



High-Level Athletes and Oral Health

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Abstract

Oral health is an important aspect of athletes' overall health, yet it is often overlooked. Dental pain and its pharmacological treatment can have an impact on athletic performance, leading sports medicine physicians to include dental consultations in the management of athletes. However, athletes lack information and dental surgeons are often not well-informed about the specific needs of athletes. This literature review focuses on the peculiarities of athletes, dental trauma, barotrauma, focal conditions, dental occlusion, nutrition and dietetics for athletes, as well as dental management of athletes. The suggested recommendations to prevent dental problems include regular tooth brushing, flossing, maintaining a balanced diet, and limiting the consumption of energy drinks and sugary snacks. Athletes should also undergo regular dental check-ups to promptly detect and treat any potential dental issues. Recent research has demonstrated the importance of oral health for high-level athletes and highlights the impact of oral health on athletic performance. The aim of this literature review is to explore how regular sports practice can affect oral health, leading to phenomena such as dry mouth and early alveolar bone loss. It will also study dental traumas, barotraumas, and focal conditions in athletes. It will examine how dental occlusion can influence the athlete's posture and how pain can impact sports performance.

Subject Areas

Dentistry, Health Policy, Public Health

Keywords

Oral Health, Performance, Occlusal Splint, Dental

1. Introduction

The effects of oral health on sports performance are less known [1]. However, research findings have shown that the human body is a whole and not a series of

independent systems, and within this framework, it has been observed that a number of underperformances in sports competitions are due to dental pain or its pharmacological treatment. Sports medicine physicians have therefore included dental consultations in the management of athletes [2].

However, this consultation is often neglected by athletes due to a lack of information, as well as by dental surgeons who are not well-versed in the specific needs of athletes [3]-[5].

In this article, we will address various topics related to the oral health of athletes. We will explore how regular sports practice can affect oral health, leading to phenomena such as dry mouth and early alveolar bone loss. We will also study dental traumas, barotraumas, and focal conditions in athletes. We will examine how dental occlusion can influence the athlete's posture and how pain can impact sports performance. Additionally, we will discuss the nutrition and dietetics of athletes, as well as the dental management of athletes in the dental office.

2. Materials and Methods

The PRISMA protocol was followed and a literature search was performed on Pub Med, Google Scholar, and Science Direct using specific keywords.

Inclusion criteria were defined and duplicates were removed. Sixteen studies were selected for review, meeting the inclusion criteria.

The eight steps of the Cochrane methodology were followed to select the studies.

A search algorithm was used with the following keywords to highlight the most relevant articles on the topic:

("Elite-athletes" OR "Athletes" OR "High-level athletes" OR "professional athletes") AND ("oral health" OR "oral conditions" OR "dental health").

3. Results

The search strategy identified 1620 studies.

The selected articles were methodically critically reviewed to ensure that only articles of sufficient methodological quality were included. 1336 studies were identified after applying the following filters:

- Language: Articles published in English.
- Date of publication: Articles published within the last 20 years.

Finally, 16 original studies were included in our review. The articles were published between 2000 and 2022.

4. Discussion

4.1. The Oral Parameters Characteristic of the Oral Behavior of the Athlete

4.1.1. Salivary Ig

Moderate intensity exercise of 15 - 45 minutes alters salivary immunoglobulin concentrations.

High intensity training decreases salivary Ig A at rest, but moderate training increases it.

Salivary immunoglobulin concentration decreases significantly during maximal exercise, independent of training level.

4.1.2. Salivary pH

Salivary pH is acidified by strenuous exercise and alkalinized by moderate exercise.

4.1.3. Salivary Flow

Salivary secretion increases after moderate to high intensity exercise, with effects on the secretion of proteins, lysozyme, amylase and MUC5B.

However, an 8% water loss almost completely inhibits salivary secretion.

The consequences of these changes on the oral health of athletes can be significant (**Figure 1**).

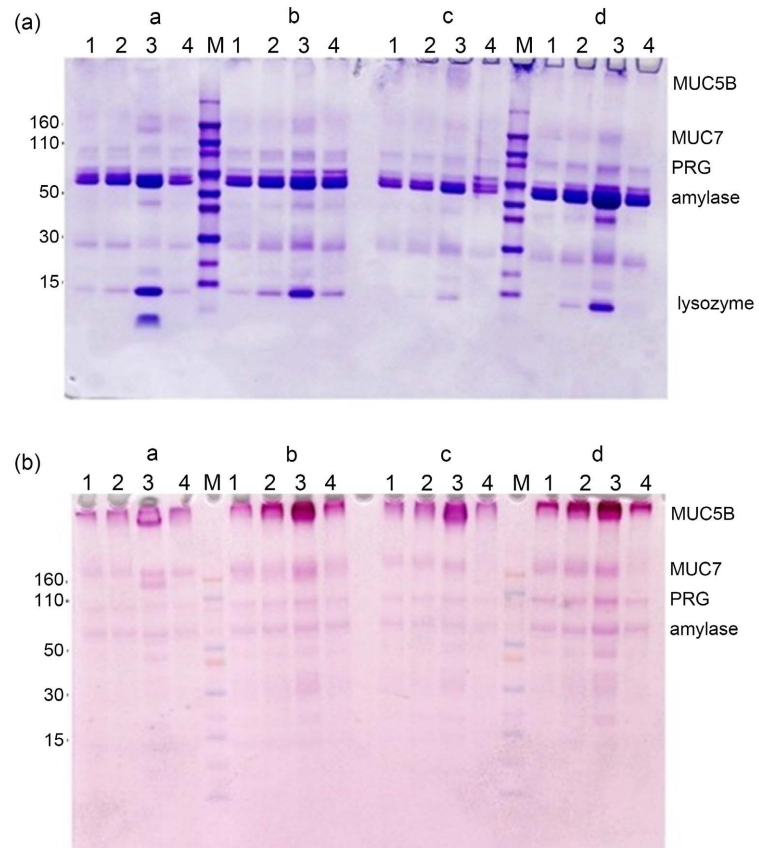


Figure 1. Effect of exercise on salivary proteins. Saliva samples from 4 different individuals were collected at rest: 1, after moderate exercise intensity: 2, high exercise intensity 3 [6].

4.1.4. Salivary Cortisol in Athletes

High performance athletes can be subjected to a variety of stressful situations, which can be measured using salivary cortisol as an indicator of their mental

health. However, comparisons of cortisol levels between athletes and non-athletes are inconclusive.

Studies suggest that athletes may have more effective coping mechanisms in response to stressful situations, which may explain the greater release of cortisol in these situations. Ultimately, cortisol concentrations in athletes appear similar to those in physically active and sedentary individuals, which is important for maintaining health [5] [7] [8] (Table 1).

Table 1. Descriptive characteristics of salivary cortisol studies in athletes and sedentary individuals.

Authors	G	Sport	Gender	N	Age	Concentration of salivary cortisol (nmol/l)	Results
Gouarné <i>et al.</i> [7]	Ath	Triathlon	H	10	26.5 (2.7)	10.6 (0.9)	Ath H = Séd H
	Séd	-	H	9	25.1 (1.4)	13.9 (1.7)	
Minetto <i>et al.</i> [8]	Ath	Endurance sports	H	11	24.5 (5.1)	9.9 (4.7)	Ath H = Séd H
	Séd	-	H	11	25.3 (5.4)	10.2 (9.8)	
Minetto <i>et al.</i> [25]	Ath	Various sports	H	20	24.9 (7.6)	12.5 (9.1)	Ath H = Séd H
	Séd	-	H	10	27.4 (2.4)	10.2 (9.8)	
Rimmele <i>et al.</i> [26]	Ath	Running	H	18	24.7 (0.8)	7.1 (2.4)	Ath H = Séd H
	Séd	-	H	24	23.6 (0.6)	9.8 (5.6)	
Rudolph <i>et al.</i> [10]	Ath	Running	H	13	19.8 (1.4)	9.4 (5.5)	Ath H = Séd H
	Séd	-	H	13	21.0 (1.2)	8.8 (4.1)	
Georgopoulos <i>et al.</i> [27]	Ath	Artistic gymnastics	F H	142 97	16.4 (1.3)	F: 15.4 (7.4) * M: 10.2 (5.5)	Ath F > Séd H
	Séd	-	F H	40 41	15.6 (1.7)	F: 11.6 (8.3) M: 9.1 (8.3)	Ath H = Séd H
Roupas <i>et al.</i> [28]	Ath	Artistic gymnastics	F	51	16.9 (2.6)	15.7 (5.8)	Ath F = Séd F

H: men; F: women; Séd: sedentarity; Ath: athletes.

4.2. Barotrauma

Barotraumatism is a painful phenomenon linked to barometric depression localized to one or more teeth or to the dental sector.

- Healthy teeth: anatomical and functional predispositions associated with favouring factors are necessary to observe pain in aviators and divers.
- Decayed teeth: Decay is the most common cause of aerodontalgia, but does not necessarily cause pain.
- Teeth with recent fillings: it seems that the more recent the filling, the more likely the tooth is to be the site of aerodontalgia.
- Faulty fillings: air trapped under a filling is not a likely cause of aerodontalgia, but an air bubble may appear when the filling is made or when the tooth is brought down to a loose filling joint.

4.3. Early Alveolysis in High Level Athletes

- Higher rate of alveolysis: high level athletes (74%) vs basic athletes (6%).
- Variation between 20.8%, 27.3%, and 18% of athletes with early alveolysis.
- Etiological factors observed: poor oral hygiene, dental avulsions, occlusodontic problems, medication.

1) Interleukin I and TNF metabolism associated with exercise

Interleukins 1 stimulate bone resorption in culture, but regular and moderate exercise has anti-inflammatory effects that help prevent many chronic diseases.

TNFs have a similar but lesser effect than IL 1 in inducing bone resorption.

Increased interleukin and TNF metabolism associated with heavy exercise.

2) Calcitonin and exercise (Ca)

In highly trained athletes with decreased gonadal secretion, a low calcitonin level is observed.

This value seems to be one of the factors of the decrease in bone density.

3) Parathyroid hormone (PTH)

In athletes who train for long periods of time and intensively, parathormone is low.

When training stops, its level increases.

It has a double role of bone resorption and formation.

4) Prostaglandin (Pg)

Early alveolysis in high-level athletes is mainly due to dry mouth, poor oral hygiene and a specific diet that is harmful to periodontal health, which may or may not be associated with bruxism [9].

4.4. Dry Mouth

Dry mouth in athletes can have different causes, such as emotion, stress, water loss during exercise, mouth breathing, medication or bimetallism. The consequences of hyposialia, which is the absence or decrease of saliva, can be periodontal lesions, candidiasis, dental caries and somatic complications [10].

Recommended treatments include improved oral hygiene, solid diet, milk consumption, limiting harmful foods, stopping hyposial medications and smoking, and drinking plenty of water.

4.5. Occlusion, Posture and Sports Practice

Occlusion is the alignment of the teeth and the contacts between the antagonistic teeth.

The orthostatic posture is a unique position of the human being that calls upon postural reflexes and the permanent contraction of many skeletal muscle groups.

It is possible to imagine a causal relationship between occlusion and posture.

Leroux and Patrick's studies examined the effect of mouthguards on athletes. Leroux and colleagues found that artificial occlusal disruption increased.

the proportion of athletes with asymmetrical muscle contractions and induced a significant decrease in their muscle power. The study by Patrick *et al.* confirmed that mouthguards have an effect on strength and power production in athletes [11].

4.6. Diet and Doping in Sport

For a long time, people have sought to improve their performance, including that

of sports, by using artificial methods. Ancient athletes were already using methods to influence their performance.

However, the use of doping substances such as amphetamines, anabolic steroids, cortisone, EPO, beta-blockers and others can lead to serious side effects such as cardiovascular risks, neuropsychiatric disorders, digestive problems and long-term health problems.

Former athletes who have practiced intensively report that in 50% of cases, their addiction began in association with doping products. For some, the pursuit of athletic performance and environmental pressures create an unfavorable mindset for the future, with the need for “outside input” to succeed.

The quest for the “magic potion” plays an important role in children’s imaginations.

5. Oral Health Prevention and Monitoring

Dental prevention in athletes involves six key objectives, such as selection and referral of athletes, regular oral health monitoring, provision of appropriate treatment, information on dental implications for sports performance, and individualized preparation for each athlete.

These goals are essential for dentists working with athletes, as outlined in **Table 2** and **Table 3** of the major roles of the sports medicine dentist.

Table 2. The main roles of the dentist in sports medicine.

Actions	
Select	Sometimes it is necessary to remove from competition, temporarily, depending on the level of the athlete and the opinion of the coach,
Orient	Any subject presenting a particular fatigability, because of dysmorphoses or a traumatic or infectious history deserves to be directed towards professionals able to
Monitor	systematic search for caries and periodontal pathology, verification of the vitality of anterior teeth and those with a history of trauma
Treat	The athlete’s therapy is the restoration of perfect oral health
Inform	Many authors have been interested in the implications of dental pathologies on sports performance.
Prepare	All preventive measures must be undertaken and adapted to each athlete according to their level of competition,

Table 3. Results compared to literature data.

Authors	years	Title	TYPE
Botelho <i>et al.</i> [12]	2021	Periodontal Health, Nutrition and Anthropometry in Professional Footballers: A Preliminary Study	Transversal
Needleman <i>et al.</i> [13]	2013	Oral health and impact on performance of athletes participating in the London 2012 Olympic Games: a cross-sectional study	Transversal
Marks <i>et al.</i> [14]	2015	Oral cleanliness and gingival health among Special Olympics athletes in Europe and Eurasia	Retrospective
Ashley <i>et al.</i> [15]	2014	Oral health of elite athletes and association with performance: a systematic review	Review

Continued

Gallagher <i>et al.</i> [16]	2020	Implementation of a behavioural change intervention to enhance oral health behaviours in elite athletes: a feasibility study	Transversal
Ligtenberg <i>et al.</i> [6]	2015	The effect of physical exercise on salivary secretion of MUC5B, amylase and lysozyme	Transversal
Minty <i>et al.</i> [17]	2018	Oral health and microbiota status in professional rugby players: A case-control study	Case-control
Bryant <i>et al.</i> [1]	2011	Elite Athletes and Oral Health	Transversal
Hamamcilar <i>et al.</i> [18]	2019	Effect of dental caries and the consequential variation in blood parameters on the anaerobic performance of rowing athletes	Transversal
Merle <i>et al.</i> [19]	2022	Associations of Blood and Performance Parameters with Signs of Periodontal Inflammation in Young Elite Athletes—An Explorative Study	Retrospective
G. loos <i>et al.</i> [9]	2000	Elevation of Systemic Markers Related to Cardiovascular Diseases in the Peripheral Blood of Periodontitis Patients	Transversal
Merle <i>et al.</i> [20]	2021	Orofacial conditions and oral health behavior of young athletes: A comparison of amateur and competitive sports	Retrospective
Bramantoro <i>et al.</i> [21]	2020	The impact of oral health on physical fitness: A systematic review	Review
Solleveld <i>et al.</i> [22]	2015	Associations between poor oral health and reinjuries in male elite soccer players: a cross-sectional self-report study	Transversal
Schildknecht <i>et al.</i> [23]	2012	Dental injury and its prevention in Swiss rugby	Transversal
Leroux <i>et al.</i> [24]	2018	Influence of dental occlusion on the athletic performance of young elite rowers: a pilot study	Transversal

6. Conclusions

Oral and dental disorders can affect sporting activities at all levels but have a greater impact on top-level athletes due to the increased demands placed on their bodies during exercise.

Prevention and oral-dental monitoring can prevent problems and improve sporting performance. Unfortunately, the importance of oral health is often overlooked in athletes, which can lead to under-performance and injury.

Health professionals should include an inspection of the athlete's mouth in their annual medical check-up, and sports federations should encourage the use of endo-buccal protection. Awareness of oral health preservation should be developed to prevent dental-maxillary trauma in athletes.

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] Bryant, S., McLaughlin, K., Morgaine, K. and Drummond, B. (2011) Elite Athletes and Oral Health. *International Journal of Sports Medicine*, **32**, 720-724. <https://doi.org/10.1055/s-0031-1277192>

- [2] Baiju, R.M., Peter, E., Varghese, N.O. and Sivaram, R. (2017) Oral Health and Quality of Life: Current Concepts. *Journal of Clinical and Diagnostic Research*, **11**, ZE21-ZE26.
- [3] (1985) Protections dento-maxillaires (Mouth guards). *Revue odonto stomatologie*, 3225-3235. (n.d.).
- [4] Messias, A., Gomes, I.J., Reis, P.N.B., Amaro, A.M. and Neto, M.A. (2021) The Effectiveness of Dental Protection and the Material Arrangement in Custom-Made Mouthguards. *Applied Sciences*, **11**, Article 9363. <https://doi.org/10.3390/app11209363>
- [5] Cevada, T., Vasques, P., Moraes, H. and Deslandes, A. (2014) Salivary Cortisol Levels in Athletes and Nonathletes: A Systematic Review. *Hormone and Metabolic Research*, **46**, 905-910. <https://doi.org/10.1055/s-0034-1387797>
- [6] Ligtenberg, A.J.M., Brand, H.S., van den Keijbus, P.A.M. and Veerman, E.C.I. (2015) The Effect of Physical Exercise on Salivary Secretion of MUC5B, Amylase and Lysozyme. *Archives of Oral Biology*, **60**, 1639-1644. <https://doi.org/10.1016/j.archoralbio.2015.07.012>
- [7] Gouarné, C., Groussard, C., Gratas-Delamarche, A., Delamarche, P. and Duclos, M. (2005) Overnight Urinary Cortisol and Cortisone Add New Insights into Adaptation to Training. *Medicine & Science in Sports & Exercise*, **37**, 1157-1167. <https://doi.org/10.1249/01.mss.0000170099.10038.3b>
- [8] Minetto, M.A., Paccotti, P., Borrione, P., Massazza, G., Ventura, M., Termine, A., Di Luigi, L. and Pigozzi, F. (2006) Effects of the Training Status on the Hormonal Response and Recovery from High-Intensity Isokinetic Exercise: Comparisons between Endurance-Trained Athletes and Sedentary Subjects. *The Journal of Sports Medicine and Physical Fitness*, **46**, 494-500.
- [9] Loos, B.G., Craandijk, J., Hoek, F.J., Dillen, P.M.E.W. and Van Der Velden, U. (2000) Elevation of Systemic Markers Related to Cardiovascular Diseases in the Peripheral Blood of Periodontitis Patients. *Journal of Periodontology*, **71**, 1528-1534. <https://doi.org/10.1902/jop.2000.71.10.1528>
- [10] Rudolph, D.L. and McAuley, E. (1998) Cortisol and Affective Responses to Exercise. *Journal of Sports Sciences*, **16**, 121-128. <https://doi.org/10.1080/026404198366830>
- [11] Patrick, D.G., van Noort, R. and Found, M.S. (2005) Scale of Protection and the Various Types of Sports Mouthguard. *British Journal of Sports Medicine*, **39**, 278-281. <https://doi.org/10.1136/bjism.2004.012658>
- [12] Botelho, J., Vicente, F., Dias, L., Júdice, A., Pereira, P., Proença, L., *et al.* (2021) Periodontal Health, Nutrition and Anthropometry in Professional Footballers: A Preliminary Study. *Nutrients*, **13**, Article 1792. <https://doi.org/10.3390/nu13061792>
- [13] Needleman, I., Ashley, P., Petrie, A., Fortune, F., Turner, W., Jones, J., *et al.* (2013) Oral Health and Impact on Performance of Athletes Participating in the London 2012 Olympic Games: A Cross-Sectional Study. *British Journal of Sports Medicine*, **47**, 1054-1058. <https://doi.org/10.1136/bjsports-2013-092891>
- [14] Marks, L., Fernandez, C., Kaschke, I. and Perlman, S. (2015) Oral Cleanliness and Gingival Health among Special Olympics Athletes in Europe and Eurasia. *Medicina Oral Patología Oral y Cirugía Bucal*, **20**, e591-e597. <https://doi.org/10.4317/medoral.20396>
- [15] Ashley, P., Di Iorio, A., Cole, E., Tanday, A. and Needleman, I. (2014) Oral Health of Elite Athletes and Association with Performance: A Systematic Review. *British Journal of Sports Medicine*, **49**, 14-19. <https://doi.org/10.1136/bjsports-2014-093617>

- [16] Gallagher, J., Ashley, P. and Needleman, I. (2020) Implementation of a Behavioural Change Intervention to Enhance Oral Health Behaviours in Elite Athletes: A Feasibility Study. *BMJ Open Sport & Exercise Medicine*, **6**, e000759. <https://doi.org/10.1136/bmjsem-2020-000759>
- [17] Minty, M., Canceill, T., Lê, S., Dubois, P., Amestoy, O., Loubieres, P., *et al.* (2018) Oral Health and Microbiota Status in Professional Rugby Players: A Case-Control Study. *Journal of Dentistry*, **79**, 53-60. <https://doi.org/10.1016/j.jdent.2018.10.001>
- [18] Hamamcılar, O., Kocahan, T., Akinoğlu, B. and Hasanoglu, A. (2019) Effect of Dental Caries and the Consequential Variation in Blood Parameters on the Anaerobic Performance of Rowing Athletes. *Medical Journal of Islamic World Academy of Sciences*, **27**, 55-60. <https://doi.org/10.5505/ias.2019.78466>
- [19] Merle, C.L., Richter, L., Challakh, N., Haak, R., Schmalz, G., Needleman, I., *et al.* (2022) Associations of Blood and Performance Parameters with Signs of Periodontal Inflammation in Young Elite Athletes—An Explorative Study. *Journal of Clinical Medicine*, **11**, Article 5161. <https://doi.org/10.3390/jcm11175161>
- [20] Merle, C.L., Richter, L., Challakh, N., Haak, R., Schmalz, G., Needleman, I., *et al.* (2022) Orofacial Conditions and Oral Health Behavior of Young Athletes: A Comparison of Amateur and Competitive Sports. *Scandinavian Journal of Medicine & Science in Sports*, **32**, 903-912. <https://doi.org/10.1111/sms.14143>
- [21] Bramantoro, T., Hariyani, N., Setyowati, D., Purwanto, B., Zulfiana, A.A. and Irmalia, W.R. (2020) The Impact of Oral Health on Physical Fitness: A Systematic Review. *Heliyon*, **6**, e03774. <https://doi.org/10.1016/j.heliyon.2020.e03774>
- [22] Solleveld, H., Goedhart, A. and Vanden Bossche, L. (2015) Associations between Poor Oral Health and Reinjuries in Male Elite Soccer Players: A Cross-Sectional Self-Report Study. *BMC Sports Science, Medicine and Rehabilitation*, **7**, Article No. 11. <https://doi.org/10.1186/s13102-015-0004-y>
- [23] Schildknecht, S., Krastl, G., Kühl, S. and Filippi, A. (2012) Dental Injury and Its Prevention in Swiss Rugby. *Dental Traumatology*, **28**, 465-469. <https://doi.org/10.1111/j.1600-9657.2012.01115.x>
- [24] Leroux, E., Leroux, S., Maton, F., Ravalec, X. and Sorel, O. (2018) Influence of Dental Occlusion on the Athletic Performance of Young Elite Rowers: A Pilot Study. *Clinics*, **73**, e453. <https://doi.org/10.6061/clinics/2017/e453>
- [25] Minetto, M.A., Lanfranco, F., Baldi, M., Termine, A., Kuipers, H., Ghigo, E., *et al.* (2007) Corticotroph Axis Sensitivity after Exercise: Comparison between Elite Athletes and Sedentary Subjects. *Journal of Endocrinological Investigation*, **30**, 215-223. <https://doi.org/10.1007/bf03347428>
- [26] Rimmele, U., Seiler, R., Marti, B., Wirtz, P.H., Ehlert, U. and Heinrichs, M. (2009) The Level of Physical Activity Affects Adrenal and Cardiovascular Reactivity to Psychosocial Stress. *Psychoneuroendocrinology*, **34**, 190-198. <https://doi.org/10.1016/j.psyneuen.2008.08.023>
- [27] Georgopoulos, N.A., Rottstein, L., Tsekouras, A., Theodoropoulou, A., Koukkou, E., Mylonas, P., *et al.* (2011) Abolished Circadian Rhythm of Salivary Cortisol in Elite Artistic Gymnasts. *Steroids*, **76**, 353-357. <https://doi.org/10.1016/j.steroids.2010.10.013>
- [28] Roupas, N., Mamali, I., Armeni, A., Markantes, G., Theodoropoulou, A., Alexandrides, T., *et al.* (2012) The Influence of Intensive Physical Training on Salivary Adipokine Levels in Elite Rhythmic Gymnasts. *Hormone and Metabolic Research*, **44**, 980-986. <https://doi.org/10.1055/s-0032-1321816>