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Review

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Medical nose reshaping: current evidence behind techniques

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Abstract

The nose, centrally located on the face, plays a crucial role in facial aesthetics. Any imbalance in its length, width, tip position, or a gross deformity, such as dorsal hump and deviation, can significantly affect the overall facial harmony, which is thus a major concern for patients. When it comes to minor deformities, they have been treated with hyaluronic acid, toxin injection, and thread insertion since 2005. This study has originally been carried out to review the published medical literature on the non-surgical techniques for Medical Nose Reshaping (MNR): a PubMed search was carried out in December 2020 using the search terms: “Nose [and] filler”, “Nose [and] botulinum toxin” and “Nose [and] thread”. A large number of studies were identified and reviewed, and it was found that rhinoplasty remains the gold standard to correct nose defects; nevertheless, MNR is gaining popularity due to its minimal invasiveness, short downtime, and the market availability of different injectables, toxins, and threads. This study aims to provide an evidence-based approach to guide the use of non-surgical techniques for MNR by reviewing published medical literature and drawing on the authors’ experience.

Keywords: Nose, medical, non-surgical, filler, threads, toxin

INTRODUCTION

Because the nose is centrally located within the face, it is crucial to assess its aesthetic features, as any imbalance in length, width, tip position, or a gross deformity - such as dorsal hump and deviation - can easily affect the entire facial harmony and therefore be of major concern for patients.

When it comes to minor deformities, the so-called "non-surgical or liquid rhinoplasty" offers an option for patients who prefer to avoid or are not eligible for surgery under general anesthesia. Although the results are temporary, this technique allows for addressing such deformities. After the first report on this procedure (using a resin for dental restoration in 1953)[1], injectable silicone use has also been reported[2].

Several authors subsequently published more papers about the use of calcium hydroxyapatite[3], freeze-dried acellular cadaveric dermis[4], hyaluronic acid and botulinum toxin[5], poly-methyl-methacrylate[6] and bovine collagen[7].

Autologous fat then started to be used as an ancillary procedure in addition to surgical rhinoplasty[8], but is now also used as an outpatient filling technique[9,10].

As in surgical rhinoplasty, the tri-dimensional reshaping may be done by means of grafts[11-13], and even when using injectables, treatment plans must be made and injections performed according to the same rules[14].

The debate about indications, techniques, and the best material to be injected is still open, and regardless of the product used, achievable results are obtained just by mere volume addition.

As for surgical procedures, sound knowledge of nasal anatomy - both structural and vascular - is required, and even more so when a nasal injection is to be performed, regardless of the material to be injected.

The most common complications are unfortunate and harmful for both patient and doctor, as the greatest concern in injectable nose reshaping is intravascular product injection[15,16].

Brain infarction, blindness, and skin necrosis have been reported with all available products and even after autologous fat injection[17-20].

After a 2010 paper presented a minimally invasive procedure for the correction of nasal tip deformities in carefully selected patients, many authors began to consider threads as a valid alternative for performing medical nose jobs in response to the increasing incidence of the mentioned complications[21].

Sutures have always been part of standardized rhinoplasties to reshape, project, and rotate the nasal tip area[22,23], and in the last few years, threads, commonly used in cosmetic fields, were then being adopted as an alternative tool to injectables and toxins, for nose reshaping[24-26].

As long as non-surgical procedures, even when performed under local anesthesia, do not jeopardize the key anatomic structures of the nose, they can be adopted in properly selected patients as a simple method to carry out nose reshaping. Moreover, not every patient requires all of the steps of surgical rhinoplasty in order to see his or her concerns addressed, and both selected nose deformities and nasal aging can be dealt with very easily, safely, and quickly.

The reversibility of the result, at least for a short period of time, is also appealing to patients who are uncertain about the real outcome of nasal surgery.

This study has originally been carried out to review the published medical literature on the non-surgical techniques for Medical Nose Reshaping (MNR) so as to provide an approach based on available evidence and the authors' experience.

DATA COLLECTION

PubMed research for "Nose [and] filler", "Nose [and] botulinum toxin" and "Nose [and] thread" retrieved a total amount of 101 articles, starting from 1975 to 2020.

Results were limited to human subjects in clinical trials, randomized controlled trials, case reports, comparative studies, controlled clinical trials, and multi-center studies.

No limit based on the year or language of publication was applied.

A manual review of abstracts was also performed to omit unrelated articles.

Details of the database search are listed in Figure 1. Without considering the first two references (edited in 1953 and 1986) at the end of this paper, there has been an increasing number of publications about 'medical nose reshaping' since 2005. The results, therefore, include 99 articles from 2005 to 2020.

DATA DISTRIBUTION

Study type

Twenty-two articles were prospective studies, 49 were retrospective, and 28 were not mentioned.

Among all the published papers, only one RCT study[27] is currently available about nose reshaping (plunging tip) with botulinum toxin. A total of 12 review articles have been written, the first in 2009[28], then in 2013[29], in 2014[30], and furthermore from 2016 to 2019[31-39].

Additionally, among all papers related to complications, 6 include a review too, the first published in 2009[40], then another in 2014[41], one in 2018[42], and the last one in 2019[43-45].

The remainder is case series or case reports [Figure 2].

Topic: anatomy

Seven papers were published about anatomical topics [Figure 3]: interestingly enough, except for the ones published by Saban *et al.* in 2008[46] and 2012[47], the other five published from 2016 to 2019 were mostly directed at applying anatomy notions in order to avoid complications or to perform some particular technique disclosed within the paper[48-52].

Topic: techniques

Since 2005, there has been an increase in articles that focused on new or personal techniques. The first described the use of botulinum toxin[53,54] and hyaluronic acid[55], whilst in 2007 the first nose reshaping done with collagen[56] and fat[8] have been presented. In 2008 Redaelli published the first comprehensive paper about the use of hyaluronic acid and botulinum toxin for nose reshaping[5]; furthermore, polylactic acid, polyacrylamide, and tricalcium phosphate injection have been reported[57,58].

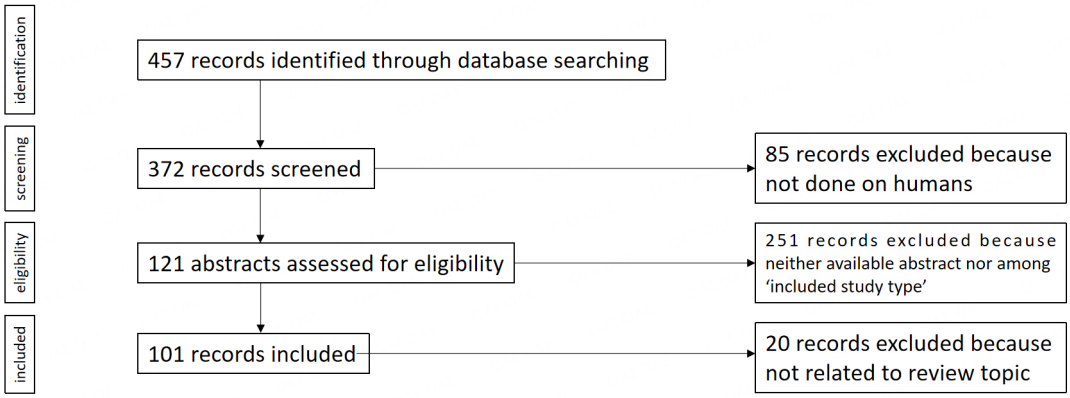

Figure 1. Flow diagram of the search strategy.

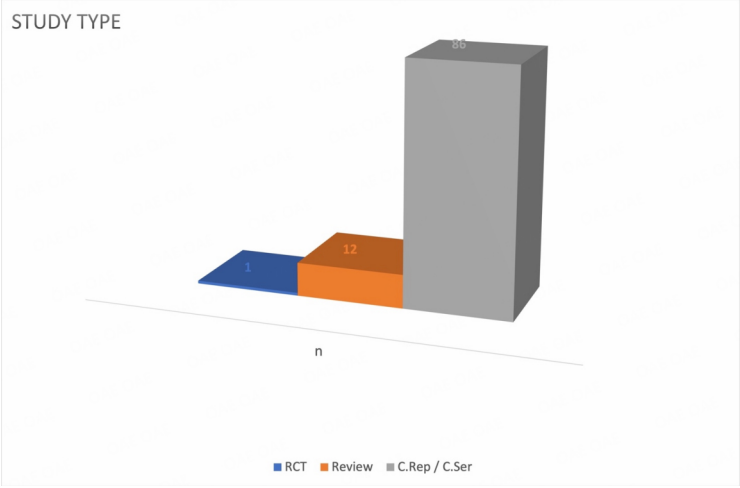

Figure 2. Retrieved articles: study type. RCT: Randomized Controlled Trial; Review: Narrative Review; C.Ser: Case Serie; C.Rep: Case Report.

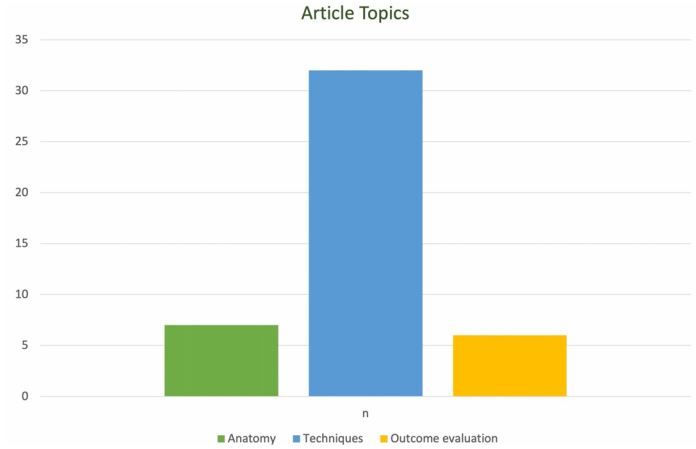

Figure 3. Articles distribution: treated topic.

In 2010 the first nose job done by threads was presented[21] as an office-based procedure to correct selected

flaws. This procedure cannot be considered by all means as non-surgical because of the procedural steps and the required skills to perform them.

Since 2010, several Authors have kept on publishing about nose reshaping until the present day, sharing their personal approaches and experience over the years through case reports and case series[59-67].

In 2018, a paper related to the thread nose job method was published[26], several years after the first article ever mentioning this topic.

In 2019, the use of carboxymethylcellulose was first reported[68] as a submucosal injection to improve upper airway aerodynamics in a patient affected by 'empty nose syndrome', since Redaelli *et al.* first published in 2012[59] about hyaluronic acid injected to functionally improve external nasal valve, normally performed only via surgical insertion of cartilage grafts on the alar rim[69].

The rest of the published papers, even if in the form of case series, began to present injectable nose reshaping as a technique based on the principles of previously-existing surgical techniques - as opposed to techniques based on personal experience and anatomy only - in order to improve results, safety, and reliability[14,70-74].

Nose thread lifting techniques are further presented with their related complications[25,75] [Figure 3].

Topic: outcome evaluation

Since 2015, papers on objective and validated measurements of achievable results of non-surgical nose reshaping have started to be published constantly, once a year, ranging from anthropometric points evaluation[76-77] to the use of software[78,79].

The first ever medical nose reshaping satisfaction paper was published in 2015[80] and the only one published after that date was in 2020[81] [Figure 3].

Topic: agents

Out of the 37 published related to hyaluronic acid injections, 7 papers were published with a focus on injected materials: in 2007 and 2014 related to fat[82,83], in 2009 about CaOH[81] and collagen[7], PMMA[84] and polyacrylamide[85] injection, and in 2019 about autologous fluid cartilage[86], which can be harvested and used in the operating room like any other cartilage in order to refine surgical rhinoplasty[87] [Figure 4].

Injectable fillers have been precisely mentioned in 75 papers from 2006 to 2020: 14 reporting CaOH use, 1 fluid cartilage, 1 carboxymethylcellulose, 2 collagen, 1 Acrylamide (Dermalive) 7 fat, 1 Polyamide, 1 polymethylmethacrylate, 1 silicone, and the last 8 the combined use of the mentioned injectables.

Toxin was referred to in 9 papers, 5 from 2005 to 2010, 3 in 2012-13, the last 1 in 2018; 4 alone[27,53-54,60] while 4 in association with fillers[5,58-59,61], and 1 in association with fillers and threads[24].

Threads were used in 7 papers, the first in 2010, 2 in 2013-14, and then 4 in 2017-20; 4 used alone [21,26,75,88], 2 in association with fillers[25,65], and 1 in association with fillers and botulinum toxin[24].

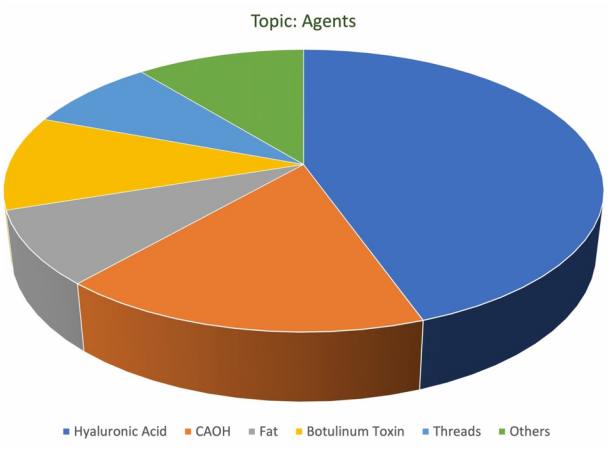

Figure 4. Articles distribution: injected agent.

In particular, the work published in 2014 by Saban *et al.* was the first one related to the functional treatment of the nasal valve with threads. Finally, 25 articles did not indicate the used material[88].

Topic: complications

Complications-related papers have been published since 2008[89,90], and for the next six years, their presence has been constant but minimal in 2009[40], 2010[91,92], 2011[93-95], 2013[15,96,97], 2014[18,41,98-100] until a first rise in 2015 when five papers were published[20,101-104].

There was a renewed focus in 2018 and 2019, with seven[42,105-109] and seven[43-45,110-112] published papers, respectively, after two years of low interest in 2016[16,113-115] and 2017[19,116,117] [Figure 5].

There is only one systematic review to be found[45], while the others are case series or case reports and three do not mention the sample size of cases.

While non-vascular complications are the minority - mainly granulomatous reaction[91], dermatomyositis[110], mass formation, and migration[89,114] - the reported complications are most commonly vascular, as reported in 27 papers: neuro-ophthalmologic complications such as brain infarction[16,18,104,111], blindness[43,45,96,100,106,118] and ophthalmoplegia[102] (sometimes together), overall slightly exceeding cutaneous complications such as skin necrosis[20,40,41,90,95,97,103,109] [Figures 6 and 7].

It is remarkable that neither botulinum toxin-related complications nor thread-related complications have been reported until today. However, there is one published paper focused on thread lifting complications on the nose, but those were due to some previously implanted prosthetic material and therefore cannot be accounted for as the root cause issue[75].

Among the most reported materials associated with post-injection adverse events in the currently available literature, 14 papers refer to complications with HA alone[16,18-20,80,93,94,97,107-109,114-116], while 8 reported complications encountered when injecting CaOH alone[41,80,89,92,102,105,106,113].

Nose reshaping by fat is reported to present with complications in 2 articles[17,45] and the remaining 12 articles generically report complications associated with "dermal fillers"[15,40-42,83,86,90,95,96,99,100,109].

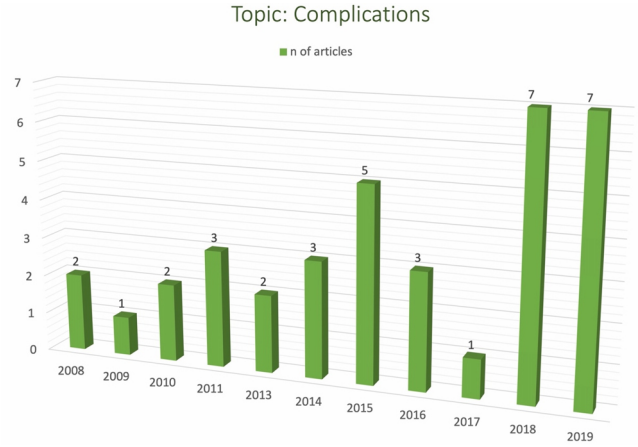

Figure 5. Complications-related articles: publication trend.

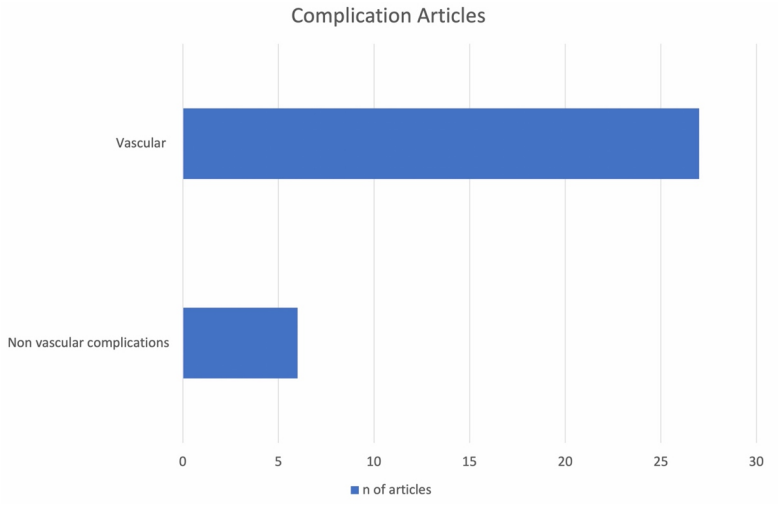

Figure 6. Complications-related articles: types of complication.

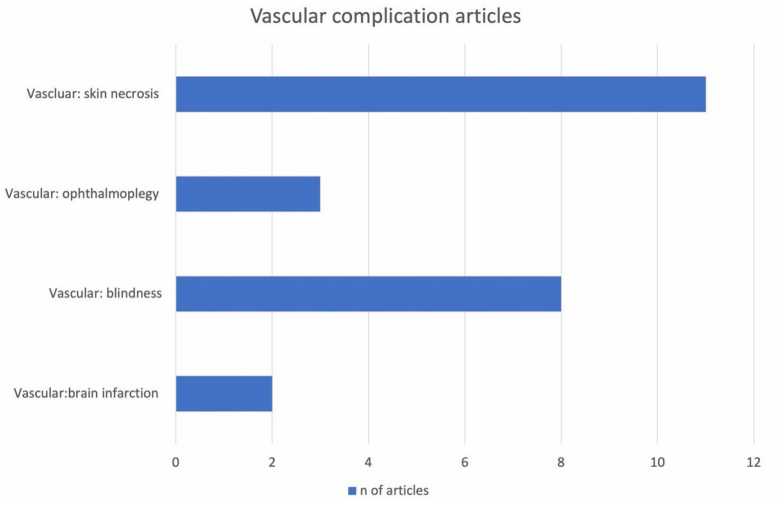

Figure 7. Vascular complications-related articles: types of complication.

Complications due to collagen[103], acrylamide[101], and silicone[110] injections are poorly mentioned since these materials are no longer employed.

DATA REVISION

Starting from 2005 to 2010, Medical Nose Reshaping techniques that have been presented are: injecting botulinum toxin by Dayan[53] and Redaelli[5], grafting some adipose tissue by Cárdenas[8], injecting hyaluronic acid by Beer[55] and Redaelli[5], collagen by De Lacerda[56] and using other injectables by Rokhsar[57], Braccini[58] and Siclovan[81], and finally by Tiryaki[21] inserting threads.

Great efforts have been made in the following years to define safe and reliable techniques aimed at minimizing vascular risks, which still must be considered as an inner characteristic of every filler injection, but unfortunately extremely significant when treating nose deformities.

The majority of the literature hss been written by Authors who published from 2010 up to 2019 about their personal methods, accompanied with complication-related papers in the same time interval. It is true to say that despite a thoughtful choice of materials, solid anatomical knowledge, and the use of a reliable technique, complications are more likely to occur when it is the nose that is being treated.

Regardless of the chosen method, sound knowledge of anatomy is essential for nasal reshaping. It is recommended to consult the paper by Saban *et al.* published in 2012[47] about the medical and surgical application of nasal arterial vascular system, along with the previous study focused on the nasal superficial musculoaponeurotic system[46]. These papers provide comprehensive details about the layers of nasal envelope, which can greatly benefit those undertaking MNR.

Thereafter, the interest toward that topic in nose reshaping dropped until 2016[47], when there was a renewed focus on nasal vascular anatomy, driven by the upward trend of injection-related complications published since 2010[48,49] and it kept steady in the following years.

The external nose blood supply is an anastomotic system supplied by branches of the ophthalmic and facial arteries presenting with many anatomic variations from patient to patient and even from one side to the opposite within the same patient. It lies within or above the mentioned Superficial Muscle-Aponeurotic layer along with the lymphatic net: starting cephalad form the internal carotid system, the dorsal nasal artery arises directly from the ophthalmic and runs over the nasal bones under the SMAS plane at the nasal root and then gradually gets more superficial as it runs down towards the tip and the external nasal artery, rising from the anterior ethmoid artery is the other major vessel of the upper part of the nose.

The lateral nasal artery is a branch of the facial artery; rising from the external carotid system, it proceeds medially above the alar groove to meet the columellar artery: they supply the alar wings and, together with the dorsal one, the nose tip as an arcade along the cephalic margin of the lateral crura. The columellar artery is a terminal branch of the superior labial artery that supplies the base of the nose. Although they are located above the muscle layer, small perforating vessels branch off to the lateral and dorsal nasal arteries running between the SMAS and the cartilaginous or bony surfaces.

This vascular anatomy, therefore, provides several anastomoses: the ones with the internal carotid system, which in case of retrograde embolism can result in brain infarction and blindness, whereas the ones with the external system lead to a geographic pattern of vascular imbalance which may result in skin necrosis, due to either direct embolization or to compression from product excess or soft tissue edema.

The anatomical structures involved must be evaluated with the objective of safety and efficiency, as for every surgical or non-surgical procedure on the face, encompassing all layers of the nasal superficial soft tissue envelope, from the surface down the skin, the subcutaneous tissue, the SMAS, the deep fat or so-called areolar layer, and finally perichondrium or periosteum.

It is mainly the nasal vessels and the nasal SMAS layer that must be considered when reshaping with injectables. Most of the arterial vasculature runs superficial to the nasal SMAS, while the deepest layers are almost vessels-free; therefore, the injections should be performed within the avascular plane, at the bony-cartilaginous contact. Regarding threads: the anatomic layers to use are conversely deeper; therefore, it is the SMAS that acts as the main layer, and nasal ligaments may represent an adequate structure for anchoring the threads to mobilize the malleable cartilages and attach their new position.

Nose deformities have been addressed with medical camouflage with fillers or botulinum toxin since the very first attempts[3,4,8,53,54], but it is only after three years that a comprehensive approach has been codified by Redaelli A[5].

Nowadays. Botulinum toxin injection allows to treat:

- Dynamic tip ptosis;
- Excessive columellar show.

The first is secondary to the action of an overactive and hyperactive depressor septi nasi muscle - its weakening rotates the tip upward and opens the nasolabial angle, while the latter is due to hyperactivity of the medial portion of the levator labii superioris alaequae Nasi, which can be chemo-denervated too.

By studying the published literature, nasal flaws to be addressed for reshaping with injectables are:

- Narrow naso-frontal angle;
- Mild to moderate dorsal hump;
- Dorsal concavity or shallow dorsum (Saddle nose);
- Contour irregularities or asymmetries (Crooked nose);
- Polly-beak deformity;
- Decreased tip projection or rotation;
- Alar base deficiency and other alar rim irregularities;
- Narrow naso-labial angle;
- Minor asymmetries or irregularities after primary rhinoplasty;

• External Nasal valve functional problem.

Given the additive nature of this camouflaging technique, proper patient selection must be carried out as the treatment of large, wide, and over-projected noses is contraindicated or may present with poor results.

Hyaluronic acid is injected gently and slowly using a needle with vertical inclination to decrease its subdermal course and prevent vessel injury, or through a cannula with the tip located deep to the nasal SMAS.

For dorsum deformities, it is recommended to inject above as well as below the lowest point in order to properly shape the dorsal hump.

Lateral deviations are treated with the same approach: in the mentioned sites, the additive approach is adopted to obtain camouflage of nasal defects.

While dorsum injection always enables indirect tip rotation due to skin envelope traction, direct tip treatment can widen the nasolabial angle too, and it is carried out by injecting the inferior border of the nasal spine, which supports the tip and weakens the depressor muscle through the elongation, thus resulting in pleasing tip rotation.

Whenever aimed at defining tip morphology, injectables are used as a shield graft to blunt the supratip break or to round the tip, by injecting the lateral dome.

Correction of post-surgical deformities requires further attention. Due to the vascular anatomy alterations and the inner feature of the remaining scar tissue, minimal injections of products and adequate waiting time after the surgical intervention are both mandatory[3,8,14,119].

The above-mentioned techniques are nowadays mostly used for nose reshaping with hyaluronic acid and calcium hydroxyapatite, both capable of achieving a temporary camouflage of the addressed deformities.

When selecting the most suited material to be injected for nose reshaping, careful consideration must be given to its rheological and non-rheological properties. The first refers to the material's ability to exhibit characteristics of both a solid and a liquid, which are measured by the elastic coefficient G'(resistance to deformation) and the viscosity n*(ability to withstand shear force), respectively.

High G' material is generally a performant filler, but may be stiffer, thus inducing greater trauma and inflammation upon injection. It is more likely to cause inflammation, edema, and even lumpiness when injected into thin-skinned noses.

Lower G' material has a more natural effect, but may be unable to withstand tissue deformation at injection, therefore resulting in an insufficient result after nose injection.

Materials with higher viscosity n* present with great extrusion force and greater capability to not diffuse in tissues during facial movement[4].

Both modules are proportional to concentration amount and any dilution will decrease them[120,121].

Non-rheological properties of the injectable agent are mainly related to its hydrophilia and to the presence of lidocaine, which, as reported, also affects the rheological behavior of the agent [36].

The eligible filling for nose reshaping agent should therefore have high G' and n*, and be minimal hydrophilic as long as little volume is required to be injected in order to obtain a satisfying nose contouring.

Calcium hydroxyapatite is the only agent that would meet the ideal rheological criteria, while hyaluronic acid fillers do not; but unfortunately, it is not reversible, which is of major concern with injectables, and therefore hyaluronic acid remains nowadays the most widely injected agent[120].

Fat, once harvested and centrifuged, could be injected; however, its rate of may request repeated treatment sessions[121-125].

In 2019, Trivisonno *et al.* published a paper on the use of autologous fluid cartilage harvested and injected in the operating room to refine surgical rhinoplasty outcomes, similar to other forms of cartilage injectables[86].

In the same year, a significant upgrade occurred: as surgical and medical fields were overlapping more and more, injectable nose reshaping started to be designed and performed from the perspective of surgical techniques and not only of anatomical landmarks and structures, in order to improve results safety and reliability[14,70-74,126].

It is the Authors' opinion that this achievement is rooted in the trend that started in 2016 with the publication of medical nose job outcome evaluation[77-79] and patient satisfaction papers[76,80,81] which were similarly available for surgical rhinoplasty.

The option of using threads for nose reshaping, together with the surgical upgrade in the injection technique mentioned above, finally merge into a new outlook on "medical nose reshaping" which is what ultimately this treatment should be named, in the Author's opinion. Injectable or thread nose reshaping, nominally medical, must be therefore differentiated from rhinoplasty as the only surgical procedure.

This new conception will enable a clearer understanding of patients' needs and professional practice, pointing out the limits and opportunities of this range of procedures.

Nose reshaping can be effectively addressed using threads to correct:

- Narrow naso-frontal angle;
- Mild to moderate dorsal hump;
- Dorsal concavity or shallow dorsum (Saddle nose);
- contour irregularities or asymmetries (Crooked nose);

- Polly-beak deformity;
- Decreased tip projection or rotation;
- Alar base deficiency and other Alar rim irregularities;
- Narrow naso-labial angle;
- Minor asymmetries or irregularities after primary rhinoplasty;
- Nasal valve deficiencies (both internal and external).

When these flaws are either native or occur after primary rhinoplasty.

Discussing the technical details of this camouflaging technique is not the original purpose of this paper, partly because the technique has actually been recently codified[127], but generally, it could be claimed that threads work as a mechanical scaffold, with loops and barbs as if they were an internal framework.

For every single thread, several passages are made to create a strut or as a graft: when volume enhancement is desired, then the greater the number of loops, the greater the enlargement will be due to thread volume.

Threads are better used in sites where tissue internal pressure would be more likely to press injected substances into adjacent areas, which would lead to an early loss of the strut-like effect of the injected material. Multiple threads insertion, or multiple loops of a longer thread, could instead enable greater correction thanks to their permanence in tissues. This gives initial mechanical strength, while in the meantime, tissues are healing around the thread, thus promoting further biological support[25,26,126].

To date, it is remarkable that complications related to botulinum toxin have not been reported, while one published paper is focused on complications associated with thread lifting techniques on the nose due to the presence of previous prosthetic material insertion[75] and complications related to nose thread lifting have only been reported in recent years[127-129], coinciding with the increasing spread of this technique.

Even if not strictly related to cosmetic literature, it is of great importance to report that only three papers have been published so far about functional upper airway dynamics treated medically (internal and external valve impairment and empty nose syndrome).

The first ever paper was published by Redaelli *et al.* in 2012[59], then Saban in 2014[88] using threads. The most recent paper is from 2019[68] and it is the first to report the use of carboxymethylcellulose[68] to obtain the same outcome that would normally be achieved by cartilage grafts on the alar rim[69], as recently codified by Sulamanideze *et al.*[127].

Finally, based on the contents recorded in reviewed articles and the Authors' clinical experience, it could be advised to proceed with medical nose reshaping techniques as indicated, after a careful assessment of skin type and texture, in order to consider the way it will eventually drape after the procedure. After evaluation of the actual shape of nasal bones and the cartilaginous framework, as well as the presence of the potential irregularities to be corrected, it should bear in mind that no surgical dissection would take place:

• A narrow naso-frontal angle could be corrected either by filler injection or by inserting threads upward and downward from the procerus muscle, thus harvesting thread loops in the concavity to gain volume in the nose root to widen the angle;

• A mild to moderate dorsal hump could be treated by injecting fillers along the midline, above and below the hump in order to conceal it. When using threads, a hump is corrected by running multiple loops above and below it to project the overlying tissue of the low dorsum, thus concealing the deformity by camouflage. Even indirectly, the correction could be made by tissue heaping when the tip is lifted if desired;

• A saddle nose, with dorsal concavity or a shallow dorsum, is approached by carrying out multiple loops in the concavity to project the overlying tissue of the low dorsum, thus concealing the deformity by camouflage. Threads are to be preferred when the amount of filler to be injected appears to be too large and can therefore be displaced laterally due to tissue pression; conversely, the barbs anchor the volume created by the loops in the site where they are implanted;

• Crooked nose and Polly-beak deformity are badly addressed with threads. These are therefore not indicated in such cases. Treating these deformities with filler injection requires extensive experience and excellent technical skills as they represent the most difficult challenges to be faced in medical nose reshaping, plus they often require surgical correction;

• A tip that is under-projected or under-rotated, with or without a narrow naso-labial angle, is always approached with botulinum toxin injection in the depressor nasi muscle. While it could be fully effective in the case of isolated dynamic tip, the position and the angle could be further improved with both filler injection or thread insertion: the filler is injected at the base and along the columella in order to strengthen and project the tip as would a columellar strut, and a small amount is injected below the tip, to better define its rotation. When threads are preferred, multiple threads are inserted from the tip cephalad along the midline and into the columella to create a framework that can maintain it in the elevated position by the barbs, while some extra loops in the tip also allow for further projection, acting as a columellar strut (the first) and as a shield graft (the second). In both cases, the weakened muscle provides longer-lasting results;

• Fillers should be avoided or at least be a second choice, driven by extensive experience, when treating alar base deficiency and other alar rim irregularities: the hazard of vascular complications when injecting in this area is high and the operator must be aware that it could be totally avoided by carrying out linear insertion of multiple threads above the lateral crura of the alar cartilage, that would act like an alar batten graft, and these are of course the ones to be recommended instead;

• Threads should be finally considered the first choice for any correction secondary to previous rhinoplasty: to avoid the danger arising from vascular impairment due to iatrogenic fibrosis and vascular net recovery. Injection of fillers for post-surgical nose correction requires adequate skills and must be performed knowing how to treat complications by dissolving the agent that can therefore only be hyaluronic acid.

All the treatments mentioned here could be carried out both by needle and cannula (fillers), while threads loaded on blunt cannulae have to be preferred since using threads on sharp needles could result in damage to the tip cartilages.

In the Authors' experience, hyaluronic acid should always be chosen for filling procedures as it is the only one to dissolve in case of any adverse event.

This review has indeed some limitations: only one paper among many is a randomized controlled study[27] on nose reshaping with botulinum toxin for the treatment of plunging tips.

The level of evidence is therefore poor: other articles have directly reviewed the topic but non-systematically or not even in relation to the main complication-related topic.

To the best of the Authors' knowledge, this is the first literature review on comprehensive approaches to medical nose reshaping for non-surgical nose deformity correction. It has therefore been carried out following a very basic assumption: whenever a method to determine the true outcome, safety and reliability of treatments - something that is therefore beyond the mere judgment of patients and clinicians - is lacking, evidence has to be incorporated in daily clinical practice, drawing knowledge from case reports, pilot studies, up to available high-quality studies, as Evidence Based Medicine is essential to provide better answers for patients and physicians[130].

CONCLUSIONS

Medical Nose Reshaping (MNR) can represent a reliable and effective camouflage technique, providing a high patient satisfaction rate.

The authors prefer the terms "medical" instead of "injectable", "liquid" or "non-surgical" and avoid calling this treatment "rhinoplasty", as that term should only be destined to the actual surgical procedure. While rhinoplasty remains the gold standard to correct nose defects; however, due to the market availability of different injectables, toxins and threads, along with the minimal invasiveness and short recovery time, many patients have benefited from MNR to correct specific deformities.

The debate about MNR remains ongoing due to insufficiently detailed indications and techniques in the past, along with numerous reports of mild to severe complications in the published literature.

In the Authors' experience, this treatment can bring great satisfaction to both patients and doctors when executed properly, primarily due to its immediate and long-lasting results. However, further refinement of this technique is required to ensure safe and reliable outcomes for patients.

Prospective, randomized controlled studies and systematic reviews of the literature are undoubtedly desirable as they will allow us to better standardize these procedures.

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Author's contributions

Made substantial contributions to the conception and design of the study, performed data analysis and interpretation: Diaspro A, Sulamanidze K

Verified the analytical methods, provided critical feedback, and helped shape the research, analysis, and manuscript: Pascali M, Bertossi D, Saban Y, Redaelli A
Contributed to the final manuscript: Diaspro A, Sulamanidze K, Pascali M, Bertossi D, Saban Y, Redaelli A

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