REVIEW ARTICLE

Prosthetic Rehabilitation of Microstomia Patients: A Systematic Review of Published Case Reports and Case Series

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Abstract

Statement of problem: Prosthetic techniques commonly employed for the rehabilitation of edentulous patients might not be adequate in the treatment of patients with microstomia.

Purpose: The purpose of this paper is to systematically review all the prosthetic techniques that have been used in the oral rehabilitation of patients with microstomia.

Materials and methods: Data sources, including PubMed, Google Scholar, SCOPUS and Web of Science, were searched for case reports and case series published through September 2017. Three investigators reviewed and verified the extracted data. Only case reports and case series on prosthetic rehabilitation in microstomia patients published in the English language were considered eligible.

Results: A total of 212 records were identified from the database search. Forty duplicate records were removed. The remaining 172 articles were assessed for eligibility, and 139 articles were removed because they did not satisfy the inclusion criteria. A total of 34 cases (including 32 case reports and 1 case series) were finally included in the qualitative analysis. The review revealed the use of a modified impression technique with flexible and sectional trays to record impressions in patients with microstomia. Modified forms of oral prostheses ranging from sectional, flexible, collapsible and hinged dentures to implant-supported prosthesis were fabricated to overcome the limited mouth opening. The success of the prosthetic technique primarily depended on the extent of the microstomia and the nature of the cause of the microstomia.

Conclusion: Even though the patient acceptance of the prosthetic techniques summarized in the systematic review were high, long-term success rates for each option could not be assessed because of the short follow-up time in most of the included case reports and series.

Keywords: Dental implants, Microstomia, Rehabilitation, Scleroderma.

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Introduction

Prosthetic rehabilitation of a compromised oral status is a challenge. Our previous publication systematically reviewed prosthetic rehabilitation in oral submucous fibrosis patients, which is characterized by reduced mouth opening.[1] Microstomia is a condition in which patients manifest congenital or acquired reductions in the size of the oral aperture that is severe enough to compromise cosmesis, nutrition, and quality of life. Most microstomia cases are acquired, but congenital microstomia is not uncommon. Acquired microstomia is a leading post-surgical complication of the oral cavity.[2-4] Other common causes of acquired microstomia include perioral burns and connective tissue disorders, such as scleroderma.[5] Acquired microstomia cases due to connective tissue disorders are progressive in nature and lead to significant interference in day-to-day activities, such as speech, deglutition, and oral hygiene maintenance. Microstomia also complicates endotracheal intubation and increases the risk for aspiration. Prosthetic techniques commonly employed for the rehabilitation of edentulous patients might not be adequate in the treatment of patients with microstomia.

The ideal prosthetic technique for the treatment of edentulous patients with microstomia remains uncertain among practitioners. This systematic review assesses published case reports and case series on the various techniques and prostheses used in the oral rehabilitation of microstomia patients.

Materials and methods

Eligibility Criteria

Published case reports and case series reporting on prosthetic rehabilitation of microstomia patients were included in the

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present systematic review. Only cases with a reduction in the size of the oral aperture were included, and cases with reduced mouth opening with a normal oral aperture (e.g., oral submucous fibrosis, temporal-mandibular joint ankylosis, etc.) were excluded. Reviews, commentaries, clinical trials, basic research articles and letters to the editors were excluded from the present review.

Search Methods

Guidelines for the preferred reporting items for systematic reviews and meta-analyses statement (PRISMA) were strictly adhered to in this systematic review. A comprehensive search was performed in PubMed, Google Scholar, Scopus, and Web of Science from database inception through June 1, 2017. The following MeSH terms and keywords were used in different combinations for the search: microstomia, prosthetic dentistry, implant prosthodontics, removable prosthodontics, and prosthodontic rehabilitation. References and citations of the identified case reports and case series were searched manually for additional cases.

Data Extraction and Management

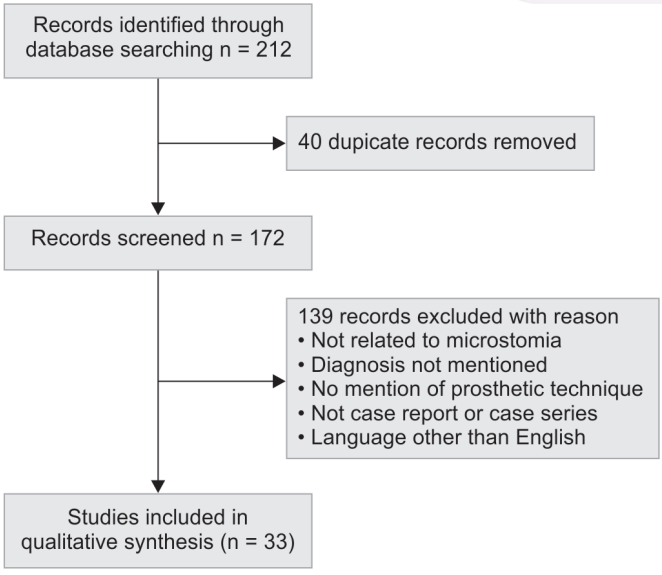
Extracted data from the included case reports consisted of the first author's name, year of publication, age, and gender of the patient, pre-prosthetic surgical and/or non-surgical interventions used, prosthetic technique and the prosthesis used, the clinical outcome and the follow-up period. Extracted data from the included case series consisted of the number of cases in addition to the aforementioned data.

Results

Search Strategy

The literature search revealed a total of 212 published articles (104 in PubMed and 101 in Google Scholar, 6 in Scopus and 1 in Web of Science). Forty duplicate articles were removed (172). The full texts of the remaining 172 articles were assessed for eligibility, and 139 articles were excluded due to the following reasons: not related to microstomia or did not mention any prosthetic technique/type of prosthesis, not a case report or a case series, or the article was not in English. Finally, 32 case reports and 1 case series reporting on a total of 34 cases were included.[2-34] Flowchart 1 illustrates a summary of the search strategy.

Flowchart 1: Summary of the search strategy



Reported Cases

Thirteen (38.2%) of the 34 reported microstomia cases were due to post-surgical complications,[2-4,9,12,17,18,23-26,28,34] and 14 (41.1%) cases were due to scleroderma/systemic sclerosis,[5,6,8,10,13-15,19-22,27,29,32]. Two cases of burn injuries,[7,11] and, one case each of Freeman-Sheldon syndrome,[30] muscular dystrophy,[31] and congenital maxillo-mandibular syngnathia,[33] and one case of coexisting systemic lupus erythematosus and scleroderma[16]. Twelve (35.29%) cases were male, and 22 (64.7%) cases were female. The mean age was 51.76 years, with the youngest patient being 12 days old,[33] and the oldest patient being 93 years old.[28] The minimal mouth opening which was reported was 4 mm,[33] and the maximum mouth opening was less than 35 mm.[12] The average mouth opening was calculated as 22.7 mm. Eight cases involved the use of pre-prosthetic surgical and/or non-surgical therapy to aid in the placement of the prosthesis.[2,6,10,30,33]

The most frequently used impression technique was the sectional impression tray [8 (23.5%) cases],[5,12,14,22,23,27,31,32] followed by flexible, folded, and semi-rigid impression tray [4 (11.7%) cases].[3,7,12,19] Other impression techniques included the use of a plasticized intermediary liner to make the impression [1 (2.9%) case][25] and recording of the impression via manually dispensing a putty-type impression material intra-orally [1 (2.9%) case].[17] The most frequently used prostheses, included sectional, collapsed, flexible and folded dentures [14 (41.1%) cases],[5,11,13,14,16,18,19,20-22,24,28,29,32] followed by implant-supported prosthesis [5 (14.7%) cases].[6,8,17,23,26] Other forms of prosthesis included a hinged prosthesis with swing lock [1 (2.9%) case],[31] resin-bonded bridge work [1 (2.9%) case],[27] complete denture with minimal inter-occlusal space [1(2.9%) case][10] and a cast iron-platinum magnetic attachment system to the prosthesis [1 (2.9%) case].[13] Prostheses that were fabricated to increase or maintain mouth opening included an intra-oral splint [1 (2.9%) case],[7] custom dynamic commissure retractor [1 (2.9%) case][30] and a dynamic opening device that consisted of an extraoral framework attached to intraoral maxillary and mandibular base plates [1 (2.9%) case].[9] Buller et al.[15] fabricated a metal appliance with a large ring (for finger grip) to aid in the easy removal of the removable partial denture clasp from the teeth [1 (2.9%) case]. Kam et al.[16] fabricated a set of modified tweezers and magnets to aid in the insertion and removal of the removable partial denture [1 (2.9%) case]. Cases with defects involving intra- and extra-oral structures used interconnected intra- and extra-oral prosthesis to obtain optimal retention and function [3 (8.8%) cases].[4,25,34] Distraction osteogenesis was performed using internal distractors for the case of congenital maxillo-mandibular syngnathia [1 (2.9%) case].[33]

The shortest follow-up period was 1 week,[4] and the longest follow-up period was 8 years.[9] The mean follow-up period was 17.54 months (excluding the 13 cases that did not mention the exact follow-up period).

Most cases reported that the patient adapted well to the prosthesis with no major complications. Hajimahmoudi et al.[32] observed a minor ulcer on the patient's mandibular mucosal ridge

Table 1: Summary of data collected from case reports and case series on prosthetic rehabilitation in microstomia patients.

S. No	*Author (year)*	*No. of patients (Age in years/ gender)*	*Mouth opening before treatment*	*Reason for microstomia*	*Surgery/ adjunct therapy*	*Prosthetic treatment*	*Recall and follow-up*
1	Jensen et al.[6] (1990)	1 (39/M)	20 mm	Systemic sclerosis	Cheek and mouth stretching exercises.	Implant supported bridge	24 months follow-up did not reveal any complications
2	MacMillan et al.[7] (1991)	1 (21/F)	15 mm	Burn injuries	Nil	Flexible impression tray followed by the fabrication of an intra-oral splint	At 3-month follow-up, the patient had a mouth opening of 38 mm
3	Langer et al.[8] (1992)	1 (54/F)	28 mm	Scleroderma	Nil	Implant supported overdentures	Not available
4	Brunello et al.[9] (1995)	1 (74/M)	15 mm	Post-surgical complication	Nil	A dynamic opening device consisting of extra-oral steel framework attached to intra-oral maxillary and mandibular base plates	8 years follow-up revealed no complications
5	Cheng et al.[3] (2000)	1 (78/F)	22 mm	Post-Surgical complication	Nil	Semi-rigid impression tray followed by traditional complete denture fabrication	Not available
6	Fischer et al.[10] (2000)	2 1st case-(20/M)	21 mm	Scleroderma	Oral augmentation exercises	No treatment planned for the edentulous area	Lost to follow-up
		2nd case-(49/F)	25 mm	Scleroderma	Nil	Complete dentures fabricated with minimal inter-occlusal space	6 months follow-up revealed no complications
7	Suzuki et al.[11] (2000)	1 (65/M)	33 mm	Peri-oral burn scar	Nil	Sectional collapsed denture	3-year follow-up showed that the patient was satisfied with the prosthesis
8	Cheng et al.[12] (2001)	1 (68/M)	Less than 35 mm	Post-Surgical complication	Nil	Sectional altered cast impression maxillary tray and semi-rigid mandibular impression tray were used to fabricate the intra-oral prosthesis	Not available
9	Watanabe et al.[13] (2002)	1 (67/F)	32 mm	Scleroderma	Nil	Cast iron-platinum magnetic attachment system applied to sectional collapsed complete dentures	2-year follow-up did not reveal any complications.
10	Cura et al.[14] (2003)	1 (48/F)	25-30 mm	Scleroderma	Nil	Sectional impression tray followed by fabrication of folding maxillary complete denture	18-month follow-up showed that the patient was satisfied with the prosthesis
11	Buller et al.[15] (2005)	1 (35/F)	25 mm	Scleroderma	Nil	A metal appliance with a large ring for the finger was fabricated to ease the removal of the RPD's clasp from the teeth	4-year follow-up revealed no complication

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S. No	Author (year)	No. of patients (Age in years/ gender)	Mouth opening before treatment	Reason for microstomia	Surgery/ adjunct therapy	Prosthetic treatment	Recall and follow-up
12	Kam et al.[16] (2006)	1 (28/F)	20 mm	Systemic lupus erythematous with Scleroderma	Nil	Sectional RPD was fabricated along with a set of modified tweezers and magnets to aid in its insertion and removal	Regular recalls were made. No other information is available
13	Cheng et al.[17] (2006)	1 (71/F)	Less than 28 mm	Post-surgical complication	Nil	Impressions were taken by manually dispensing putty-type impression material intra-orally followed by fabrication of implant-supported overdentures	Follow up scheduled after 6 months. No additional information is available
14	Geckili et al.[18] (2006)	1 (71/M)	20-25 mm complication	Post-surgical complication	Nil	2 piece denture consisting of a smaller anterior and a larger, hinged, collapsible posterior piece	Patient has been using the prosthesis for 15 months. No additional information is available
15	Samet et al.[19] (2007)	1 (58/F)	14 mm	Systemic sclerosis	Nil	Folded custom impression tray followed by fabrication of Valplast flexible RPD	Long-term follow-up did not reveal any complications
16	Jivanescu et al.[20] (2007)	1 (50/F)	18 mm	Scleroderma	Nil	Flexible maxillary complete denture	The patient was recalled after 6 months to incorporate a metal frame into the prosthesis, but it was not possible as the scleroderma worsened the mouth opening
17	Dikbas et al.[21] (2007)	1 (58/F)	34 mm	Scleroderma	Nil	Collapsible and sectional maxillary and sectional mandibular complete dentures	2-month follow-up showed that the patient was satisfied with the prosthesis
18	Colvenkar SS[22] (2009)	1 (65/F)	20-25 mm	Scleroderma	Nil	Sectional Impression Tray and Sectional Denture	Follow-up revealed no complications
19	Cheng et al.[23] (2008)	1 (75/M)	19 mm	Post-surgical complication	Nil	Sectional impression followed by Implant supported prosthesis	1-year follow-up did not reveal any complications
20	Givan et al.[24] (2009)	1 (63/M)	20 mm	Post-surgical complication	Nil	Folding maxillary removable complete denture with a custom palatal hinge	Regular follow-up revealed no complication
21	Bidra et al.[25] (2010)	1 (77/F)	33 mm	Post-surgical complication	Nil	The plasticized intermediary liner was used to make the impression followed by fabrication of a combined intra- and extra-oral prosthesis	1 year follow up revealed no complications
22	Bilhan et al.[26] (2011)	1 (24/F)	20-25 mm	Post-surgical complication	Nil	5 dental implants and fixed hybrid prosthesis in the maxilla and 2 implants supporting an overdenture in the mandible.	At 1-year follow-up, there were no complications with the prosthesis.
23	Garg et al.[4] (2011)	1 (45/F)	20 mm	Post-surgical complication Patient underwent partial maxillectomy	Nil	Dual impression technique followed by the fabrication of acrylic denture with obturator for the maxillary defect	Follow-up after 1 week revealed that the patient was comfortable eating and speaking

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S. No	Author (year)	No. of patients (Age in years/ gender)	Mouth opening before treatment	Reason for microstomia	Surgery/ adjunct therapy	Prosthetic treatment	Recall and follow-up
24	McKenna et al.[27] (2012)	1 19 mm	Nil	Sectional impression followed by fabrication of resin-bonded bridgework	6-month follow-up did not reveal any complications	(48/F)	Scleroderma
25	Egan et al.[28] (2012)	1 (93/F)	30 mm	Post-surgical complication	Nil	Maxillary and mandibular denture base made from a flexible amine-free resin	6-month follow-up indicated no complications
26	Kirchheimer et al.[2] (2012)	1 (23/M)	5 mm	Post-surgical complication	TMJ reconstruction surgery	Alloplastic joint	At follow-up, after 2 years the patient had a mouth opening of 35 mm
27	Singh et al.[29] (2013)	1 (55/F)	23 mm	Scleroderma	Nil	Collapsible Hybrid Acrylic Resin and Permanent Silicone Soft Liner Complete Denture	A 2-year follow-up showed that the patient was satisfied with the prosthesis
28	Sadrimanesh et al.[30] (2013)	1 (17/F)	20 mm	Freeman-Sheldon Syndrome	Surgery increased mouth opening to [37] mm	5 days post-surgery impression was taken and a custom dynamic commissure retractor was fabricated	The patient used the prosthesis 6 months following which she underwent further corrective surgeries
29	Rathi et al.[31] (2013)	1 (32/M)	25 mm	Muscular dystrophy	Nil	Sectional impression technique followed by the fabrication of the hinged mandibular complete dental prosthesis with swing lock	Not available
30	Hajimahmoudi et al.[32] (2014)	1 (68/M)	30 mm	Scleroderma	Nil	Sectional custom tray followed by fabrication of sectional dentures	The first review revealed minor ulceration in the mandibular ridge mucosa. A corresponding relief was placed on the prosthesis and the subsequent follow-up did not reveal any complications.
31	Turk et al.[5] (2014)	1 (56/F)	23 mm	Scleroderma	Nil	Sectional impression tray and a collapsed partial denture using a hinge attachment	Follow-up after 4 months showed that the patient was satisfied and adapted well to the prosthesis
32	Konas et al.[33] (2015)	1 (12-day-old/F)	4 mm	Congenital maxillo-mandibular Syngnathia	Osteotomies Distraction osteogenesis	Internal distractors	Postoperative visit after 1 month revealed a sufficient oral aperture
33	Singh et al.[34] (2015)	1 (65/M)	23 mm	Post-Surgical complication	Nil	Combine intra- and extra-oral prosthesis. Permanent silicone soft liner open-hollow bulb obturator	Follow up visits did not reveal any complications

on follow up, and a 'g' relief was included in the corresponding area of the prosthesis. The patient did not reveal any other ulcerations on further follow-up. Jivanescu et al.[20] reported a case wherein a metal frame was to be incorporated into the fabricated prosthesis, but it was not possible because of the rapid progression of scleroderma, which resulted in severe microstomia. Table 1 shows the selected characteristics of the included case reports and case series.

Discussion

Microstomia is a significant limiting factor in the provision of satisfactory oral prosthesis. The overall mouth opening in most edentulous microstomia cases falls well short of the smallest diameter of the conventional prosthesis. These cases demand the use of innovative prosthetic appliances. The lack of mouth opening also complicates any pre-prosthetic preparations, especially the recording of impressions. Therefore, most clinicians use a combination of innovative impression techniques followed by fabrication of a modified version of a conventional prosthesis or a specialized prosthesis customized to the patient. Few studies used pre-prosthetic surgical and/or non-surgical approaches to provide adequate mouth opening and enable insertion of the prosthesis.[6,10,30,33] Surgical approaches may provide rapid results,[30] but the post-surgical complications, especially post-surgical fibrosis, may result in further limitations of mouth opening.

Several causes exist for microstomia, but most microstomia cases in the included studies were due to post-surgical com plications,[2-4,9,12,17,18,23-26,28,34] and scleroderma/systemic scler osis.[5,6,8,10,13-15,19-22,27,29,32] Other less common reasons include congenital maxilla-facial syngnathia,[9] muscular dystrophy,[31] burn injuries,[7,11] Freeman-Sheldon syndrome[30] and one case of coexisting systemic lupus erythematosus and scleroderma[16] The various techniques and appliances used for the prosthetic rehabilitation of microstomia patients are described below.

Impression Technique

Limited mouth opening results in a restricted path of insertion and removal of traditional impression trays in microstomia patients. Modifications of the impression trays are attempted to bypass the rigidity of the tongue and reduced aperture of the mouth. The impression tray in these cases can be sectioned,[5,12,14,22,23,27,31] or fabricated from a flexible material.[3,7,12,19] The impression techniques employed point to a range of innovative methodologies in the modification of the tray to facilitate insertion and removal or using flexible impression materials to eliminate the use of trays. However, the complexity of the design process for each individual technique might be a deterrent in reproducing the same technique in a different setting and clinical scenario. Modification of plastic[35] or metal stock trays[36-38] seems comparatively less arduous to perform than the complex designs attempted for with customized trays fabricated from the auto-polymerizing resin.[39-41] However, the customized approach might adapt better to a particular clinical situation. Nevertheless, the current absence of evidence on the repeatability and reproducibility of a single technique (or it's modifications) leads to a fragmented clinical evidence base, mostly based on individual studies. General advantages or disadvantages to any of the mentioned impression techniques could not be summarized from the available evidence. However, the selection of a technique demands consideration of specifics, including the severity of microstomia and the type of prosthesis required for the patient.

Denture Fabrication

The fabrication of dentures in a microstomia patient is complicated because of the limited oral aperture, the constriction of the alveolar ridges and the limitations of border extensions. These conditions demand the use of sectional/collapsible/folded dentures or dentures made of a flexible material to enable optimal insertion and removal of the prosthesis dentures.[5,11,13,14,16,18-22,32] The sectional custom trays in most cases were fabricated using auto-polymerizing acrylic resin. The custom trays were fabricated into two sections that were held together at the midline with locking mechanisms ranging from swing-locks to simple hinge attachments. The folded dentures were sectioned similar to sectional dentures, and the two sections were united using flexible silicone rubber. Flexible dentures used flexible materials, such as valplast, to enable its easy insertion and removal. The reduced ability of patients with a diminished mouth opening to maintain oral hygiene may put these patients at additional risk for infections, especially when maintaining a prosthesis which demands additional care. Reducing the complexity of the prosthesis design and introducing interventional oral hygiene maintenance programs[42] may contribute to the longevity and success of any prosthesis designed to rehabilitate a patient with microstomia.

Intra and Extraoral Prosthesis

Surgeons often excise part of the maxillofacial complex to ensure disease-free surgical margins. The extra-oral prosthesis in these cases is fabricated with the intraoral prosthesis, and it is often inter-connected to ensure optimal retention and function.[4,25,34] Retention for prosthesis can be obtained either from the remaining teeth[43] or from adjacent bony structures.[44] The immediate restoration of the dentition and accessibility for future monitoring are advantages of obturating a defect with a prosthesis when compared to surgical reconstruction.[45] However, inadequate seal and stability of the prosthesis might lead to a lower quality of life in patients requiring extensive rehabilitation.[46,47] The extent of the palatal defect is a prime consideration in the decision of planning a prosthetic or a surgical reconstruction as described by Okay et al.[48]

Implants

Implant-supported prosthesis played a major role in the prosthetic rehabilitation of microstomia patients.[6,8,17,23,26] The general considerations for implant placement, including assessment of the patient's gnathic bone density and height, and an adequate mouth opening is required for the placement of an implant-based prosthesis. Even though conventional impression procedures have been employed in the fabrication of implant-supported prostheses in microstomia patients,[49,50] challenges should be expected in areas like transfer of implant components during the procedure. Components of an implant-supported prosthesis should have an accurate fit to avoid post-insertion complications. Impression techniques, particularly the transfer of components has been found to have a definitive influence on the accuracy of multi-unit implant prostheses.[51] Recent techniques advocated to minimize the issues in transferring implant components could be considered to transgress this problem.[52] Pre-prosthetic surgical and/or nonsurgical approaches are used to increase mouth opening and enable implant placement in cases with severe microstomia.

Surgical Approach

Commissuroplasty is often used to increase mouth opening in microstomia cases.[30] Surgery provides immediate results, but there

are significant long-term adverse effects, including post-surgical fibrosis. Fibrosis resulting from commissuroplasty may result in further constriction of the oral aperture.

Non-surgical Approach

These approaches include the use of mouth opening exercises, medications, and prosthetic devices to improve mouth opening. Several mouth opening exercises are used in microstomia patients, including forceful opening and closing of the mouth.[6,10] The latter approach may cause trauma to the oral cavity that results in fibrosis and further restricts mouth opening.

Distraction Osteogenesis

This technique is a common method for bone regeneration in cases of congenital and acquired hypoplasia of the gnathic bones. Hypoplasia of gnathic bones may result in microstomia, and the use of distraction osteogenesis enables enlargement of the skeletal tissues in the hypoplastic areas within a relatively short period. Cases of congenital maxillo-mandibular syngnathia exhibit severe microstomia. These cases are managed using distraction osteogenesis wherein an internal distractor is placed following the separation of the fused bones to prevent relapse and ensure the achievement of adequate distraction.[33]

Conclusion

The follow-up data of the included case reports and case series demonstrate that all of the mentioned prosthetic techniques and prostheses produced the adequate patient adaptation with no major complications. Most prostheses mentioned in the systematic review revealed good short-term results, but the progressive nature of chronic fibrosing lesions, such as scleroderma, may reduce their long-term success rates. The sustenance of a prosthetic device depends on the prosthetic technique used and the etiological factor (i.e., disease course) that caused the microstomia. Reducing the complexity of prosthesis design and continued support and instructions on maintenance of the prosthesis might significantly contribute to the longevity of the prosthesis. The authors conclude that any one of the prosthetic techniques/prosthesis mentioned in this systematic review may be adopted by the clinician for the prosthetic rehabilitation of microstomia patients by assessing the prosthetic needs of the patient and the severity of the microstomia.

References

1. Patil S, Sarode SC, Sarode GS, Bhandi S, Awan KH, Ferrari M. Prosthetic rehabilitation of oral submucous fibrosis patients: a systematic review of published case reports and case series. PLOS ONE 2017;12:e0184041.
2. Kirchheimer S, Sainuddin S, Bojanic S, Saeed NR. Simultaneous custom-made replacement of the temporomandibular joint and cranioplasty. Br J Oral Maxillofac Surg 2013;51:e70-e71.
3. Cheng AC, Wee AG, Shiu-Yin C, Tat-Keung L. Prosthodontic management of limited oral access after ablative tumor surgery: a clinical report. J Prosthet Dent 2000;84:269-273.
4. Garg SK, Bansal S, Shireen RK. Microstomia in a maxillectomy patient: a prosthetic challenge. Contemp Clin Dent 2011;2:34-36.
5. GözdeTürk AG, Ulusoy M. A collapsible partial denture for a patient with limited mouth opening induced by scleroderma: a clinical report. J Prosthodont 2015;24:334-338.
6. Jensen J, Pedersen SS. Osseointegrated implants for prosthetic reconstruction in a patient with scleroderma: report of a case. J Oral Maxillofac Surg 1990;46:739-741.
7. MacMillan ARG, Oliver AJ, Richardson L, Reade PC. An intraoral splint for the prevention of microstomia from facial burns. Burns 1991;17:72-74.
8. Langer Y, Cardash HS, Tal H. Use of dental implants in the treatment of patients with scleroderma: a clinical report. J Prosthet Dent 1992;68:873-875.
9. Brunello DL, Mandikos MN. The use of a dynamic opening device in the treatment of radiation induced trismus. Aust Prosthodont J 1995;9:45-48.
10. Fischer DJ, Patton LL. Scleroderma: oral manifestations and treatment challenges. Spec Care Dentist 2000;20:240-244.
11. Suzuki Y, Abe M, Hosoi T, Kurtz KS. Sectional collapsed denture for a partially edentulous patient with microstomia: a clinical report. J Prosthet Dent 2000;84:256-259.
12. Cheng AC, Wee AG, Tat-Keung L. Maxillofacial prosthetic rehabilitation of a midfacial defect complicated by microstomia: a clinical report. J Prosthet Dent 2001;85:432-437.
13. Watanabe I, Tanaka Y, Ohkubo C, Miller AW. Application of cast magnetic attachments to sectional complete dentures for a patient with microstomia: a clinical report. J Prosthet Dent 2002;88:573-577.
14. Cura C, Cotert HS, User A. Fabrication of a sectional impression tray and sectional complete denture for a patient with microstomia and trismus: a clinical report. J Prosthet Dent 2003;89:540-543.
15. Sharon-Buller AS, Sela M. Development of a device for removing a partial denture in a patient with scleroderma. Spec Care Dentist 2005;25:234-235.
16. Kam AYL, Chung WC, Luk WK. Oral rehabilitation of a patient with scleroderma associated with systematic lupus erythematosus: a case report. Spec Care Dentist 2006;26:121-123.
17. Cheng AC, Kwok-Seng L, Wee AG, Tee-Khin N. Prosthodontic management of edentulous patient with limited oral access using implant-supported prostheses: a clinical report. J Prosthet Dent 2006;96:1-6.
18. Geckili O, Cilingir A, Bilgin T. Impression procedures and construction of a sectional denture for a patient with microstomia: a clinical report. J Prosthet Dent 2006;96:387-390.
19. Samet N, Tau S, Findler M, Susarla SM, Findler M. Flexible, removable partial denture for a patient with systemic sclerosis (scleroderma) and microstomia: a clinical report and a three-year follow-up. Gen Dent 2007;55:548-551.
20. Jivanescu A, Bratu D, Negrutiu M. Prosthetic rehabilitation of a patient with scleroderma- induced microstomia. Int Poster J Dent Oral Med 2007;9:382.
21. Dikbasl, Koksal T, Kazazoglu E. Fabricating sectional-collapsible complete dentures for an edentulous patient with microstomia induced by scleroderma. Quintessence Int 2007;38:15-22.
22. Colvenkar SS. Sectional impression tray and sectional denture for a microstomia patient. J Prosthodont 2010;19:161-165.
23. Cheng AC, Koticha TN, Tee-Khin N, Wee AG. Prosthodontic management of an irradiated maxillectomy patient with severe trismus using implant-supported prostheses: a clinical report. J Prosthet Dent 2008;99:344-350.
24. Givan DA, AuClair WA, Seidenfaden JC, Paiva J. Sectional impressions and simplified folding complete denture for severe microstomia. J Prosthodont 2010;19:299-302.
25. Bidra AS, Montgomery PC, Jacob RF. Maxillofacial rehabilitation of a Microstomic patient after resection of nose, lip, and maxilla. J Oral Maxillofac Surg 2010;68:2513-2519.
26. Bilhan H, Geckili O, Atalay B, Arat S. Oral rehabilitation following removal of a rhabdomyosarcoma and subsequent microstomia: a case report. J Oral Implantol 2011;37:353-360.
27. McKenna G, Hayes M, Burke FM. Provision of resin bonded bridgework for a patient with microstomia secondary to scleroderma. Eur J Prosthodont Rest Dent 2012;20:56-60.
28. Egan JG, Swindells SA. A novel prosthodontic alternative for patients who are edentulous and have microstomia: a case report. Spec Care Dentist 2012;32:160-164.
29. Singh K, Gupta N, Gupta R, Abrahm D. Prosthetic rehabilitation with collapsible hybrid acrylic resin and permanent silicone soft liner complete denture of a patient with scleroderma-induced microstomia. J Prosthodont 2014;23:412-416.
30. Sadrimanesh R, Hassani A, Vahdati SA, Chaghari H, Sadr-Eshkevari P, Rashad A. Freeman-Sheldon syndrome: combined surgical and non-surgical approach. J Craniomaxillofac Surg 2013;41:397-402.

31. Rathi N, Heshmati R, Yilmaz B, Wilson W. A technique for fabricating a hinged mandibular complete dental prosthesis with swing lock for a patient with microstomia. The Journal of Prosthetic Dentistry 2013;110:540-543.
32. Hajimahmoudi M, Mostafavi AS. A simple and effective method for prosthetic rehabilitation in scleroderma patients: a clinical report. Int J Prosthodont 2014;27:169-173.
33. Konaş E, Aliyev A, Tunçbilek G. Congenital maxillomandibular Syngnathia: a new management technique using distraction techniques. J Craniofac Surg 2015;26:e68–e70.
34. Singh K, Kumar N, Gupta N, Sikka R. Modification of existed prosthesis into a flexible wall hollow bulb obturator by permanent silicone soft liner for a hemimaxillectomy patient with restricted mouth opening. Prosthodont Res 2015;59:205-209.
35. Luebke RJ. Sectional impression tray for patients with constricted oral opening. J Prosthet Dent 1984; 52:135-137.
36. Benetti R, Zupi A, Toffanin A. Prosthetic rehabilitation for a patient with microstomia: A clinical report. J Prosthet Dent 2004;92:322-327.
37. Dhanasomboon S, Kiatsiriroj K. Impression procedure for a progressive sclerosis patient- A clinical report. J Prosthet Dent 2000;83: 279-282.
38. Ohkubo C, Ohkubo C, Hosoi T, Kurtz KS. A sectional stock tray system for making impression. J Prosthet Dent 2003; 90:201-204.
39. Baker P, Brandt R, Boyajian G. Impression procedure for patients with severely limited mouth opening J Prosthet Dent 2000;84:241-244.
40. Mirfazaelian A. Use of orthodontic expansion screw in fabricating section custom trays. J Prosthet Dent 2000;83:474-475.
41. Fernandes A, Mascarenhas K, Aras MA. Custom sectional impression trays with interlocking type handle for microstomia patients. Indian J Dent Res 2009;20:370-373.
42. Poole J, Conte C, Brewer C, Good CC, Perella D, Rossie KM, et al. Oral hygiene in scleroderma: The effectiveness of a multi-disciplinary intervention program. Disabil Rehabil 2010;32:379-384.
43. Parr GR, Tharp GE, Rahn AO. Prosthodontic principles in the framework design of maxillary obturator prostheses. J Prosthet Dent 1989;62:205-212.
44. Eckert SE, Carr AB. Implant-retained maxillary overdentures. Dent Clin North Am 2004; 48:585-601.
45. Iyer S, Thankappan K. Maxillary reconstruction: Current concepts and controversies Indian J Plast Surg 2014;47:8-19.
46. Kornblith AB, Zlotolow IM, Gooen J, Huryn JM, Lerner T, Strong EW, et al. Quality of life of maxillectomy patients using an obturator prosthesis. Head Neck 1996;18:323-34.
47. Rogers SN, Lowe D, McNally D, Brown JS, Vaughan ED. Health-related quality of life after maxillectomy: a comparison between prosthetic obturation and free flap. J Oral Maxillofac Surg 2003;61:174-181.
48. Okay DJ, Genden E, Buchbinder D, Urken M. Prosthodontic guidelines for surgical reconstruction of the maxilla: a classification system of defects. J Prosthet Dent 2001;86:352-363.
49. Muller F, Bergendal B, Wahlmann U, Wagner W. Implant-supported fixed dental prostheses in an edentulous patient with dystrophic epidermolysis bullosa. Int J Prosthodont 2010;23:42-48.
50. Patel K, Welfare R, Coonar HS. The provision of dental implants and a fixed prosthesis in the treatment of a patient with scleroderma: a clinical report. J Prosthet Dent 1998;79:611-612.
51. Baig MR. Multi-unit implant impression accuracy: A review of the literature. Quintessence Int 2014;45:39-51.
52. Uludag B, Polat S, Sahin V, Tokar E, Ertug O. A simplified technique for solving the transfer problem of implant supported fixed partial denture for patients with microstomia. J Oral Implantol 2013;39:169-171.