
A national survey of orthodontists in Malaysia and their use of functional appliances for Class II malocclusions

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Objectives: The aim of this study was to evaluate the use of functional appliances by the currently practising orthodontists in Malaysia. The objectives were to identify the different types of functional appliances used by Malaysian orthodontists and to investigate the variation in treatment protocols when attempting growth modification.

Methods: An online questionnaire consisting of 24 open-ended and multiple-choice questions was emailed to members of the Malaysian Association of Orthodontists (MAO) ($n = 183$). The survey was based on a previous study conducted by members of the British Orthodontic Society and was modified to suit the Malaysian population. The data were analysed using SPSS to generate frequency tables and descriptive statistics.

Results: Seventy-two responses were received from current Malaysian orthodontists. Of the respondents, 71% practised in a government setting and 29% were in private practice. The Clark Twin Block was the most frequently used functional appliance by 90% of Malaysian orthodontists. Many of the respondents (57%) prescribed full-time wear of removable functional appliances for 6–9 months (except during mealtimes) (51%). Following active removable functional appliance therapy, 91% prescribed a period of retention which involved a reduction in the duration of wear. The retention phase extended for 2 to 3 months (41%) or for 4 to 6 months (39%) for the majority of the respondents.

Conclusions: The Clark Twin Block is the most frequently-used functional appliance for the management of a Class II malocclusion by orthodontists currently practising in Malaysia.

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Introduction

An orthodontic functional appliance may either be removable or fixed when used to advance a recessive mandible to a more acceptable forward relationship with the maxilla. The forces generated by the stretching of facial muscles, fascia, and/or periodontium work to alter the skeletal and dental relationships.¹ Functional appliances may be used in motivated patients to harness their growth potential for the management of mild to moderate Class II skeletal problems. Functional appliances may be used during the late mixed or early permanent dentition provided the patient experiences

and maintains a potential for growth. The appliances may be used earlier as an interceptive measure to prevent psychological trauma related to an unaesthetic, increased overjet in children.² The use of a functional appliance is contraindicated in a non-growing patient and in those with a vertical growth tendency. Patients with an anterior open bite and a high mandibular plane angle with an associated backward growth rotation are cases that should be treated cautiously.³ The mode of action of a functional appliance in the correction of a Class II malocclusion is a controversial orthodontic argument. The clinical effects of functional therapy

are evident as they can reduce an overjet and overbite in a growing patient; however, how this change is achieved is still largely unclear and likely varies between patients. Functional appliances are claimed to stimulate mandibular growth; however, this is not supported by scientific evidence.^{4,5} The clinical effects of functional appliances are reported to be mostly dentoalveolar changes, with 70% of overjet reduction achieved by tipping of the incisors.⁶

Functional appliances may be divided into two types, either fixed or removable.¹ The main management difference between these is the variable compliance demands placed on the patient. Removable appliances require compliance by adherence to wear instructions while fixed functional appliances require patient cooperation by avoiding breakages and maintaining an excellent standard of oral hygiene.⁷ The Clark Twin Block, Andresen activator, the Harvold appliance, Bionator, and Frankel appliances are examples of removable functional appliances. The Twin Block, which consists of maxillary and mandibular removable components was originally developed in Scotland by William Clark.⁸ The modified version of the Twin Block appliance has been used extensively for the treatment of prominent teeth in growing adolescents, partly due to its acceptance by patients.⁹ A disadvantage of the Twin Block appliance is that it is removable; however, advocates of the appliance argue that this is its greatest strength.

There is a vast number of functional appliances commercially available for clinical use by Malaysian orthodontists. The choice largely depends upon the geography of the practice and the available laboratory support, in addition to the education, skills experiences and emphasis that clinicians gained during their orthodontic training at different global institutions. In order to investigate the variation in the application and management protocols of functional appliances by orthodontists in Malaysia, a survey was undertaken in an attempt to explain apparent clinical differences between providers.

Materials and methods

Sampling

This was a cross-sectional study involving orthodontists currently practising in Malaysia. Ethical approval was obtained from the Faculty of Dentistry Medical Ethics Committee (DF CD1921/0112(L)) and permission to

conduct the study was obtained from the President of the Malaysian Association of Orthodontists (MAO). Due to the lack of a national specialist register at the time of the study, the surveyed sample was limited to MAO members. Determined by an online sample size calculator (<http://sampsizе.sourceforge.net/iface>), a minimum sample size of 120 participants was considered based on the number of actively practising MAO members ($n = 183$), a precision of 5%, an estimated response rate of 33%¹⁰ and a confidence interval of 95%. Convenience sampling was applied by inviting all members of the MAO who fulfilled the inclusion criteria to participate. Non-practising, student and international members were excluded as they did not meet the scope of this study.

Questionnaire

The survey questionnaire was designed using established guidelines¹¹ and was a modified version of the National Survey conducted for the British Orthodontic Society.⁹ The questions were initially distributed to ten randomly selected orthodontists for fact and content validation. Minor modifications were then made to suit the study population. The final survey was administered in English via Google Forms. It consisted of 24 open-ended and multiple-choice questions divided into five sections: (1) Demographics, (2) Provision of interceptive functional treatment, (3) Preferences in the choice of functional appliance for Class II correction, (4) Limitations of functional appliance laboratory service, and (5) Treatment protocol. The survey took approximately 8 min to complete.

An email containing a detailed explanation of the survey including a link to the online questionnaire was distributed to MAO members via the association secretariat. Members who fulfilled the inclusion criteria were invited to participate. Data collection was carried out between April 2020 and September 2020. To increase the response rate, two reminder emails were sent within that time frame, and the link to the survey was shared on the official MAO social media page. Members were also encouraged to forward the survey link to other members via 'WhatsApp' instant text messaging. No incentives were offered for participation which was voluntary. All responses were kept anonymous and the investigators guaranteed confidentiality of the submitted information. The survey questions are provided in Table I.

Table I. Survey questions.

A. Demographics	
1.	Which age range do you fall into? A. 20–29 years old B. 30–39 years old C. 40–49 years old D. 50–59 years old E. >60 years old
2.	Which institution did you obtain your orthodontic specialty qualification? A. Local B. Overseas
3.	What is the name of the institution you obtained your orthodontic specialty qualification from?
4.	What year did you graduate from your orthodontic specialty training?
5.	Which state is your current primary practice? A. Melaka B. Selangor C. Johor D. Sabah E. Sarawak F. Pahang G. Perak H. Negeri Sembilan I. Kelantan J. Terengganu K. Pulau Pinang L. Perlis M. Kedah N. Putrajaya O. Kuala Lumpur P. Labuan
6.	Which orthodontic service do you spend most of your clinical time? A. Private clinic/hospital B. Government clinic/hospital C. Government university hospital D. Private university dental facility E. Military clinic/hospital
B. Provision of interceptive functional treatment	
1.	Do you offer functional appliance therapy in your clinic? A. Yes B. No
	<i>If yes, please answer Q2 and Q3 only of this section and complete section C, D and E.</i>
	<i>If no, please answer Q4 and Q5 only and end the questionnaire.</i>

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2. If yes, how many functional appliances have you prescribed in the last 12 months?
-
3. If yes, which malocclusions do you commonly treat with functional appliances?
- A. Class II
 - B. Class III
 - C. Anterior open bite
 - D. Other (please specify: _____)
-
4. If not, would you refer a patient to another orthodontist for functional appliance therapy?
- A. Yes
 - B. No
-
5. Why do you not offer functional appliance treatment?
-
- C. Personal preferences in choice of functional appliance for Class II correction
-
1. There are several types of functional appliances currently available for the treatment of Class II malocclusion. Which do you commonly use?
- A. Fixed functional appliance
 - B. Removable functional appliance
 - C. Both fixed and removable functional appliance
-
2. What is the name of the appliance(s)?
-
3. Why is this your preferred choice of appliance(s)?
-
4. Is the cost of the functional appliance a factor in choosing your preferred appliance?
- A. Yes
 - B. No
-
5. Is patient compliance a factor in choosing your preferred appliance?
- A. Yes
 - B. No
-
6. Which appliance(s) would you **ideally** like to use and why?
-
7. Forsus for example, is a type of fixed functional appliance. Would you be willing to use this appliance if the production cost was the same as your current choice?
- A. Yes
 - B. No
 - C. Not sure
 - D. *I'm already using this appliance*
-
- D. Limitations with functional appliance laboratory service
-
1. Do you feel that your choice of functional appliance(s) is limited by the laboratory support available?
- A. Yes
 - B. No
-
2. Are you satisfied with the standard of laboratory work you receive when prescribing a functional appliance?
- A. Yes
 - B. No
 - C. *Not applicable as no laboratory work involved (e.g.: using fixed functional) or I do my own repairs*
-
3. In the event of an appliance breakage, are you satisfied with the laboratory support available?
- A. Yes
 - B. No
 - C. *Not applicable as no laboratory work involved (e.g.: using fixed functional) or I do my own repairs*
-

 E. Treatment protocol

1. What age range do you typically begin functional appliance treatment?
 - A. <6 years old
 - B. 6–9 years old
 - C. 10–14 years old
 - D. >15 years old

2. Do you feel that potential growth modification cases are often referred to you at an ideal time?
 - A. Often
 - B. Sometimes
 - C. Seldom

3. What is your typical functional appliance wear regime?
 - A. Full time including mealtimes
 - B. Full time NOT including mealtimes
 - C. Part time

4. How long is your active functional appliance phase?
 - A. <6 months
 - B. 6–9 months
 - C. 9–12 months
 - D. >12 months

5. Do you prescribe a chart or diary to measure patient compliance with removable functional appliance therapy?
 - A. Yes
 - B. No
 - C. *Not applicable as using fixed functional appliance*

6. Based on your experience in using functional appliances, which of the appliance(s) do you feel that you have the best compliance?

7. Following active removable functional appliance therapy, do you have a period of retention when the appliance is worn less?
 - A. Yes
 - B. No
 - C. *Not applicable as using fixed functional appliance*

8. If so, how long does this period of retention last?
 - A. 2–3 months
 - B. 4–6 months
 - C. 7–9 months
 - D. >9 months
 - E. *Not applicable as using fixed functional appliance*

9. Do you carry out any adjustment to the functional appliance during this retention phase?
 - A. Yes
 - B. No
 - C. *Not applicable as using fixed functional appliance*

Data analysis

The data obtained from the online questionnaire was downloaded directly onto an Excel spreadsheet. All statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) software version 22.0 (IBM Co., Armonk, NY, USA) to generate frequency tables and descriptive statistics. The chi-square test was used to identify associations. The significance level was set at $p < 0.05$. Responses to open-ended questions were grouped according to themes and represented in frequency tables where appropriate.

Results

Demographic results

A total of 72 responses were received which represented a reply rate of 39.3%. The respondents were orthodontists of various age groups with the majority (38.9%) between 30 and 39 years old, 37.5% between 40 and 49 years old, 15.3% between 50 and 59 years old and only 8.3% older than 60 years. The respondents graduated from orthodontic specialty training between the years 1985 and 2019; however, 91.7% had at least 3 years of clinical experience as orthodontic specialists. More than half (56.9%) of the orthodontists obtained their qualification from abroad and the rest were locally trained. A large proportion of the responding orthodontists (70.8%) practised in a government clinic and 29.2% worked in the private sector. An analysis by groups indicated that the respondents were a fair representation of the Malaysian orthodontists (Figure 1), and divided between government service (academic, public clinic or hospital, and military) and the private sector (private university, dental facility, and private clinic or hospital). Respondents were from

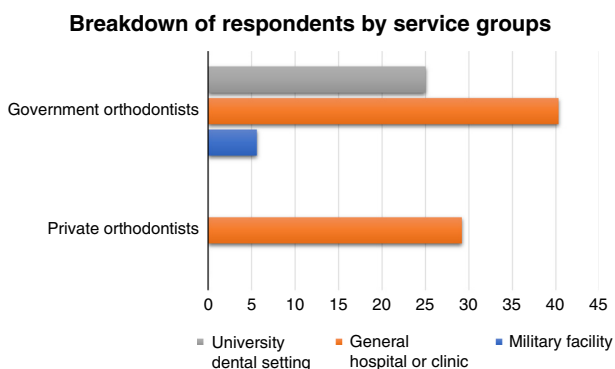


Figure 1. Breakdown of respondents based on service groups.

across Malaysia (13 out of 14 states) but the majority (50%) practised in Selangor and Kuala Lumpur which are the main state and capital of Malaysia.

Reasons for appliance use

Seventy out of 72 respondents offered functional appliance therapy as part of their clinical practice. Two respondents did not use a functional appliance; however, they claimed to refer suitable patients to other providers. The 70 operators using functional appliances treated Class II malocclusions but 8.3% stated that they also used functional appliances for Class III malocclusions. One respondent reported using functional appliances to treat anterior open bite and transverse discrepancies.

Appliances used

The majority of orthodontists (84.7%) reported using only removable functional appliances, while 11.1% used both fixed and removable functional appliances. Only one respondent (1.4%) used fixed functional appliances, exclusively. Of the functional appliances available in Malaysia, the Clark Twin Block appliance (Figure 2) is currently the most popular, according to 90.3% of the respondents (Figure 3). Besides being the most popular functional appliance, the Twin Block was also worn for a longer period each day compared to other removable functional appliances following 98.6% of clinicians recommending a fulltime wear protocol (Figure 4).

More than half of the Malaysian orthodontists (55.6%) claimed that the cost of the appliance played a significant role in treatment preference. While 67.1% preferred to use the Twin Block appliance, 27.1% indicated that a fixed functional appliance was preferable. Many respondents (58.6%) argued that they would be willing to use a fixed functional appliance, such as the Forsus appliance, if the production cost was comparable to their appliance of choice.

Patient compliance

Most orthodontists (87.5%) chose their preferred functional appliance based on patient compliance. This was reflected by the popularity of the Twin Block appliance. Most prescribers of a functional appliance (74.3%) reported that they received the best



Figure 2. The modified Clark's Twin Block appliance.

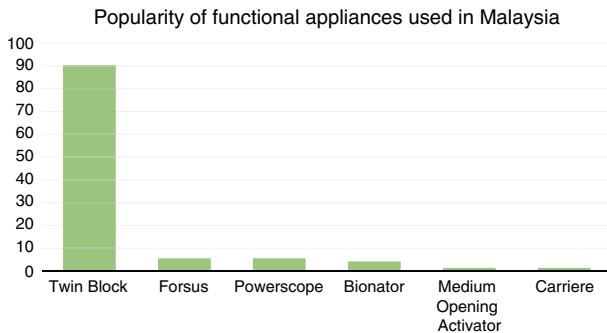


Figure 3. Popularity of functional appliances used in Malaysia.

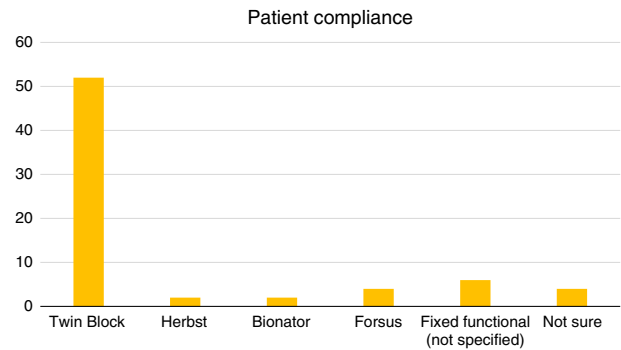


Figure 5. Functional appliance with the best patient compliance.

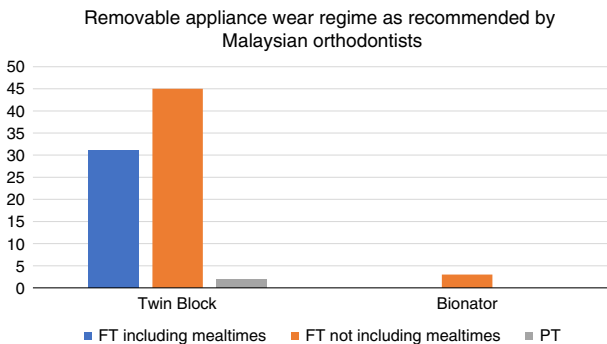


Figure 4. Recommended wear regime of removable functional appliances most used by the respondents.

compliance using the Clark Twin Block (Figure 5). A small number of respondents (17.1%) considered patients wearing a fixed functional appliance had the best compliance. However, several respondents (2.9%) considered that the Bionator produced the best compliance. Despite the problem of patient compliance with removable functional appliance therapy, only 19.4% of respondents reported the use of a chart or diary to measure appliance wear while the remaining 80.6% considered these measures unhelpful.

Satisfaction with laboratory support

More than half of the respondents (54.2%) reported satisfaction with the standard of laboratory technical

work when their chosen functional appliance was manufactured. A significant number of clinicians (77.8%) considered that their choice of functional appliance was limited by the laboratory support available. In the event of an appliance breakage, only 6.9% reported dissatisfaction with the available laboratory support. This was found to be significantly different ($p < 0.05$) between the various orthodontic services with the orthodontists in private sector more dissatisfied with their laboratory support. The majority of respondents (65.3%) reported that their laboratory support for appliance repair was satisfactory.

Timing of treatment

A total of 94.4% of respondents began functional appliance treatment in the age range of 10–14 years. Approximately 11.1% started functional treatment early at 6–9 years and another 5.6% considered treatment commencement at 15 years of age or later. Only 16.7% stated that potential growth modification cases were referred for treatment at an ideal time (Figure 6) while the majority (62.5%) said this was only seldom and 18.1% rarely received referrals at an ideal patient age.

Half of the respondents (50%) reported that their active phase of functional treatment was 6–9 months.

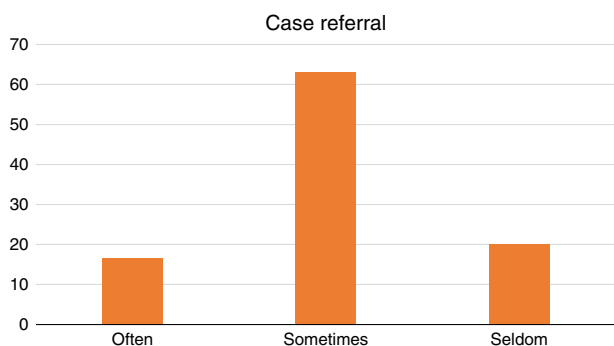


Figure 6. Received referral of potential growth modification cases at ideal time.

Of the remainder, 41.7% actively used the appliance for 10–12 months. Only 4.2% used the appliances for more than 12 months and only 1 respondent used a functional appliance actively for less than 6 months. Following the active phase of treatment, 87.5% reported that a period of retention followed during which the appliance was worn less. The retention period lasted for 2–3 months for a significant proportion of the orthodontists (40.3%), 4–6 months for 37.5%, 7–9 months for 9.7% and only 2.8% had a retention phase lasting more than 9 months. Most orthodontists (65.3%) also carried out adjustments to the functional appliance during the retention phase.

Discussion

Functional appliances may be divided into four groups: (1) tooth-borne passive (e.g. activator, Bionator), (2) tooth-borne active (e.g. Twin Block, fixed functionals), (3) tissue-borne (e.g. Frankel), and (4) combined tooth- and tissue-borne (e.g. a hybrid appliance).¹² Therefore, there are many types of appliances available and although they differ in their mechanism of action, all essentially aim to transmit forces to the dentofacial structures to produce a mixture of dental and skeletal change. A clinician's geographical location seems to influence the preferred type of functional appliance, as supported by appliance preference identified by global research. For example, Twin Block appliances are commonly reported in UK based studies but Bionators and Activators are more commonly reported in European, Scandinavian and American studies.^{13–15}

The Twin Block appliance is the most popular functional appliance of Malaysian orthodontists with 90% usage indicated by the survey respondents. This percentage is higher than the survey of the

British Orthodontic Society which found 75% of respondents preferred the Twin Block.⁹ The described advantages of this appliance over other functional appliances reported in the present study were its

1. clinical effectiveness;
2. cost-effectiveness;
3. comfort for patients;
4. simplicity to fabricate;
5. simplicity to adjust or repair;
6. versatility for simultaneous anterior-posterior, vertical and transverse correction; and
7. clinicians' familiarity (or previous training).

A previous systematic review, however, indicated that all types of functional appliances were equally effective in successfully reducing an overjet to normal limits.⁷ The widespread use of the Twin Block in Malaysia might be explained by the number of respondents who trained in the UK where the appliance is popular. Most of the present respondents were either UK trained orthodontists (50%) or underwent training locally (38%) based on the UK postgraduate curriculum. It may be possible that respondents had more exposure to the Twin Block appliance during their specialty training.

A recent local audit¹⁶ which assessed the timing of Twin Block appliance therapy found that 82% of patients started treatment at CVM CS3 or CS4 as the optimal period for growth modification.¹⁷ The mandibular growth peak is expected to occur during the year after CVM CS3 or to have occurred within 1 or 2 years prior to CVM CS4. It has been further reported that the peak in mandibular growth is expected to occur 1 year after CVM CS2, or has ended at least 1 year before CVM CS5, which suggests that stages other than CVM CS3 and CS4 are either considered too early or too late for treatment via growth modification. It is noteworthy that only 16.7% of respondents in the present study felt that referrals were received at an ideal age. This may be due to a lack of awareness by general dentists and patients to seek or refer for early treatment. In addition, inappropriate timing may be related to long waiting times especially in government sectors with large patient volumes and extensive waiting lists.

A number of randomised controlled clinical trials have been conducted to further clarify the effects of early functional appliance treatment compared to untreated control subjects.^{18–20} The trials indicated

that there was a small but significant increase in mandibular growth initially involving those treated early with functional appliances, compared with treatment as a one phase procedure in adolescence. However, the treatment gains were disappointingly lost in the long term as there was no clinically significant difference in skeletal change between those who were treated early with a functional appliance and those who were not. It was also reported that no significant difference in extraction pattern, tooth alignment, final occlusion and psychosocial benefits between the two groups. Early treatment with a functional appliance was also found to prolong the overall treatment time and incur a greater cost. Nevertheless, a small number of clinicians (11.1%) in the present study still offered early functional appliance treatment for Class II correction. Possible reasons for providing early treatment include concerns from parents, teasing or bullying at school and the risk of dental trauma associated with an increased overjet.^{21,22} This would likely explain the increased retention period of more than six months (12.5%), as reported by some respondents.

An additional local audit investigating the success rate of treatment with the Twin Block appliance found a 64.4% success rate.¹⁶ A broken lower Twin Block component was the most frequently reported reason for unsuccessful treatment or poor compliance (35.6%). This type of breakage is often an indication of poor wear compliance. Suboptimal compliance has been reported as a disadvantage of removable appliances, and it is common for patients to overestimate the duration of wear.²³ This will affect the success of treatment. In the current study, patient compliance was reported to have the greatest influence on appliance selection by the respondents, and that the Twin Block was perceived to elicit the best patient compliance. While this was based on the respondents' personal experience, they may not have been exposed to the various types of functional appliances in order to make an impartial comparison. More than two-thirds of participants also felt that their choice of appliance was limited by their laboratory support. Despite the shortcomings of removable appliances, cost was reported to be the biggest deterrent preventing the use of fixed functional appliances.

The findings of the present study highlight the need to improve the timing of referrals for Class II correction in order to optimise growth related functional appliance treatment. It is suggested that this might

be achieved by improving public awareness regarding growth modification treatment, as well as educating dentists on identifying patients suitable for early referral. There is also a need to address the problems relating to poor compliance or offer alternative treatments. It has been further suggested that effective communication, prescribed wear duration, the use of reminding tools, and physical alteration of the appliances to reduce bulk might increase patient compliance.²⁴ Improving reliability and affordability of available fixed functional appliances may also offer alternative options for Class II correction with reduced reliance on patient compliance.

Study limitations and future recommendations

The results of the present study must be interpreted with caution as the responses from the participants may not reflect the opinions and practices of all orthodontists in Malaysia. The present study was limited to MAO members and therefore suffered from a reduced response rate. It is believed that the sample may have experienced survey fatigue due to the large number of research surveys being conducted during the height of COVID-19 pandemic. The implementation of a national specialist register in the foreseeable future may improve sampling and increase the response rate and therefore the reliability of similar future studies.

Conclusion

The Clark Twin Block for the orthodontic correction of a Class II malocclusion is the most widely-used functional appliance in Malaysia.

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Conflict of Interest

The authors declare no conflict of interest.

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