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Management Protocol and Recurrence Patterns of Oral Venous Malformations: A Systematic Review

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ABSTRACT

Oral venous malformations (VMs) are congenital vascular anomalies that present significant aesthetic and functional challenges, particularly when located in the oral cavity. This systematic review evaluates the effectiveness of surgical excision, sclerotherapy, and laser therapy in treating oral VMs, focusing on treatment efficacy, recurrence rates, and factors influencing outcomes. The review finds that surgical excision is effective for localized lesions but carries higher recurrence rates for larger or deeper lesions. Sclerotherapy (Polidocanol) is highly effective for low-flow lesions, showing minimal recurrence, while laser therapy offers successful outcomes for small, superficial lesions, though combined therapies may be necessary for larger ones. The review also highlights the importance of lesion size, location, and depth in determining recurrence and suggests that multimodal approaches may provide the best clinical outcomes. Future research should focus on long-term follow-up, multicenter trials, and the standardization of treatment protocols to improve consistency and efficacy.

KEYWORDS: Oral venous malformations, Sclerotherapy, Surgical excision, Laser therapy, Recurrence rates.

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INTRODUCTION

Oral venous malformations (VMs) are congenital vascular anomalies that primarily affect the oral and maxillofacial region, presenting significant challenges for both aesthetic and functional aspects of the affected individual's life. These lesions are typically found in critical anatomical areas, such as the lip, tongue, or buccal mucosa, which can lead to severe complications, including persistent pain, bleeding, and cosmetic disfigurement. The impact of these malformations extends beyond physical health, as patients often experience significant psychosocial consequences due to visible deformities. Moreover, VMs can severely hinder oral hygiene, speech, and swallowing, leading to functional impairments that affect daily living. Studies indicate that the presence of VMs can lead to psychosocial distress, particularly when the lesions are in visible areas, as individuals with oral VMs often face challenges related to social interactions and personal well-being (Kattimani et al., 2014; Azzopardi & Singh, 2015).

The prevalence of oral venous malformations in the general population is estimated at approximately 0.5%, though it is more commonly observed in children and young adults. This highlights the importance of early identification and intervention in managing VMs, particularly in this demographic. While these malformations are often congenital, they tend to be diagnosed later in life when they become more symptomatic or cosmetically noticeable. The prevalence of VMs in the oral cavity can vary, but studies have consistently found that children and young adults are disproportionately affected, underscoring the need for effective and early treatment options (Singh et al., 2013).

Oral venous malformations can be categorized based on their flow characteristics into low-flow and high-flow lesions. Low-flow lesions, which include venous and lymphatic malformations, are characterized by the slow movement of blood or lymph through dilated vessels. These lesions tend to be more manageable and are often treated with sclerotherapy or laser therapy. On the other hand, high-flow lesions, such as arteriovenous malformations (AVMs), involve the abnormal connection between arteries and veins, leading to increased blood flow and making them more challenging to treat. The pathophysiology of VMs, particularly in high-flow cases, involves complex vascular changes that can contribute to a range of clinical symptoms, from cosmetic concerns to functional impairments. The classification of these malformations is crucial, as it directly influences the treatment approach. Low-flow lesions generally respond well to minimally invasive treatments, while high-flow lesions often require a combination of surgical and interventional approaches (McCaffrey & Kline, 2004; Decker & Kaufman, 2012).

Despite the growing body of literature on the management of oral venous malformations, treatment protocols remain non-standardized, leading to considerable variability in treatment efficacy and recurrence rates. This lack of consensus on the best treatment approach often results in differing outcomes across various clinical settings. For example, some studies suggest that surgical excision is effective for smaller, well-circumscribed lesions, while others point to sclerotherapy or laser therapy as

preferable alternatives for larger or more diffuse lesions. Furthermore, the recurrence of these lesions after treatment remains a significant issue, with some patients experiencing repeated growth or regrowth of the malformations even after multiple interventions. The variability in outcomes and the absence of universally accepted treatment protocols contribute to the uncertainty in managing VMs effectively. As a result, more robust studies are needed to define optimal treatment strategies and develop standardized protocols for both low-flow and high-flow oral venous malformations (Ramakrishnan et al., 2021; Hadad & Jafari, 2022).

The aim of this systematic review is to provide a comprehensive analysis of the current treatment options for oral venous malformations. Specifically, the review will focus on:

1. Assessing the efficacy of different treatment modalities, including surgery, sclerotherapy, and laser therapy, for managing oral VMs. The review will evaluate the success rates of each treatment, considering factors such as lesion type, size, and location.
2. Comparing recurrence rates across different treatment modalities. Recurrence is a critical concern in the management of VMs, and this review will examine how various treatment approaches impact the likelihood of recurrence over time.
3. Providing evidence-based recommendations for clinical practice. By synthesizing the findings from the reviewed studies, the paper will propose multimodal treatment strategies and offer insights into long-term management of oral venous malformations, taking into account both treatment outcomes and patient quality of life.

METHODOLOGY

Search Strategy:

A thorough and systematic literature search was performed to gather relevant studies on the treatment and management of oral venous malformations (VMs). The search encompassed databases such as PubMed, Scopus, and Google Scholar for studies published between 2000 and 2024. Specific keywords such as "oral venous malformations recurrence," "sclerotherapy outcomes," and "laser therapy for venous malformations" were utilized to identify studies that focused on the efficacy and recurrence rates of various treatment approaches for oral VMs. This search strategy was designed to capture a wide range of studies that assess both treatment success and long-term outcomes related to recurrence and complications (Wang et al., 2020).

Inclusion and Exclusion Criteria:

To ensure that only the most relevant and rigorous studies were included in the review, strict inclusion and exclusion criteria were established. Inclusion Criteria comprised studies that specifically focused on oral venous malformations treated with one or more of the following modalities: surgical excision, sclerotherapy, or laser therapy. Additionally, only studies that provided follow-up data—specifically detailing recurrence rates—were included. The follow-up period was a crucial factor, as long-term outcomes are essential to evaluating the effectiveness and recurrence potential of the treatments provided (Rosenthal & Patel, 2020; Soubhia et al., 2019).

Conversely, Exclusion Criteria were set to eliminate studies that lacked long-term follow-up data, as these studies would not contribute meaningful information regarding recurrence rates or the durability of the treatment effects. Studies focusing on non-oral VMs or on other types of vascular malformations outside the oral cavity were also excluded, as they would not provide relevant data for the specific management of oral venous malformations.

Data Extraction:

Data extraction followed the PRISMA guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) to ensure consistency and transparency. The key data points extracted included treatment modality, lesion type, recurrence rates, complications encountered, and follow-up duration. Information was extracted with a focus on treatment efficacy, recurrence rates, and any adverse effects or complications associated with the treatment modalities. This step ensured that only the most relevant data was considered, contributing to a comprehensive understanding of the effectiveness and long-term outcomes of treatments for oral VMs (Kattimani et al., 2014).

Quality Assessment:

To assess the methodological quality of the included studies, the GRADE approach (Grading of Recommendations Assessment, Development, and Evaluation) was employed. The GRADE system provides a structured framework for evaluating the quality of evidence, considering factors such as the study design, sample size, risk of bias, and consistency of findings. The GRADE approach helps in determining the strength of evidence supporting the efficacy of different treatments, allowing for a more reliable and objective analysis of the studies. Only high-quality studies were included in the review, ensuring that the conclusions drawn from the findings were based on solid, credible evidence (Li et al., 2016).

RESULTS

Overview of Studies:

The studies included in this review span a broad range of treatment options for oral venous malformations (VMs). These studies were selected based on rigorous inclusion criteria, which emphasized the inclusion of long-term follow-up data and recurrence rates for each treatment modality. The studies reviewed encompassed various treatment modalities, including surgical excision, sclerotherapy, and laser therapy, and covered a range of sample sizes, follow-up durations, and lesion types. These factors were carefully documented in the Study Overview table (Table 1), which provides a comprehensive summary of the study characteristics.

In Table 1, the study year, sample size, treatment modality, follow-up duration, and recurrence rates for each study are outlined. This table offers a comparative perspective on the clinical outcomes of the treatments, facilitating a clear understanding of the various methodologies used in the studies and their respective findings.

Table 1: Study Overview

Study Year	Sample Size	Treatment Modality	Follow-Up Duration	Recurrence Rates
Ramakrishnan et al. (2021)	Not specified	Surgical Excision, Sclerotherapy, Laser Therapy	Varies, 12-36 months	5-20%
Jeyaraj & Chakranarayan (2017)	30 patients	Sclerotherapy (Polidocanol)	18 months	0%
Kattimani et al. (2014)	45 patients	Laser Therapy (Nd:YAG)	18 months	5-10%
McCaffrey & Kline (2004)	104 cases	Surgical Excision	24 months	10-20%
O'Donnell & Hearn (2006)	40 patients	Laser Therapy (Nd:YAG)	12 months	5-10%
Pereira et al. (2010)	45 patients	Surgical Excision	36 months	10-20%
Decker & Kaufman (2012)	60 patients	Surgical Excision + Sclerotherapy	24 months	10-15%
Singh et al. (2013)	60 patients	Sclerotherapy (Polidocanol)	12 months	0-5%
Azzopardi & Singh (2015)	25 patients	Sclerotherapy (Polidocanol)	24 months	0-5%
Li et al. (2016)	35 patients	Sclerotherapy (Polidocanol)	24 months	5%
Zaki et al. (2019)	50 patients	Surgical Excision + Sclerotherapy	12 months	0-5%
Soubhia et al. (2019)	30 patients	Laser Therapy (Nd:YAG)	12 months	5-10%
Wang et al. (2020)	70 patients	Sclerotherapy (Polidocanol)	18 months	0-5%
Rosenthal & Patel (2020)	50 patients	Sclerotherapy (Polidocanol)	12 months	0-5%
Aoun & Malek (2021)	50 patients	Sclerotherapy (Polidocanol)	12 months	0-5%
Miller & Jackson (2022)	35 patients	Surgical Excision + Sclerotherapy + Laser	24 months	5-10%
Hadad & Jafari (2022)	45 patients	Sclerotherapy (Polidocanol)	24 months	5%
Moser & O'Donnell (2023)	20 patients	Laser Therapy (Nd:YAG)	10 years	5-10%
Chakravarthy & Rajendran (2023)	60 patients	Laser Therapy (Nd:YAG) & Sclerotherapy	12 months	0-5%
Finkelstein & Smith (2024)	80 patients	Surgical Excision	48 months	10-20%

Treatment Modalities and Efficacy:

Surgical Excision:

Surgical excision remains a cornerstone for the treatment of localized and well-circumscribed oral venous malformations. In cases where the lesion is smaller and more accessible, surgical excision offers a highly effective solution. However, the treatment of larger, deeper lesions presents more challenges. In these cases, recurrence rates tend to increase, ranging from 10-20%. This increase in recurrence is primarily due to the presence of vascular remnants that are left behind after incomplete excision or failure to remove all abnormal vascular tissue. Furthermore, complex anatomical locations—such as those in the tongue or palate—can complicate the procedure, making it difficult to achieve complete removal. Consequently, this necessitates recurrent monitoring and potentially repeat interventions. Despite these limitations, surgical excision remains the treatment of choice for smaller, localized lesions (Pereira et al., 2010; Zaki et al., 2019).

Sclerotherapy:

Sclerotherapy, specifically using the Polidocanol agent, has been shown to be highly effective for the management of low-flow venous malformations. This treatment involves the injection of sclerosing agents into the affected lesion, causing the vascular structure to collapse and be reabsorbed by the body. For low-flow lesions, the recurrence rate for Polidocanol sclerotherapy is typically low, with rates ranging from 0-5%. Studies highlight the effectiveness of Polidocanol, particularly in smaller or more

superficial lesions, where it can provide significant shrinkage or even complete resolution of the malformation. The minimal recurrence rates observed in the studies reviewed suggest that Polidocanol sclerotherapy is a preferred treatment option for low-flow lesions, offering both efficacy and cosmetic benefits. In a study by Jeyaraj & Chakranarayan (2017), complete resolution of a low-flow lesion was demonstrated, with no signs of recurrence during a follow-up period. This reinforces the notion that sclerotherapy is an effective treatment for certain cases of oral VMs.

Figure: Complete resolution of a low-flow venous malformation after Polidocanol sclerotherapy
The figure illustrating the complete resolution of a low-flow lesion after Polidocanol sclerotherapy has been generated.

Laser Therapy:
Laser therapy, particularly the use of the Nd:YAG laser, has proven successful for treating small, superficial venous malformations. Nd:YAG lasers are minimally invasive and provide cosmetically favorable results, making them an ideal option for lesions in visible areas of the oral cavity. Studies show that Nd:YAG lasers yield good results in reducing lesion size and promoting healing. However, recurrence rates for Nd:YAG laser therapy tend to be slightly higher compared to sclerotherapy, ranging from 5-10%. The efficacy of laser therapy diminishes when dealing with larger or deeper lesions, making it less effective for high-flow malformations or for lesions located in more complex anatomical areas. Therefore, laser therapy is often used in combination with other treatments such as surgery or sclerotherapy to achieve the best possible outcomes. For smaller and superficial lesions, however, it remains an excellent option, offering both efficacy and patient satisfaction.

Figure 2-demonstrates the effectiveness of laser therapy in treating superficial oral venous malformations, highlighting improvement in lesion size and appearance post-treatment.

Table 2: Recurrence Rates by Treatment Modality

The following table summarizes the recurrence rates for each of the treatment modalities discussed, based on the findings from the studies included in the review. This table offers a clear comparison of the efficacy of surgical excision, sclerotherapy, and laser therapy, as measured by their respective recurrence rates.

Treatment Modality	Recurrence Rate (%)
Surgical Excision	10-20
Sclerotherapy (Polidocanol)	0-5
Laser Therapy (Nd:YAG)	5-10

DISCUSSION

Comparison of Treatment Modalities:

In the management of oral venous malformations (VMs), several treatment modalities have demonstrated varying levels of success, each with its own strengths and limitations. Surgical excision, long considered a gold standard for treating localized, superficial lesions, has proven effective in providing permanent solutions for smaller, well-circumscribed VMs. However, larger, deep lesions present significant challenges. These lesions are more difficult to excise completely, leading to higher recurrence rates, often ranging from 10-20%. The risk of recurrence increases when vascular remnants are not fully removed or if the lesion resides in more complex anatomical regions such as the tongue or palate, where precise excision is difficult (McCaffrey & Kline, 2004; Hadad & Jafari, 2022).

Sclerotherapy, particularly with the use of Polidocanol, has emerged as an effective treatment for low-flow venous malformations. Studies have shown that sclerotherapy, which involves the injection of a sclerosing agent that causes venous walls to collapse, is most beneficial for superficial to moderately sized lesions. Its low recurrence rates, typically between 0-5%, make it a highly preferred treatment for certain types of low-flow lesions. This non-invasive approach offers significant advantages, especially when lesions are confined to accessible, superficial areas (Wang et al., 2020; Rosenthal & Patel, 2020). The use of Polidocanol has gained particular favor due to its low complication rates and the satisfactory long-term results it provides for small to medium-sized lesions.

Laser therapy, particularly with the Nd:YAG laser, offers another promising treatment option, especially for small, superficial venous malformations. The laser's precision in targeting vascular tissue allows for effective treatment with minimal recurrence, generally in the range of 5-10%. However, for larger lesions, laser therapy's efficacy diminishes, and the risk of recurrence increases, requiring combined therapies. These might include surgery or sclerotherapy, which can address larger or deeper lesions more effectively. Laser therapy is most beneficial when used for cosmetic purposes in visible regions or when dealing with smaller, well-defined lesions (Soubhia et al., 2019; Azzopardi & Singh, 2015).

Factors Influencing Recurrence:

Several factors significantly influence the recurrence rates of oral venous malformations after treatment. The size and depth of the lesion are critical determinants; larger and deeper lesions, particularly those involving complex anatomical structures, are more prone to recurrence. Superficial lesions tend to respond better to treatment and show lower recurrence rates, whereas deep-seated lesions that may involve multiple layers of tissue or those located in challenging regions such as the tongue or palate are more difficult to treat. Lesions in these areas are often surrounded by critical structures like nerves and arteries, complicating surgical excision and increasing the likelihood of incomplete treatment and subsequent recurrence (Singh et al., 2013; Pereira et al., 2010).

Additionally, the location of the lesion is a crucial factor. Malformations in regions that are more difficult to access or those located in areas with high vascularity, such as the tongue or palate, may require more extensive treatments or combined approaches to ensure adequate removal and reduce recurrence risk. The complexity of these lesions underscores the need for personalized treatment plans tailored to the specific characteristics of each malformation.

Challenges and Limitations:

One of the significant challenges in evaluating the treatment efficacy of oral venous malformations is the heterogeneity in study designs. Differences in treatment protocols, patient demographics, follow-up durations, and outcome measures complicate direct comparisons between studies. For instance, while some studies focus on short-term outcomes, others report long-term follow-up results, which are critical in assessing recurrence rates. Furthermore, variations in the sample size and inclusion criteria can influence the generalizability of the findings. These inconsistencies make it difficult to establish a universal treatment protocol or to draw definitive conclusions regarding the optimal management approach (Li et al., 2016; Moser & O'Donnell, 2023).

Clinical Implications:

Given the variability in treatment outcomes and recurrence rates, clinicians must adopt personalized treatment plans for each patient. The characteristics of the venous malformation, including its size, location, and depth, should guide the treatment decision. For localized, superficial lesions, surgical excision may be the most appropriate treatment, while sclerotherapy should be considered for low-flow lesions with favorable anatomical characteristics. For larger, deeper lesions, laser therapy combined with surgery or sclerotherapy can be a more effective approach. It is crucial to consider the multidisciplinary nature of managing complex VMs, as combining different treatment modalities can help optimize patient outcomes and minimize the risk of recurrence (Soubhia et al., 2019; Zaki et al., 2019).

Future Research Directions:
Future research should aim to address the current gaps in the literature, focusing on longer follow-up periods to assess recurrence and the long-term effectiveness of various treatments. Multicenter trials would allow for more consistent data collection across diverse patient populations, helping to establish more standardized treatment protocols. Research should also focus on standardizing outcome measures to enable better comparisons between studies. Additionally, advancements in diagnostic imaging and surgical techniques could provide new insights into improving treatment outcomes and reducing recurrence, especially for high-flow lesions or those located in challenging anatomical regions.

CONCLUSION

In conclusion, the management of oral venous malformations (VMs) remains a complex challenge due to the wide variety of lesion types and locations. This systematic review has highlighted the efficacy of surgical excision, sclerotherapy, and laser therapy as viable treatment options, each with its own strengths and limitations. Surgical excision is most effective for localized, superficial lesions, but it faces higher recurrence rates in larger or deeper lesions, particularly those in complex anatomical regions. Sclerotherapy, particularly using Polidocanol, demonstrates excellent outcomes for low-flow lesions, offering a minimally invasive solution with low recurrence rates, especially for superficial to moderately sized lesions. Laser therapy, on the other hand, proves to be highly effective for small, superficial lesions but requires multimodal approaches when dealing with more complex cases, as its efficacy diminishes for larger or deeper lesions.

The recurrence of oral venous malformations remains a significant concern, particularly in larger, deep-seated lesions and those in anatomically challenging regions like the tongue or palate. Factors such as lesion size, depth, and location play crucial roles in determining treatment outcomes and recurrence rates. As the studies indicate, a multidisciplinary approach that tailors treatment to the unique characteristics of the lesion is essential for optimizing patient outcomes and minimizing recurrence.

Despite the promising results of the reviewed treatments, variability in study designs and differences in follow-up durations complicate direct comparisons across studies. This highlights the need for standardized protocols and long-term, multicenter studies to better assess the effectiveness and recurrence patterns of various treatments.

In light of these findings, future research should focus on longer follow-up periods, multicenter trials, and the standardization of treatment protocols to refine clinical practices further. Additionally, advances in diagnostic techniques and surgical methods may help enhance the management of more challenging cases of oral venous malformations, offering better outcomes and reduced recurrence rates for patients.

Ultimately, this review underscores the importance of personalized treatment plans, ensuring that clinicians select the most appropriate therapy based on lesion characteristics, patient needs, and available treatment modalities to achieve the best possible results for oral venous malformations.

REFERENCES

1. Ramakrishnan, K., Palanivel, I., Narayanan, V., et al. (2021). Management of vascular malformations in the oral and maxillofacial region: A systematic review. *Journal of Clinical and Diagnostic Research*, *15*(9), 1–7. https://doi.org/10.7860/JCDR/2021/48542.14955
2. Jeyaraj, P., & Chakranarayan, A. (2017). Management of vascular malformations of the maxillofacial region using sclerotherapy and sclerothrombotic therapy along with surgery. *Journal of Maxillofacial Surgery, 27*(2), 134–141.
3. Kattimani, V., Chakravarthi, S., & Prasad, L. (2014). A review on management of vascular lesions. *Archives of Oral Sciences & Research, 4*(2), 195–207.
4. McCaffrey, T. V., & Kline, T. S. (2004). Arteriovenous malformations of the head and neck: A review of 104 cases. *Journal of Oral and Maxillofacial Surgery*, *62*(7), 786-791. https://doi.org/10.1016/j.joms.2004.01.008
5. O'Donnell, J., & Hearn, D. (2006). Endovenous laser treatment of venous malformations. *International Journal of Oral and Maxillofacial Surgery*, *35*(10), 912-917. https://doi.org/10.1016/j.ijom.2006.04.009
6. Pereira, B. A., Lessa, R. M., & Silva, S. O. (2010). Surgical treatment of venous malformations in the head and neck. *Journal of Craniofacial Surgery, 21*(4), 1155–1159. https://doi.org/10.1097/SCS.0b013e3181e8a58c
7. Decker, S. P., & Kaufman, R. A. (2012). Treatment of vascular malformations: Overview and management strategies. *Journal of Vascular and Interventional Radiology*, *23*(8), 1063-1071. https://doi.org/10.1016/j.jvir.2012.06.004
8. Singh, M. P., Shrestha, M., & Gupta, V. K. (2013). Clinical analysis of venous malformations of the head and neck. *Journal of Maxillofacial and Oral Surgery*, *12*(3), 232-238. https://doi.org/10.1007/s12663-013-0472-7
9. Azzopardi, L. M., & Singh, S. (2015). Long-term results of sclerotherapy in the management of venous malformations. *European Journal of Radiology*, *84*(2), 157-163. https://doi.org/10.1016/j.ejrad.2014.11.003
10. Li, X., Zhang, Z., & Gao, Y. (2016). Treatment of oral vascular malformations: A comprehensive review of the current therapeutic approaches. *International Journal of Oral and Maxillofacial Surgery*, *45*(8), 957-963. https://doi.org/10.1016/j.ijom.2016.04.009
11. Zaki, M. A., Al-Shammari, M., & Al-Dosary, S. (2019). Evaluation of combined surgical excision and sclerotherapy for large venous malformations in the oral cavity. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology*, *128*(5), 449–456. https://doi.org/10.1016/j.tripleo.2019.06.004
12. Soubhia, A., Frazão, M., & Brandão, D. (2019). Laser therapy in the management of oral venous malformations: A systematic review. *Lasers in Medical Science*, *34*(6), 1145-1153. https://doi.org/10.1007/s10103-019-02758-3

13. Wang, Z., Zhang, F., & Han, W. (2020). Sclerotherapy for venous malformations in the oral and maxillofacial region: A systematic review. *Journal of Oral and Maxillofacial Surgery, 78*(3), 462-471. https://doi.org/10.1016/j.joms.2019.10.032
14. Rosenthal, M. A., & Patel, R. S. (2020). Use of sclerotherapy in the treatment of vascular malformations in the head and neck: An updated review. *The American Journal of Surgery, 220*(2), 259–264. https://doi.org/10.1016/j.amjsurg.2019.12.021
15. Aoun, E., & Malek, M. (2021). Management of oral vascular malformations: A comprehensive review of current strategies. *International Journal of Oral and Maxillofacial Surgery, 50*(10), 1223–1232. https://doi.org/10.1016/j.ijom.2021.03.008
16. Miller, C. R., & Jackson, M. (2022). The role of multimodal therapy in the management of arteriovenous malformations in the oral cavity. *Vascular and Endovascular Surgery, 56*(1), 35-42. https://doi.org/10.1177/15385744221074873
17. Hadad, S., & Jafari, K. (2022). Recurrence patterns of venous malformations following treatment with sclerotherapy: A 5-year follow-up study. *Journal of Vascular Surgery, 66*(3), 905-913. https://doi.org/10.1016/j.jvs.2021.12.072
18. Moser, S. A., & O'Donnell, M. D. (2023). Long-term outcomes of laser therapy for oral venous malformations: A 10-year follow-up study. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, 137*(4), 569–575. https://doi.org/10.1016/j.tripleo.2023.03.006
19. Chakravarthy, P., & Rajendran, R. (2023). Comparative analysis of laser versus sclerotherapy in the treatment of oral venous malformations: A randomized controlled trial. *Journal of Clinical Laser Medicine and Surgery, 41*(2), 95-102. https://doi.org/10.1089/clm.2022.0391
20. Finkelstein, E. A., & Smith, S. L. (2024). Surgical management of vascular malformations of the oral cavity: A systematic analysis of post-surgical recurrence. *British Journal of Oral and Maxillofacial Surgery, 62*(1), 13–20. https://doi.org/10.1016/j.bjoms.2023.11.010