依 頼 論 文　◆企画：第 126 回学術大会／海外特別講演

Implant therapy in the geriatric patient

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Frauke Müller 先生について

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昨年春に横浜で開催された日本補綴歯科学会第 126 回学術大会の海外招待講演者として Frauke Müller 先生が招聘され，該博な知識と明晰な論理展開に裏打ちされた講演により，本学会会員に多大な感銘を与えたことは皆様の記憶に新しいところと存じます．大久保大会長よりご指名いただき，講演の座長を務めさせていただいたことは，彼女と長年友誼を交わして来た私にとってたいへん嬉しいことでした．そして今回，超多忙にも関わらず，その講演の要旨を日本補綴歯科学会誌に寄稿していただくことができましたので，改めて Frauke Müller 先生についてご紹介させていただきます．

Frauke Müller 先生は，ドイツのキールの出身で，ボン大学歯学部を卒業し，同大学で Doctor degree を取得しました．その後，マインツ大学の歯科補綴学講座に移って研鑽を積み，1988 年と 1993-1994 年の二度にわたって英国の London Hospital Medical College に留学，1996 年にはドイツ語圏の教授資格である Habilitation を取得しました．そして，2003 年にスイスのジュネーヴ大学歯学部の高齢者歯科学・可撤性歯科補綴学分野の教授に就任し，今日に至っています．

Frauke Müller 先生の国際的な活躍は，日本でも多くの研究者に認知されているところですが，主な役職をご紹介しますと，まず高齢者歯科学の領域では，European College of Gerodontology (ECG) ならびに IADR の Geriatric Oral Research Group (GORG) の大会長，Swiss Society for Gerodontology and Special Care Dentistry の会長（2010-2016 年）を務めました．また歯科インプラント学の分野では，ITI Board of Directors のメンバーであり，ITI Treatment Guide の中で高齢者へのインプラント治療の章を担当しています．先生がこれまで発表した査読付き学術論文は 140 編，著書は 20 冊を数え，招待講演は 400 回以上に及んでいます．2013 年には，高齢者歯科学分野での功績により，The IADR Distinguished Scientist Award in Geriatric Oral Research を受賞し，この分野での世界の第一人者であることは今さら贅言を要しません．

Frauke Müller 先生の研究の専門性は，歯科補綴学の基盤の上に，顎口腔機能学や臨床疫学の手法を応用したものです．高齢者の口腔機能，生きがい，栄養などの問題を客観的に評価し，補綴的介入の効果を多角的に分析するという点で，わが国の歯科補綴学と非常に通じるところがあります．

学会で先生と会うたびに，研究についてディスカッションができることが，私にとっても何よりの楽しみです．また，先生のジュネーヴでのスタッフであった Martin Schimmel 先生は，スイスのベルン大学高齢者歯科学の教授となり，近年ジュネーヴとベルンのネットワークによって次々発表される高齢者の咀嚼機能や補綴治療効果に関するすぐれた論文は，われわれ日本の研究者を大いに刺激してくれています．

口腔機能による高齢者の健康と生きがいの維持・回復は世界的な課題であり，欧州に Frauke Müller 先生という理解しあえるリーダーがいることは，われわれにとってたいへん心強いことだと思われます．今後もわが国と欧州の歯科補綴学・高齢者歯科学分野が双方向に交流し切磋琢磨することで，広く世界に貢献することを念じて止みません．

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Frauke Müller was born in Kiel, Germany and studied dentistry in Bonn, where she received her Dental and Doctorate Degree. Until 2003, she worked at the Department of Prosthetic Dentistry of the University of Mainz, Germany where she received her habilitation (PD). She spend several years at the London Hospital Medical College, England. Professor Müller is Past-President of the ECG (European College of Gerodontology), the GORG of IADR (Geriatric Oral Research Group) and the Swiss Society for Gerodontology and Special Care Dentistry (SSGS). Since 2017 she is President of the Prosthodontic Research Group of the IADR. She is member of the ITI Board of Directors (International Team for Implantology) and author of the ITI Treatment Guide no 9 on "Implant therapy in the Geriatric Patient". Frauke Müller is Associate Editor of Gerodontology and edited the textbook "Oral Healthcare and The Frail Elder". In 2013 she was awarded the IADR Distinguished Scientist Award in Geriatric Oral Research. Her research activity is mainly related to gerodontology, oral function as well as complete and implant prosthodontics.

ABSTRACT
When tooth loss occurs later in life, ageing and multimorbidity impact dental treatment decisions. There is sufficient evidence to state that the mandibular implant overdenture is a well-established treatment modality, certainly in non-dependent edentulous individuals, but little is known on the very old and geriatric edentulous patients. They often present unfavourable anatomical conditions, xerostomia and a lack muscle control. Although the benefits of dental implants are well documented, elderly adults are often reluctant to agree to an implant insertion, even if cost is removed as limiting factor. The main reasons for implant refusal are the fear of surgery and pain. The present paper describes the use of minimal-invasive and simple treatment concepts for elderly, edentulous patients. It further highlights possible complications, which may arise with the onset of dependency and/or frailty and advises further simplification of the implant-restorations when needed. Recall and maintenance in this group of patients is crucial to assure the patients' benefit from the intervention until late in life.

Key words:
Geriatric dentistry, Dental implants, Implant-overdenture

Recent developments – the "new" edentulous patient

Recent developments indicate an increasing life expectancy and tooth loss occurring later in life [1,2]. So what will future "edentulous cases" look like? Physiological aging is not the only characteristic of late life; cognitive impairment, frailty and multiple chronic diseases, as well as the side effects of the related medications, also become common [3,4]. Very old and fragile edentulous patients will often present a considerable challenge to the clinician, as the anatomical conditions are likely to be poor for gaining denture retention and stability, and muscle control will have likewise deteriorated. Side effects from the treatment of chronic conditions such as xerostomia or sensitive mucosa can further affect oral comfort and challenge denture wearing. Beyond the challenges of wearing a denture, clinical procedures can also be more difficult, for example when reduced mobility requires treating the patient in non-ideal positions or cognitively impaired patients are unable to cooperate in certain treatment steps such as taking the jaw relation [5]. Thus before beginning long and invasive treatments, the patient's physical tolerance should be investigated to determine the acceptable treatment burden per session [6].

"新"無歯顎患者の動向
近年の平均余命の増進は晩年に歯の欠損を伴うことも示している．同時に歳を重ねるということは全身的障害や認知障害，虚弱などの問題を抱える可能性もあり，高齢無歯顎患者においては義歯の維持，安定を得にくく，治療術式も困難となる．そこで，治療開始前には患者の身体的許容性をよく把握する必要がある．

Denture adaptation

A major challenge arises when existing well-adapted dentures have to be replaced because they are lost or have become unhygienic, worn or simply insufficient. Learning new motor skills or adapting existing motor patterns requires neuroplasticity, which may be compromised at a very high age [7]. Therefore the capacity to adapt to a replacement denture which is different in form and function may be considerably diminished, which can cause disappointment for both, the patient and the dentist [8]. Denture retention facilitates the adaptation process as denture kinetics rely less on motor skills [9]. Another strategy to foster denture adaptation may be fabricating dentures, which copy selected features from the existing well-adapted prostheses by using duplication techniques.

義歯への適応

さまざまな理由により慣れ親しんだ義歯の再製作を要する場合，神経可塑性の低下した高齢者では新しい義歯の形態や機能への適応能力が低下しているため，期待に添えない結果に至る可能性がある．義歯への適応を促すための方略としては，咀嚼運動に依存しない義歯の維持力を高めること，既存の慣れ親しんだ義歯の特徴を模倣することが挙げられる．

Implant overdentures

There is sufficient evidence to state that the mandibular implant overdenture (IOD) is a well-established treatment modality, certainly in non-dependent edentulous individuals [10,11]. The list of functional benefits they offer is headed by a substantial increase in chewing efficiency, as indicated by the significantly reduced number of chewing cycles required to obtain a given comminution of a standardized test food [12]. This improvement seems largely independent from the chosen attachment system or the number of implants used. Along with the increased chewing efficiency, the maximum bite force is increased after stabilizing a mandibular denture with dental implants [13]. A group of Dutch scientists evaluated chewing efficiency with a sieving method in volunteers with different dental states [13]. Although they confirmed that their 12 complete denture wearers with significantly resorbed alveolar ridges had the lowest chewing performance, and that the group of investigated 40 mandibular IOD wearers performed much better, the 24 edentulous patients with little or no resorption of the ridges outperformed the IOD patients in the study. Little is known about chewing efficiency in geriatric patients, as the limiting factors may instead be related to general health and functional decline rather than bite force, occlusal morphology or denture stability. At any rate, if an increased chewing efficiency is aimed, worn occlusal surfaced should be replaced by new denture teeth [14].

CT scans have revealed that edentulous persons present a smaller cross-sectional area of the masseter and lateral pterygoid muscles and a lower density of the tissues than their age-matched dentate peers [15]. Although with age muscle waste occurs in all skeletal muscles, the effect might be accelerated when wearing complete dentures as the load bearing during chewing is limited by pain from the denture-bearing tissues and denture displacement when the bolus is placed unfavorably. It is therefore safe to assume that a lack of muscle training is contributing to the lower masseter muscle bulk in edentulous individuals. Experimental resistance training in elderly adults proved effective in increasing muscle strength and bulk [16], but data on the training effect of forceful chewing in elderly adults remains scarce [17]. In a cross sectional study, the thickness of the masseter muscle was investigated by means of an ultrasound technique [18]. Two groups of patients with implant prostheses, either fixed or removable, were compared to a group of conventional complete denture wearers and a fully dentate control group of similar age. The results indicate that the mean masseter muscle thickness of the patients with the implant reconstructions was greater than in complete denture wearers, but less than in persons with a natural dentition.

インプラントオーバーデンチャー（IOD）

下顎IODは無歯顎者の治療法として確立されており，アタッチメントの種類やインプラントの数に依存せず咀嚼能率と最大咬合力が増加する．IODの咀嚼能率は高度な顎堤吸収患者よりも高いが，顎堤吸収が軽度な患者よりは低いと報告されている．しかし，高齢者では明らかでなく人工歯の磨耗も関係する．無歯顎者は咀嚼筋の断面と密度が小さく，咀嚼負荷の制限により加齢に伴う筋萎縮が加速する．インプラント補綴装着者の咬筋は全部床義歯装着者より厚く有歯顎者より薄い．

Nutritional intake

Tooth loss is accompanied by a decrease in chewing efficiency which goes along with a silent change in nutritional intake, as the food choice is adapted to what is feasible to chew[19]. Hence edentulous persons tend to consume a diet, which is low in protein, non-starch polysaccharides, calcium and vitamins[20]. However, Weiss and coworkers confirmed that a BMI of 28 or above is associated with a reduced mortality[21]. Weight loss is a critical issue in geriatric care[22] and may even be an early sign of cognitive decline[23]. Although chewing efficiency does not seem directly correlated to a patient's weight, it may indirectly contribute towards a better nutritional intake as it invites a wider food choice and allows eating unblended meals, which look more appetizing. Despite these intuitive correlations, improving chewing efficiency as only the measure does not change dietary intake, as other factors such as habits, food preference, general health, mobility, culture, and cooking skills as well as cognitive impairment and appetite may play a role[24]. While tailored nutritional counseling has been shown to increase the intake of fruits and vegetables with edentulous patients who were provided replacement dentures[25], oral health and chewing efficiency are only one piece in the puzzle that influences the nutritional state of elderly individuals.

栄養摂取

歯の喪失による咀嚼効率の低下は，栄養摂取量の低下を招く．このため無歯顎者は各種栄養素の摂取が少なくなる傾向にある．体重減少は，老人医療における重大な問題であり，認知機能低下の早期兆候ともいわれる．咀嚼効率と体重は直接相関していないように思われるが，咀嚼効率を維持することにより食事の選択肢が広がり，栄養価の高い食物を摂取することで間接的に体重変化と関連する可能性がある．食物摂取量の変化には患者自身の背景（認知機能，食事の嗜好，健康状態など）が大きな役割を果たすので，咀嚼効率の改善だけでは食物摂取量は変化しない．口腔の健康や咀嚼効率は，高齢者の栄養状態に影響を及ぼす1つの尺度にしか過ぎない．

Psychosocial benefits of implant overdentures

The stabilization of mandibular complete dentures by means of osseointegrated implants is one of the most effective interventions in dentistry. This is mainly due to the alleviations of the limitations in social interactions and psychological well-being related to tooth loss and its consequences. Qualitative research demonstrates that complete denture wearers modify their behaviors, as they feel uneasy smiling or sometimes learn certain techniques to do so with a hand covering the mouth[26]. Implant overdentures may reduce the patient's biggest fear, which is the loss of denture retention in a public context revealing that they wear complete dentures. Although complete denture wearers experience a significant increase in satisfaction after the renewal of their conventional dentures[27,28], those with new implant overdentures seem to be even more satisfied with their prostheses. The latter is reported for randomized controlled research conditions[29,30] as well as for a context where the patient freely chooses his/her treatment option[31].

IODの心理社会的利益

インプラントによる下顎全部床義歯の安定化は，最も効果的な歯科的介入の一つである．これにより，歯の喪失およびこれに関連する社会生活や心理面での安定を多く享受できるからである．全部床義歯装着により，大きな笑いをためらうことや口を手で覆って笑うなど，患者は振る舞いを変容させることが報告されている．IOD装着により，全部床義歯の脱離という患者が最たる不安を軽減できるであろう．無歯顎患者への全部床義歯新製により治療満足度は有意に上昇するが，RCT研究により，新たにIODを装着するほうがより高い治療満足度を実感することが報告されている．

Survival and success of implant overdentures

Systematic reviews on implant survival in patients aged 65 years or over[32] or 75 years and over[33] indicated no lower survival rates than in younger adult cohorts. The majority of studies investigate mandibular implants placed in the interforaminal region to retain removable overdentures. From the literature, it seems that neither the number of implants used nor the attachment system chosen or splinting the implants has a significant impact on the treatment success[34,35]. Treatment concepts for the maxilla, single implant mandibular overdentures and short or small diameter implants are to date less well documented. Although immediate, early and conventional loading protocols of mandibular implant dentures are predictable treatment modalities, early and conventional loading tended to reduce failures of osseointegration within the first year post insertion[36]. It can be concluded that mandibular implant overdentures are a safe and successful treatment modality, which presents multiple functional, structural and psychosocial benefits to the patient.

IOD の生存と成功

65 ～ 74 歳の患者群および 75 歳以上の患者群を対象とした文献レビューにより，両群間のインプラントの生存率に差が無いことが示された．またこれらの文献から，インプラント治療の成功に重大な影響を及ぼす要因は，埋入されたインプラント数でも，使用されたアタッチメントシステムでも無いことも判明した．下顎 IOD に対する治療プロトコルとして即時，早期および通常荷重などが適用されているが，埋入 1 年以内のインテグレーションロスの発生に関して，早期および通常荷重のほうが即時荷重に比べ少ない傾向にある．下顎 IOD は，患者に多くの機能的，構造的および心理社会面での利益を提供可能な安全かつ予知性の高い治療法であろう．

Apprehensions and attitude

Despite the convincing evidence on mandibular implant overdentures, a great number of patients refuse implant placement, even when cost as limiting factor is eliminated within the context of a clinical trial. Walton and MacEntee[37] reported a 35% refusal rate when recruiting for a study where 2 implants would be placed to retain a lower denture, all at no cost to the patient. Whereas agreeing to participate in the study was mainly motivated by functional improvement and comfort, nearly half of the refusals were related to the surgical intervention or the perception that implants were not necessary. There may be several reasons for this. Firstly, elderly patients tend to become more satisfied with their dentures, even if they are according to dental professional criteria insufficient[38]. Elderly patients may further have other, more important priorities in their lives, especially when they suffer from multiple chronic diseases and/or they present with severe disabilities. A recent survey of 92 persons who either lived at home, in a long-term care (LTC) facility or were hospitalized revealed that a negative attitude seems related to being a women, the type and quality of the denture, having little knowledge of implants and being hospitalized[39]. Ellis et al.[11] undertook a qualitative approach to investigate implant refusal in dissatisfied complete denture wearers. They confirmed the fear of surgery and post-operative pain, as well as the perception of inadequacy of the intervention for a person at an advanced age. The strategy to allow edentulous individuals to benefit from oral implants late in life should be to schedule the intervention when they are not (yet) institutionalized. Their motivation could be fostered by competent professional information and minimally invasive surgical procedures.

インプラント治療への不安と拒絶

下顎 IOD の有効性は証明されているものの，インプラントの埋入を拒否する患者は多い．それは外科処置への不安やインプラントの必要性を認識していないことが主な理由である．無歯顎者が将来的にインプラントの恩恵を受けるには，施設に入る前に方針を立てておくことである．専門的な情報を与え，侵襲が少ない手術手技を提示することで大きな動機づけになる．

Features of age-adequate dental prostheses

Removable prostheses for the elderly have to be designed to meet the conditions of the aged orofacial system and the functional impairment of the patient[40]. Dentures need to be manufactured robust, forgiving clumsy handling in patients with reduced manual dexterity. Loosened ligaments of the TM joints along with an atrophy of the tuberculum articulare imply the use of denture teeth with no more than 20° cusp inclination. The issue of reduced motor control, leading to a less precise closing trajectory of the mandible is best met with a freedom-in-centric occlusal concept. In very old patients, who are successfully adapted to a more anterior position of the mandible, restorations may copy this “convenience occlusion” rather than force the patient in the centric relation. Impaired vision and tactile sensitivity require well-polished denture surfaces, which preclude niches for the retention of food debris and plaque[41]. It is further important that the denture has the highest denture retention that still allows handling of the prostheses by the patient.

加齢に応じた補綴装置

高齢者の可撤性義歯は，衰えた機能に適応するように設計する．不用意な取り扱いで壊れないようにする．関節周囲組織の老化に応じて人工歯の咬頭傾斜を緩く，運動機能の低下に対応してワイドセントリックを与えるといった配慮が必要である．また，視覚や触覚の衰えた患者では義歯の研磨にはとりわけ注意する．さらに，患者自身が外せる必要十分な維持力の確保も大切である．

Design of implant overdentures

Even careful and systematic appreciation of the literature in the field does not make it possible to recommend an ideal number of implants for mandibular implant overdentures[42]. A carefully conducted RCT by Meijer and his group investigated treatment concepts using bar-supported mandibular overdentures in edentulous patients[43]. Sixty patients of similar age were randomized into two groups. They received either two or four implants and were followed up for a period of 10 years. No difference was found in radiological and clinical parameters, patient satisfaction and maintenance needs. However, analysis of the posterior bone loss indicated a significantly more pronounced atrophy when only two implants had been placed[44]. As this seemed independent of the peri-implant bone loss, it may rather be related to the sinking in of the posterior denture saddle under occlusal load. In young edentates, where chewing muscle atrophy is not yet clinically relevant, or in cases with a strong antagonistic dentition, it seems preferable to create a large support area, thus placing four implants in the canine and second premolar region. Distal extensions are advisable to enlarge the support area even further, but often the denture height is not sufficient to accommodate the superstructure. Frequent fractures of these extensions will be reduced if recent CAD/CAM technologies for milled titanium bars are used[45].

The stronger occlusal load with implant overdentures may also impact the atrophy of the maxillary ridge. Tymstra et al. demonstrated that with both a two- and four-implant mandibular overdenture the maxillary anterior bone resorption was significant over a 10-year period, whereas in a control group with complete denture wearers it was not[46]. Whatever the number of implants placed is, it seems advisable to frequently remount the dentures to avoid anteriorization of the occlusion and/or reline the mandibular denture when necessary.

The ideal position of two implants would be in the in the most anterior and most lateral position of the edentulous mandible. It seems important that no anterior lever is created, as this might lead to a rocking movement of the overdenture as the free-end saddles sink into the denture bearing tissues during the wearing period. When four implants are placed, the position of the anterior implants should be the same as in a 2-implant overdenture, and the posterior implants should be placed as distal as possible, but anterior to the mental foramen[40]. Extensive splinting of implants should be avoided in the dentulous mandible, as mandibular flexure may create a certain discomfort for the patient and expose the implants to uncontrolled forces. Is a

single implant on the mandibular midline sufficient to satisfy the edentulous patient? Indeed, an RCT, which randomized edentulous participants between one and two mandibular implants for a mandibular implant-overdenture, showed a significant increase in patient satisfaction in both groups [47]. However, already at the 12-month follow-up visit, five of the 42 patients in the one-implant group shifted from the positive half of the VAS scale to the negative half. Implant survival seems excellent using this treatment concept although long-term observations of patient-centered and functional outcome measures scarce [48]. It remains to be borne in mind that the midline suture of the mandible often presents a midline mandibular lingual canal with blood vessels and nerves, which requires attention during implant placement [49].

インプラントオーバーデンチャー（IOD）のデザイン

理想的なインプラント本数を推奨することは難しいが，2本と4本インプラントのIODではX線，臨床所見，患者満足度とメインテナンスの頻度に関して有意な差は認められなかった．しかし，2-IODにおいて臼歯部顎堤の骨吸収量が有意に多く認められため，若い無歯顎患者においてはインプラントを4本配置することも考慮したほうが良い．その際には，義歯の破折に注意をする必要がある．下顎IODによる強い咬合力により，上顎の無歯顎顎堤前歯部に骨吸収を生じることがあるので，リマウントやリラインを行い咬合の安定を計る必要がある．2本のインプラントの理想的な位置は，最も前方かつ側方であり，インプラントを支点とした前後的なシーソーのような動きをしない位置にインプラントを配置することが重要である．1本支持のIODは良好な患者満足度と生存率を示しているが，長期間の臨床研究報告は十分でない．

Maxillary implant-overdentures

The mucosa covering the hard palate has a considerably higher resilience than the one covering the mandibular alveolar ridge; therefore placing two implants to support an upper implant-overdenture must be discouraged. Very soon, the overdenture would begin rocking over the implant axis, thus causing discomfort and a frequent need for relining. Therefore, a minimum of four implants has to be recommended, allowing for a palatal-free horse-shoe design, where the implants are placed in the canine region and as close as possible to the chewing center, just mesial of the sinus to avoid additional surgery. This treatment concept keeps the phonetic zone free from bulky superstructures and encourages a natural morphology of the palatal coverage, which in turn facilitates the natural feel and speech of the patient. A shallow 0.5 mm deep carved dam helps to avoid food impaction under the prosthesis. The transition of the palatal coverage to the natural hard palate should be fabricated in chrome cast, as this allows a smooth transition from the natural to the artificial palate. Unlike in a palatal band for a partial denture, this transition is situated in a zone of the palate where the tongue is in contact during rest; therefore it seems particularly important to avoid structures that invite the initiation of disturbing habits of the tongue.

上顎インプラントオーバーデンチャー

2本のインプラントでは義歯の動揺を抑えることができず，頻繁なリラインが必要となるため，上顎においては4本のインプラントによる口蓋を覆わない馬蹄形のオーバーデンチャーが推奨される．埋入位置としては犬歯部および上顎洞のすぐ近心が良い．この治療コンセプトにより口蓋部を解放することができるため，違和感や発音障害を防ぐことが可能となる．

Attachment systems

Again, the literature does not conclusively recommend one ideal attachment system for the implant-supported overdenture. However, a review of attachment systems by Andreiotelli et al. summarized the advantages and inconveniences of some commonly used systems [50]. Whereas bar attachments require a lot of vertical space and create high initial fabrication costs, they provide good retention and require little maintenance. In contrast, ball attachments use little space, yet they wear and require regular adjustments. Few studies exist on the use of telescopic crowns and milled bars, but despite their high fabrication cost they seem to perfectly satisfy the patient and require

very little maintenance[51]. Magnets, however, seem to provide low retentive forces[50]. The range of available attachment systems was recently complemented by the CMLoc (Cendres & Métaux, Biel, Switzerland), where an additional version (CMLoc Flex) allows aligning the attachment axis by intra-orally. Novel developments also include the Locator R-Tx (Zest anchors, Carlsbad, US) with an improved design and surface as well as the Novaloc System with a black carbone surface, which is currently the most wear-resistant surface (Straumann, Basel, Switzerland).

アタッチメントシステム

IODにおける最適なアタッチメントシステムについては未だに結論が出ていない．バーアタッチメントは十分なクリアランスが必要でコストが高いものの，維持力が高く，メインテナンスが少なくて済む．対照的にボールアタッチメントは少ないクリアランスでも可能であるが，調整が必要である．近年，インプラントの埋入角度補正が可能なCMLocやLocator R-Tx，耐摩耗性に優れたNovaloc systemなどが開発されており，選択の幅が広がってきた．

Accompanying the functional decline

Although success and survival rates of dental implants seem similar in younger and older edentulous patients[32,52-54], there are certain risk factors that are related to aging as well as the onset of dependency and multi-morbidity[32]. Maintaining good oral hygiene becomes more difficult and is usually less meticulously performed. Little is known about the prevalence and pathophysiology of peri-implantitis in geriatric patients, but it seems that the inflammatory reaction to an experimental gingivitis / mucositis is even stronger around implants than in natural control teeth[55,56]. Furthermore handling a (retentive) IOD may exceed the manual force and/or cognitive ability of the patient as well as the competence of the caregivers. It must also be born in mind that denture use as such is less frequent in geriatric patients in general, but in particular in those who are cognitively impaired, bedbound, ventilated or undergoing chemotherapy[57]. Thus for geriatric

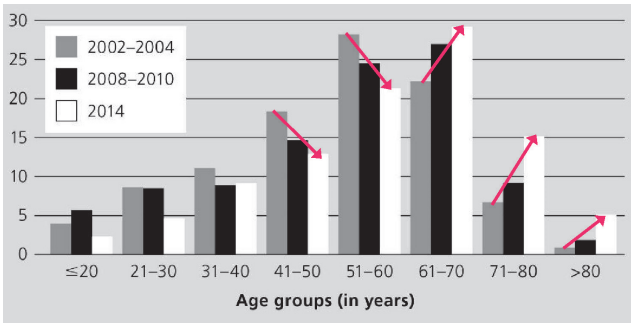

Figure 1: Age structure of patients having implants placed at the University of Bern (Data from[59])

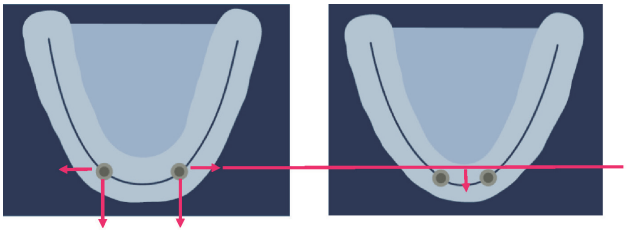

Figure 2: Two implants the interforaminal area should be placed as anterior and as lateral as possible, without creating an anterior lever.

Figure 3: In elderly and fragile patients the denture retention should be chosen (and if necessary adapted) so that the patient can manage the denture independently.

patients it seems imperative to add “management of implant prosthesis and ability to maintain oral hygiene” to the success criteria mentioned previously. Care should be taken that implant patients do not “disappear” from the dentist’s recall system when they become institutionalized. They should be closely monitored and if needed the denture

retention should be changed for lighter-retention systems or the attachments should be removed to transform the IOD to a conventional complete denture. This “back-off” strategy requires visionary and “reversible” treatment planning when implant prostheses are planned and fabricated[58].

機能低下に対する配慮

高齢者ではIODの着脱が満足にできない場合がある．したがって，「インプラント補綴の管理と口腔衛生を維持する能力」を前述の成功基準に加えることが不可欠である．施設に入れられたときに歯科医のリコールシステムから「消えていない」よう注意が必要である．必要に応じて維持力を弱くするか，通常の全部床義歯に変更する必要がある．インプラント補綴が予定される際に，「可逆的」な治療計画が必要である．

Summary and conclusion

Tooth loss will remain a reality in old age, but will occur later in life, which will confront the dental profession with more complex reduced partial and complete denture cases. The standard of care in geriatric patients must be adapted to the patient’s motivation, functional and cognitive impairment and medical condition as well as his/her socio-economic context.

結　論

現代の高齢者の欠損補綴診療がさまざまな問題で複雑化・困難化することは避けがたい．高齢患者における標準的治療は，患者のモチベーション，機能障害，認知障害および医学的状態，さらには経済的状況にも適合させなければならない．

※ 各セクション末に編集委員による要訳を加えました．

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