use diamond cylindrical burrs to correct irregular areas while removing humps and reducing the lateral walls. The larger contact area of cylindrical burrs compared to spherical burrs create a smoother bony surface while minimizing the risk of producing grooves or irregularities. This clear advantage remains evident even in comparison to the piezo scraper. We use them to reshape dorsal residual humps after pushing the pyramid down and to sculpt the lateral walls postosteotomy.

On many occasions, after completing a basal osteotomy, some step deformity may become apparent. The use of burrs for filing out the basal edge of the osteotomy helps create a gentle transition to the face and thereby reduces the width of the nasal base.

Discussion

The osseocartilaginous vault is natural asymmetrical and the challenges in its corrective surgery necessitate a highly personalized approach to each case. The lateral side walls are naturally asymmetric, either in a concave or convex fashion. Shaping these asymmetries by performing osteoplasty using powered instruments has become very popular in today's world.[17] Osteoplasty or rhinosculpture[6] described by Gebault[6] as a "bone reshaping procedure with associated narrowing and remodeling of the bony vault" can also be

performed with piezoelectric devices, but it takes more time and, as mentioned before, it can only work on the bony pyramid and lateral walls, leaving the cartilaginous portion untreated. Piezo sculpting and osteoplasty with burrs have the same purpose to achieve the best possible symmetry between both sides in terms of the size, shape, and angulation of the lateral bony walls.[17]

Certainly, piezo instruments have become popular in the last few years as delicate and selective devices, while tools like burrs are criticized because of the high risk of soft tissue trauma. In our opinion, when used properly, cylindrical burrs are safe, precise, and offer the advantage of treating both bone and cartilage when necessary. They can be used in conjunction with piezoelectric devices to obtain the best possible results. Combined use of burrs with piezoelectric devices allows the surgeon to achieve optimal outcomes in rhinoplasty.

Complications

We did not encounter any additional complications, including callus formation, except for the lateralization of the osteotomy during the follow-up period.

Cylindrical burrs can inadvertently damage cartilage tissue and surrounding soft tissue if used with insufficient irrigation or at inappropriate angles. The use of cylindrical burrs over septal cartilage is recommended at an angle in order to avoid damaging the perichondrium over the cartilage tissue. We have performed approximately 300 lateralized osteotomies—a rate that is comparable to the lateralization rates encountered after osteotomies performed with conventional methods. Furthermore, as our surgical expertise with osteoplasty (bone reshaping) has grown, we have observed a concurrent decrease in the lateralization rate. As our osteoplasty experience has grown over the years, we observe a proportionate decrease in our lateralization rate.

Conclusion

Public expectations have evolved over the years and obligate us to provide increasingly refined aesthetic outcomes in rhinoplasty. The development of power instruments, particularly burrs and piezoelectric devices, has become a game-changer for rhinoplasty in recent years. These power tools help reduce operating time, minimize damage to the surrounding soft tissues, and facilitate delivery of precise surgical results.

Having several advantages over the classical surgical tools, burrs can also be used in conjunction with piezo tools to further optimize results. Burrs have the ability to create a smooth transition between the lateral sidewalls of the nose and the face, treat bone asymmetries and yield homogeneous upper and middle thirds with a soft transition with the upper lateral cartilages cartilages. In our opinion, the integration of burrs into the rhinoplasty surgeon's armamentarium allows enhanced surgical precision and achieving superior surgical outcomes.

Conflict of Interest
None declared.

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