

# A dualistic perspective on dental treatment procrastination

*Jie Huang<sup>1</sup>, Liqi Wang<sup>1</sup>, Yin Zhou<sup>1</sup>, Jiali Dai<sup>1</sup>, Xiaoyin Wu<sup>2</sup>, Yangke Zhao<sup>2\*</sup>*

<sup>1</sup>Savaid Stomatology School, Hangzhou Medical College, Hangzhou, China

<sup>2</sup>School of Basic Medical Sciences & Forensic Medicine, Hangzhou Medical College, Hangzhou, China

\*Corresponding Author. Email: zhaoyangke@hmc.edu.cn

---

**Abstract.** Dental fear is the primary cause of delayed dental treatment among patients, and this delay further exacerbates dental fear, perpetuating the cycle of postponed care. Previous studies have treated procrastination as a singular pathological behavior—an aimless, impulsive, and irrational avoidance of negative emotions—significantly associated with high levels of dental fear, low self-efficacy, and high neuroticism. In reality, active procrastination constitutes a strategic form of delay. Active procrastination involves consciously scheduling tasks, maintaining confidence in one's ability to complete them despite pressure, and avoiding actions that would objectively worsen the situation without offering any positive benefits. Distinguishing between active and passive procrastination is essential in this study. This distinction suggests that clinical paradigms should shift from single-focused treatments targeting procrastination toward individualized therapies addressing its underlying mechanisms. Only then can the vicious cycle of fear-treatment procrastination be broken.

**Keywords:** dental fear, active procrastination, self-efficacy

---

## 1. Introduction

Clinical findings indicate that high levels of dental fear are a significant reason why patients with oral diseases delay seeking timely treatment [1]. Dental fear, a common psychological disorder with a certain prevalence rate across countries [2], refers to a highly irrational fear response triggered by stimuli associated with dental procedures, exhibiting a severity significantly greater than ordinary anxiety reactions and manifesting as active avoidance [3]. This severely impacts people's emotions and behavior, not only intensifying patients' psychological stress at the time but also triggering a cascade of harmful effects. These include worsening oral health conditions, diminished quality of life, and a vicious cycle of dental fear, avoidance behaviors, escalating fear and leading to increasingly complex and painful dental treatments [4, 5].

Procrastination refers to the conscious delay of task completion despite time loss, often accompanied by negative emotions such as worry, tension, and guilt—even when the individual recognizes that starting the task sooner would facilitate its completion. However, procrastination is not a simple, single-dimensional concept, which can be divided into two forms: passive procrastination and active procrastination [6]. Passive procrastination is essentially an irrational, emotion-driven maladaptive behavior, the core of which is the failure of self-regulation [7]. It is usually closely related to personality traits such as neuroticism, low self-control, high self-doubt, and fear of negative evaluation [8, 9]. In contrast, active procrastination is defined as

an intentional, strategic delay in which the individual prefers pressure and is confident that he can complete the task before the deadline [6]. According to the "procrastination-health model", procrastination is a stable trait that can systematically predict adverse health behaviors and outcomes. Individuals tend to postpone healthy behaviors to the future, thus posing a potential risk to their own health [10]. On a personality basis, active procrastinators usually show higher extroversion and openness [11], and in some non-health areas such as education, it has been found to be associated with certain adaptive outcomes [12]. Most of research has confirmed that psychological factors such as self-doubt and fear of negative evaluation are important variables driving procrastination in adults [13], which are prevalent among patients with dental fear. But we examine these two procrastination patterns in the context of health management, particularly dental visits, patients may interpret their procrastination as "proactive" or "strategic" [14]. However, their underlying motivation may still be an underestimation of the severity of the problem, underlying anxiety, or a maladaptive strategy to cope with fear, rather than truly effective self-management [15, 16], which leads to lower dental fear but worse oral health.

Although some studies have begun to explore procrastination behavior in dental visits [13, 17], most existing studies have failed to systematically distinguish between active and passive procrastination patterns, especially regarding the specific role of active procrastination in dental fear situations, its interaction with passive procrastination, and how they jointly influence patients' medical decisions. Based on this, this article aims to systematically explore the characteristics, interrelationships, and influence pathways of active and passive procrastination patterns in patients with dental fear and their impact on their treatment behavior. By clarifying the intricate mechanisms of action between these two patterns and dental fear, it is hoped that this study will provide a new perspective for theoretical understanding of breaking the vicious cycle of dental fear and offer important empirical evidence for early identification of high-risk patients with procrastination and the development of targeted psychological and behavioral intervention strategies in clinical practice.

## **2. Procrastination and health**

Procrastination always manifests in various forms throughout population groups [18] impacting different aspects of daily lives and functions [19]. The key of trait procrastination is long-term and stable, of course unlimited time and situation. However, situational procrastination tends to defer when individuals in some specific scenes. For example, academic procrastination, refers to the behavior or tendency of students to procrastinate completing learning tasks, impacted by the five factor personality traits and students' self-responsibility [20, 21]. In the health related field, bedtime procrastination causes the deficiency of sleep time, thereby destroying health and life satisfaction [22]. A research investigates the relation between delaying sleep and sleep quality, believes a negative relationship between self-control and sleep onset delay, which negatively affects both sleep duration and quality [23].

A previous research finds that procrastinators tend to focus more on past or present rather than future goals [24], which makes individuals feeling good and helps them escaping negative emotion like anxiety and pressure [25], albeit at the cost of long-term benefits. Therefore, individuals with procrastination often find it extremely challenging to engage in activities that require advance preparation or sustained effort—such as going to bed earlier, exercising, seeking medical care, or adopting a healthy lifestyle [16]. Moreover, a longitudinal study found that stress mediates the relationship between procrastination and health, particularly regarding short-term physical health impacts [26]. What's more, the risk of procrastination will improve when in a high stressful situation [27], which maybe lead to symptoms happening or increase disease risk. And the procrastination-health model also suggests procrastination may add risks for hypertension and cardiovascular

disease [28]. When researchers explore which classification of individuals likes to defer, they discovered groups with low income, inadequate social security, and mild disease symptoms are more possible to delay seeking medical service [29], all of which shows harm to public health advancement.

Though procrastination is viewed as a detrimental habit or behavior most of time, is this real in reality? The perspective of a metacognitive model of procrastination suggests that positive cognitions about procrastination can lead person to choose to delay deliberately, with outcomes that are not entirely detrimental [30]. Active procrastination is defined as intentionally delaying starting task to better manage time utilization, achieving satisfactory work outcomes and performance at last. Individuals who use procrastination as a strategic delay—intentionally postponing starting to enhance work performance under time pressure and achieve greater efficiency [6]. This may stem from a preference for moderate stress levels [31], with positive procrastination indirectly fostering creative thinking through the role of creative self-efficacy [32]. This procrastinatory phenomenon shows active procrastinator's positive trait, such as high self-efficacy [33], emotional stability, extroversion [11] and good self-regulation [34].

So compared with passive delay, positive procrastination may have a positive effect on healthcare. When we talk about mental health, although research shows individuals with mental health issues exhibit higher procrastination tendencies [35], active procrastinators experience lower stress and depression levels [6] and report higher psychological well-being scores [36] and life satisfaction compared to negative procrastinators. The result perhaps is related with active procrastinators' boldness, which reflect confidence and pressure insensitivity [37]. Furthermore, positive procrastination can positively predict psychological resilience to some extent [38]. This may stem from the fact that active procrastinators require greater resilience to deal with challenges under pressure. There is similar result in adamecic learning. Active procrastinators among Korean undergraduates evidences they can achieve satisfactory academic achievement through the effects of flow and self-regulation [39].

Unlike traditional procrastination, active procrastination as a functional delay, represents an adaptive self-regulation [33]. Thus, high psychological well-being correlates positively with positive procrastination, potentially benefiting mental health development [40].

### **3. Passive procrastination inducing the vicious cycle in dental fear**

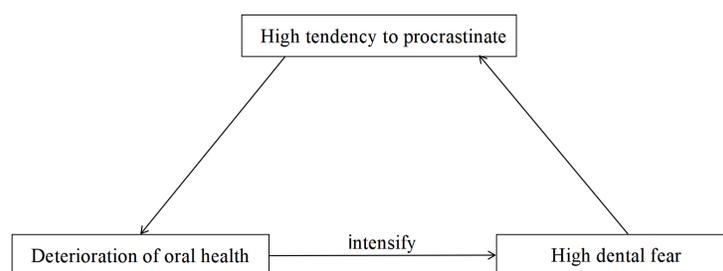
Procrastination in seeking dental care is a prevalent but problematic phenomenon within oral health, with deep psychological mechanisms. According to research by Steinvik [13] and Haycock [41], among others, it has been determined that delays in dental care are significantly associated with lower self-efficacy in oral health; the probability of delaying dental visits can be reduced by 78% for those with higher self-efficacy. This psychological characteristic is also accompanied by significant cognitive distortions: patients tend to have catastrophic expectations about the treatment process in advance, overestimating the possible intensity of pain and underestimating their ability to tolerate and cope with the pain [42]. Moreover, the anticipatory imagination of tasks can exacerbate procrastination behavior [43]. At the same time, the stronger the emotions produced by episodic future thinking, the higher the probability that delayed options will be preferred [44]. Prior to treatment, patients vividly imagine scenes of negative outcomes, such as the sound of the drill and discomfort during treatment, which induce negative emotions like anxiety and disgust, while they screen out neutral or reassuringly positive information [45, 46]. Notably, several studies have mentioned that the proportion of negative memories in dental fear is significantly greater than that of positive memories [47-49].

Furthermore, the process from excessive psychological concern to the formation of genuine dental fear is closely related to brain functioning. When patients feel anxious in anticipation due to fear, brain areas

responsible for pain perception, such as the anterior insula and anterior cingulate cortex, are activated in advance [50, 51], therefore making anticipated pain turn into real physiological feelings. The experiment further confirmed that pre-activation of the anterior insula-ACC network is positively correlated with dental avoidance behavior in patients, indicating that the fear response becomes deep-rooted within the brain's self-preserving circuitry [52]. While this type of fear has become a subconscious alert response, simple statements of fact will not be able to dislodge it.

Correspondingly, the most common response of patients when fear is involved is to directly choose avoidance behavior to deal with anxiety [53]. Immediately postponing or canceling a dental appointment reduces anxiety, thus forming a typical negative reinforcement mechanism [54]. Even if patients may rationally recognize the long-term adverse consequences that can be caused by procrastination, the immediate comfort from anxiety relief is often a stronger driver for behaviors, thereby further consolidating this pattern of avoidance (Figure 1).

Ultimately, in actual treatment, the outcomes of such procrastination are often serious. Dental problems that could have been resolved with simple interventions in the early stages progress into complex conditions due to delayed treatment, subsequently requiring more invasive procedures. Treatments that become necessary are in turn more painful and complicated. This ironically confirms the patient's terrifying imagination of dental visits and thus forms a vicious cycle: fear leads to avoiding dental visits, avoidance leads to worsening dental problems, and worsened problems necessitate more painful treatments, further deepening the fear of dental visits [48, 55, 56].



**Figure 1.** A vicious cycle of passive procrastination in Dental Fear

#### 4. Active procrastination: a complex adaptive strategy

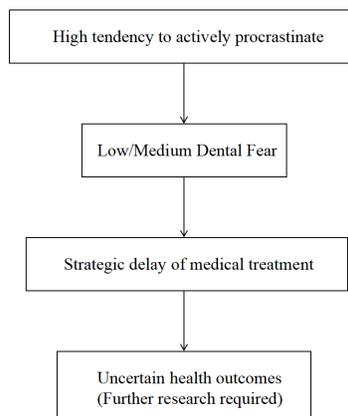
Active procrastination is a deliberate and selective behavioral pattern associated with specific psychological resources and personality traits. The pioneering research by Choi and Moran [57] described it selectively enduring delays to ultimately achieve satisfying outcomes. Personality traits are the decisive factors in proactive procrastination. Hoshino [17] and Zhe Shang [15] et al. found that extraversion, openness, and conscientiousness are generally positively correlated with active procrastination. Conversely, neuroticism shows a negative correlation with active procrastination; individuals high in neuroticism, being prone to anxiety, find it difficult to engage in controlled delays and are more likely to fall into dysfunctional passive procrastination. Agreeableness typically has no significant association with active procrastination, its influence being weak and highly dependent on the specific context. Multiple studies [58-61] indicate that active procrastination is significantly positively correlated with self-efficacy. Meanwhile, mindfulness is also positively correlated with active procrastination and self-efficacy plays a partial mediating role between mindfulness and active procrastination. This suggests that mindfulness not only directly promotes active procrastination but also indirectly enhances an individual's tendency towards it by boosting self-efficacy.

Additionally, although research in the field of dental health failed to directly confirm a significant effect of self-compassion on procrastination, some studies [62] generally indicates that self-compassion, as a positive psychological quality buffering stress, is associated with better self-regulation. It may provide necessary emotional support for active procrastinators during the delay period by reducing self-criticism and anxiety. Furthermore, because active procrastinators possess self-control ability, they can maintain their anxiety levels within a manageable range during the delay period and remain confident in their ability to control the task process and final outcome [13, 63, 64], making procrastination a strategic form of time management.

In the context of dental visits, procrastination behavior usually appears to be dysfunctional; however, active procrastinators show a different pattern of delay: strategic. While there is a postponement of their visits, they are able to complete treatment arrangements within their self-set "internal deadlines" [65].

Empirical research results [66] indicate that the relationship between active procrastination (Figure 2) and dental fear runs contrary to the traditionally perceived understanding. There is no significant positive correlation, and there is even a trend with the hint of negative correlation. fMRI evidence showed that during the pain anticipation phase, typical dental fear patients demonstrated significant activation in the anterior insula and anterior cingulate cortex [50, 52]. This early neural hypersensitivity constitutes the physiological basis of the fear-avoidance cycle. Neuroimaging studies have pointed out time after time [67-69] that procrastination behavior is closely related to functional connectivity between the prefrontal cortex and emotion-related brain regions. In contrast, active procrastinators show more optimized functional connectivity of the prefrontal-limbic system, especially the inhibitory regulation of amygdala responses by the dorsolateral prefrontal cortex [70], thus enabling them to keep cognitive control while facing decisions on dental treatments and effectively block the spread of fear emotions.

Of course, while this pattern is adaptive, there exists a danger of over-optimism. Does this self-induced delay objectively accelerate the progression of oral diseases from simple to complex stages—from shallow cavities to deep cavities, and then to root canal treatments or even extractions, which are more costly interventions? This question awaits answers from specialized empirical research. After all, those who actively delay treatment may, due to their own good self-management, ultimately seek medical care and maintain satisfactory oral health in the short term [71]. However, the most critical factor is whether one can accurately assess their own critical threshold to prevent triggering more severe long-term pathological changes. Overall, this challenges the proposition that "procrastination is inherently negative".



**Figure 2.** Active procrastination strategy in Dental Fear

## 5. Conclusion

This study does not simply endorse the past understanding—that dental fear and treatment avoidance share a straightforward relationship—but instead advocates for a necessary distinction: whether avoidance is passive or active. This distinction offers a crucial insight that fundamentally reshapes our interpretation of patients' delayed treatment-seeking behavior, thereby revealing vastly different directions for therapeutic intervention.

The paper's greater significance lies in distinguishing between two types of procrastinators and proposing tailored intervention strategies based on their distinct clinical contexts: Interventions for passive procrastinators must prioritize breaking vicious cycles, focusing on altering catastrophic thinking and enhancing self-efficacy. The clinical picture for active procrastinators is more complex. The latter's issue stems not from fear-induced inaction but from the interplay between subjective self-control and the objective biological risks of oral disease. The intervention perspective should shift from merely alleviating fear to reshaping risk perception. Specifically, health education can clarify the pathological damage caused by delay, enabling the establishment of non-negotiable treatment deadlines in collaboration with the patient.

This presents clear requirements for future research: on one hand, developing assessment tools to facilitate rapid clinical diagnosis of which procrastination pattern a patient exhibits; on the other, designing long-term studies to further analyze the actual effects of various procrastination patterns. Based on this nuanced and potentially effective approach—making a subtle distinction between dental fear and non-dental fear to break the vicious treatment avoidance cycle—we may be able to explore a more refined and promising pathway to overcome treatment avoidance.

## References

- [1] AlMoneef, M., AlShethry, M., Alokla, M., AlMa2nie, M., AlMaziad, M., & Fernandez, R. (2022). Why patients delay seeking dental treatment—a survey. *Journal of Clinical Pediatric Research*, 1, 28–38.
- [2] Piechal, A., Siekierska, E., & Blecharz-Klin, K. (2025). Etiology of dental anxiety and dental phobia: Review. *European Journal of Dentistry*. <https://doi.org/10.1055/s-0045-1809146>
- [3] Bantel, D., Chmielewski, W. X., Brähler, E., Stöbel-Richter, Y., Zenger, M., Weil, K. M., & Berth, H. (2025). The dental anxiety scale (DAS) - psychometric properties and longitudinal findings among middle-aged adults. *BMC Psychology*, 13(953). <https://doi.org/10.1186/s40359-025-03304-9>
- [4] Riley, J. L., Gilbert, G. H., & Heft, M. W. (2005). Orofacial pain: Patient satisfaction and delay of urgent care. *Public Health Reports*, 120(2), 140–149. <https://doi.org/10.1177/003335490512000207>
- [5] Avramova, N. T. (2022). Dental fear, anxiety, and phobia; causes, diagnostic criteria and the medical and social impact. *Journal of Mind and Medical Sciences*, 9, 23.
- [6] Chu, A. H. C., & Choi, J. N. (2005). Rethinking procrastination: Positive effects of “active” procrastination behavior on attitudes and performance. *Journal of Social Psychology*, 145(3), 245–264. <https://doi.org/10.3200/SOCP.145.3.245-264>
- [7] Snehitha, M., Kumar, R., Srinivasulu, G., Deepthi, A., Prathyusha, V., & Prasanth, P. S. (2021). Procrastination: Serious issue to be considered—a review. *Journal of Medical and Dental Science Research*, 8, 01–05.
- [8] Zohar, A. H., Shimone, L. P., & Hen, M. (2019). Active and passive procrastination in terms of temperament and character. *PeerJ*, 7, e6988. <https://doi.org/10.7717/peerj.6988>
- [9] Duru, E., Balkis, M., & Duru, S. (2023). Procrastination among adults: The role of self-doubt, fear of the negative evaluation, and irrational/rational beliefs. *Journal of Evidence-Based Psychotherapies*, 23.
- [10] Sirois, F. M. (2007). “I’ll look after my health, later”: A replication and extension of the procrastination–health model with community-dwelling adults. *Personality and Individual Differences*, 43(1), 15–26. <https://doi.org/10.1016/j.paid.2006.11.018>

- [11] Kim, S., Fernandez, S., & Terrier, L. (2017). Procrastination, personality traits, and academic performance: When active and passive procrastination tell a different story. *Personality and Individual Differences*, 108, 154–157. <https://doi.org/10.1016/j.paid.2016.12.016>
- [12] Wessel, J., Bradley, G. L., & Hood, M. (2019). Comparing effects of active and passive procrastination: A field study of behavioral delay. *Personality and Individual Differences*, 139, 152–157. <https://doi.org/10.1016/j.paid.2018.10.024>
- [13] Steinvik, L. M., Svartdal, F., & Johnsen, J.-A. K. (2023). Delay of dental care: An exploratory study of procrastination, dental attendance, and self-reported oral health. *Dentistry Journal*, 11(2), 56. <https://doi.org/10.3390/dj11020056>
- [14] Chowdhury, S. F., & Pychyl, T. A. (2018). A critique of the construct validity of active procrastination. *Personality and Individual Differences*, 120, 7–12. <https://doi.org/10.1016/j.paid.2017.08.024>
- [15] Shang, Z., Cao, Y., Cui, Z., & Zuo, C. (2023). Positive delay? The influence of perceived stress on active procrastination. *South African Journal of Business Management*, 54, 3988.
- [16] Sirois, F. M. (2017). Procrastination, health, and health risk communication. In Oxford Research Encyclopedia of Communication. Oxford University Press. <https://doi.org/10.1093/acrefore/9780190228613.013.157>
- [17] Hoshino, Y., Kataoka, S., & Ansai, T. (2023). Association of personality traits with dental visit procrastination by Japanese university students. *Biopsychosocial Medicine*, 17(33). <https://doi.org/10.1186/s13030-023-00288-z>
- [18] Ferrari, J. R., Diaz-Morales, J. F., O’Callaghan, J., Diaz, K., Argumedo, D., & (2007). Frequent behavioral delay tendencies by adults: International prevalence rates of chronic procrastination. *Journal of Cross-Cultural Psychology*, 38(4), 458–464. <https://doi.org/10.1177/0022022107301058>
- [19] Khan, S., Alzakari, M., Alsuhaibani, R., Alkanhal, A., Alghanmi, A., Alabdulkarim, A., Salahuddin, A., Huda, A., Moiz, M. U. A., & Alzkari, F. (2025). Assessment of chronic procrastination in Saudi Arabia: a cross-sectional study. *BMC Psychology*, 13(414). <https://doi.org/10.1186/s40359-025-02764-3>
- [20] Kağan, M., Çakır, O., İlhan, T., & Kandemir, M. (2010). The explanation of the academic procrastination behaviour of university students with perfectionism, obsessive–compulsive and five factor personality traits. *Procedia - Social and Behavioral Sciences*, 2, 2121–2125. <https://doi.org/10.1016/j.sbspro.2010.03.243>
- [21] Karatas, H., et al. (2015). Correlation among academic procrastination, personality traits, and academic achievement. *Anthropologist*, 20, 2.
- [22] Kroese, F. M., De Ridder, D. T. D., Evers, C., & Adriaanse, M. A. (2014). Bedtime procrastination: Introducing a new area of procrastination. *Frontiers in Psychology*, 5, 611. <https://doi.org/10.3389/fpsyg.2014.00611>
- [23] Hill, V. M., Rebar, A. L., Ferguson, S. A., Shriane, A. E., & Vincent, G. E. (2022). Go to bed! A systematic review and meta-analysis of bedtime procrastination correlates and sleep outcomes. *Sleep Medicine Reviews*, 66, 101697. <https://doi.org/10.1016/j.smr.2022.101697>
- [24] Specter, M. H., & Ferrari, J. R. (2000). Time orientations of procrastinators: Focusing on the past, present, or future? *Journal of Social Behavior & Personality*, 15.
- [25] Sirois, F. M., & Giguère, B. (2018). Giving in when feeling less good: Procrastination, action control, and social temptations. *British Journal of Social Psychology*, 57(2), 404–427. <https://doi.org/10.1111/bjso.12243>
- [26] Sirois, F. M., Stride, C. B., & Pychyl, T. A. (2023). Procrastination and health: A longitudinal test of the roles of stress and health behaviours. *British Journal of Health Psychology*, 28(4), 860–875. <https://doi.org/10.1111/bjhp.12658>
- [27] Sirois, F. M. (2023). Procrastination and Stress: A Conceptual Review of Why Context Matters. *International Journal of Environmental Research and Public Health*, 20(6), 5031. <https://doi.org/10.3390/ijerph20065031>
- [28] Sirois, F. M. (2015). Is procrastination a vulnerability factor for hypertension and cardiovascular disease? Testing an extension of the procrastination–health model. *Journal of Behavioral Medicine*, 38(3), 578–589. <https://doi.org/10.1007/s10865-015-9629-2>

- [29] Aslan, Y., & Özdil, Y. (2025). Examination of healthcare demand procrastination behaviors from a societal perspective. *Journal of Community Health Research*.
- [30] Fernie, B. A., Bharucha, Z., Nikčević, A. V., Marino, C., & Spada, M. M. (2017). A metacognitive model of procrastination. *Journal of Affective Disorders*, 210, 196–203. <https://doi.org/10.1016/j.jad.2016.12.042>
- [31] Chiu, S.-I., Chen, T.-Y., Chang, T.-L., & Chen, C. Y. (2020). Procrastination, dependence and social loafing: Comparison in high/low task visibility between active/passive procrastinators. *International Journal of Psychiatry Research*, 3, 1–11.
- [32] Liu, W., Pan, Y., Luo, X., Wang, L., & Pang, W. (2017). Active procrastination and creative ideation: The mediating role of creative self-efficacy. *Personality and Individual Differences*, 119, 227–229. <https://doi.org/10.1016/j.paid.2017.06.019>
- [33] Corkin, D. M., Shirley, L. Y., & Lindt, S. F. (2011). Comparing active delay and procrastination from a self-regulated learning perspective. *Learning and Individual Differences*, 21(6), 602–606. <https://doi.org/10.1016/j.lindif.2011.08.003>
- [34] Vincent, I. J., Law, M.-Y., Chew, Z. L.-K., & Lai, C.-S. (2024). Self-regulation and resilience: The role on active procrastination of young adults. *International Journal of Public Health*, 13, 1538–1547.
- [35] Shi, X., Wang, S., Liu, S., Zhang, T., Chen, S., & Cai, Y. (2019). Are procrastinators psychologically healthy? Association between psychosocial problems and procrastination among college students in Shanghai, China: A syndemic approach. *Psychology, Health & Medicine*, 24(5), 570–577. <https://doi.org/10.1080/13548506.2018.1546017>
- [36] Habelrih, E. A., & Hicks, R. E. (2015). Psychological well-being and its relationships with active and passive procrastination. *International Journal of Psychological Studies*, 7(1), 25–34. <https://doi.org/10.5539/ijps.v7n1p25>
- [37] Sanecka, E. (2022). Psychopathy and procrastination: Triarchic conceptualization of psychopathy and its relations to active and passive procrastination. *Current Psychology*, 41(2), 863–876. <https://doi.org/10.1007/s12144-020-00891-8>
- [38] Ajaikumar, N. (2021). A study investigating active procrastination and impulsivity as predictors of resilience in students. *Journal of Organisation & Human Behaviour*, 10.
- [39] Kim, E., & Seo, E. H. (2013). The relationship of flow and self-regulated learning to active procrastination. *Social Behavior and Personality: An International Journal*, 41(8), 1099–1113. <https://doi.org/10.2224/sbp.2013.41.8.1099>
- [40] Ismail, Z. (2016). Psychological well-being and its relationship with active and passive procrastination: A study on students of a business university in Karachi. *Academic Journal of Interdisciplinary Studies*, 5(2), 87–94.
- [41] Haycock, L. A. (1993). The cognitive mediation of procrastination: An investigation of the relationship between procrastination and self-efficacy beliefs. Unpublished doctoral dissertation, University of Minnesota.
- [42] Agarwal, N., & Sirts, K. (2025). Exploratory study into relations between cognitive distortions and emotional appraisals. arXiv Preprint. arXiv: 2503.15979
- [43] Jia-Meng, W., & Ting-Yong, F. (2019). The effect of episodic future thinking on procrastination: The dissection effect of contents of task. *Journal of Psychological Science*, 42(3), 619.
- [44] Benoit, R. G., Gilbert, S. J., & Burgess, P. W. (2011). A neural mechanism mediating the impact of episodic prospection on farsighted decisions. *Journal of Neuroscience*, 31(24), 6771–6779. <https://doi.org/10.1523/JNEUROSCI.6559-10.2011>
- [45] Simon, S. L. (2002). Biased recall in anxiety: Competing forces of emotional avoidance and information processing biases. Unpublished manuscript.
- [46] Risløv Staugaard, S., Jøssing, M., & Krohn, C. (2017). The role of negative and positive memories in fear of dental treatment. *Journal of Public Health Dentistry*, 77(1), 39–46. <https://doi.org/10.1111/jphd.12169>
- [47] Klages, U., Ulusoy, O., Kianifard, S., & Wehrbein, H. (2004). Dental trait anxiety and pain sensitivity as predictors of expected and experienced pain in stressful dental procedures. *European Journal of Oral Sciences*,

- 112(5), 477–483. <https://doi.org/10.1111/j.1600-0722.2004.00167.x>
- [48] Armfield, J. M., Stewart, J. F., & Spencer, A. J. (2007). The vicious cycle of dental fear: Exploring the interplay between oral health, service utilization and dental fear. *BMC Oral Health*, 7(1). <https://doi.org/10.1186/1472-6831-7-1>
- [49] Babel, P. (2014). The effect of affect on memory of pain induced by tooth restoration. *International Dental Journal*, 64(5), 246–251. <https://doi.org/10.1111/idj.12115>
- [50] Su, L., Yang, Z., Jackson, T., Chen, H., & Huang, C. (2016). The formulation of fear of pain and its influence on pain perception. *Advances in Psychological Science*, 24(7), 1228. <https://doi.org/10.3724/SP.J.1042.2016.01228>
- [51] Yidan, S., & Xin, Y. (2025). Functional MRI study on anxiety-enhanced temporomandibular joint pain. *Journal of Shanghai Jiao Tong University (Medical Science)*, 45(2), 342.
- [52] Wannemueller, A., Margraf, J., Busch, M., Jöhren, H.-P., & Suchan, B. (2024). More than fear? Brain activation patterns of dental phobic patients before and after an exposure-based treatment. *Journal of Neural Transmission*, 131(4), 393–404. <https://doi.org/10.1007/s00702-024-02754-6>
- [53] Hong, F., Chen, P., Yu, X., & Zeng, J. (2023). Prevalence of dental anxiety among adults in China: A meta-analysis. *Hua Xi Kou Qiang Yi Xue Za Zhi (West China Journal of Stomatology)*, 41(1), 88–98. <https://doi.org/10.7518/hxkq.2023.01.012>
- [54] Zuo, X., & Hong, S. (2022). Research progress of chronic pain and memory bias. *Advances in Social Sciences*, 11(1), 50–56. <https://doi.org/10.12677/ASS.2022.111009>
- [55] Genco, R. J., Williams, R. C. (2010). *Periodontal disease and overall health: A clinician's guide* (pp. 254–263). Professional Audience Communications Inc.
- [56] Li, Y., Zhang, Y., Huang, J., Wu, X., Hu, W., & Zhao, Y. (2025). Work along both lines: A modified model of the vicious circle of Dental Fear and Anxiety (DFA). *Journal of Clinical and Translational Technology*, 3, 40–44. <https://doi.org/10.54254/3049-5458/2025.24232>
- [57] Choi, J. N., & Moran, S. V. (2009). Why not procrastinate? Development and validation of a new active procrastination scale. *Journal of Social Psychology*, 149(2), 195–211. <https://doi.org/10.3200/SOCP.149.2.195-212>
- [58] Cao, L. (2012). Examining 'active' procrastination from a self-regulated learning perspective. *Educational Psychology*, 32(5), 515–545. <https://doi.org/10.1080/01443410.2012.689358>
- [59] Eerde, W. V. (2004). Procrastination in academic settings and the Big Five Model of personality: A meta-analysis. In H. C. Schouwenburg, C. H. Lay, T. A. Pychyl, & J. R. Ferrari (Eds.), *Counseling the procrastinator in academic settings* (pp. 29–40). American Psychological Association. <https://doi.org/10.1037/10808-003>
- [60] Taura, A. A. (2017). Relationships between motivational beliefs and active procrastination: The mediating role of self-regulation. *ATBU Journal of Science, Technology and Education*, 5, 86–94.
- [61] Wolters, C. A. (2003). Understanding procrastination from a self-regulated learning perspective. *Journal of Educational Psychology*, 95(1), 179. <https://doi.org/10.1037/0022-0663.95.1.179>
- [62] Sirois, F. M. (2014). Procrastination and stress: Exploring the role of self-compassion. *Self and Identity*, 13(2), 128–145. <https://doi.org/10.1080/15298868.2012.712873>
- [63] Wolters, C. A., Won, S., & Hussain, M. (2017). Examining the relations of time management and procrastination within a model of self-regulated learning. *Metacognition and Learning*, 12(3), 381–399. <https://doi.org/10.1007/s11409-017-9164-9>
- [64] Qian, X. (2021). Impulsivity and passive and active procrastination: The mediating effects of need for cognitive closure. *Current Psychology*, 40(3), 1320–1329.
- [65] Lu, C., Pan, F., & Fang, F. (2021). Relationship between active or passive procrastination and mindfulness, and self-efficacy of college students. *Journal of Shandong University (Health Sciences)*, 59(7), 108–113.
- [66] Huang, J., Gao, J., Li, Y., Lin, H., Weng, Y., & Lu, K. (2025). Exploring the influence mechanism of mental toughness on dental fear—a mediation model. *Scientific Annals*, 14, 225–232. <https://doi.org/10.3724/SP.J.1042.2025.01228>

[//doi.org/10.12677/sa.2025.145140](https://doi.org/10.12677/sa.2025.145140)

- [67] Zhang, S., Liu, P., & Feng, T. (2019). To do it now or later: The cognitive mechanisms and neural substrates underlying procrastination. *Wiley Interdisciplinary Reviews: Cognitive Science*, 10(6), e1492. <https://doi.org/10.1002/wcs.1492>
- [68] Chen, Z., Liu, P., Zhang, C., & Feng, T. (2020). Brain morphological dynamics of procrastination: The crucial role of the self-control, emotional, and episodic prospection network. *Cerebral Cortex*, 30(6), 2834–2853. <https://doi.org/10.1093/cercor/bhz278>
- [69] Feng, T., Wang, X., & Su, T. (2021). Developmental cognitive mechanism and neural basis of procrastination. *Advances in Psychological Science*, 29(4), 586.
- [70] Liu, P., & Feng, T. (2017). The overlapping brain region accounting for the relationship between procrastination and impulsivity: A voxel-based morphometry study. *Neuroscience*, 360, 9–17. <https://doi.org/10.1016/j.neuroscience.2017.07.042>
- [71] Orhun, Y., Cohn, A., & Raymond, C. B. (2024). Motivated optimism and workplace risk. *The Economic Journal*, 134(651), 2951–2981. <https://doi.org/10.1093/ej/ueae024>