

A DECENTRALISED BLOCKCHAIN DENTISTRY DURING AND AFTER THE COVID 19 CRISIS

Jeyaraj Brintha Jei^{1,*}, Samson Behin Sam², Kuttae Viswanathan Anitha³

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Abstract

Blockchain is a systematic data registration mechanism that makes the system difficult or impossible to hack, change or cheat. A blockchain is a chain consisting of a complete ledger or database of all transactions that can be publicly distributed to all users. In dentistry, blockchain technology is protective and trustworthy to exchange data to preserve patient information and transactions. This helps to turn the bulkier paper records into a digital archive that can be accessed internationally and helps the dentist, patients, and colleagues. It is commonly used in different industries, such as the food industry, medical health care, forensics, banking, etc. This technology can integrate various workflows and allows patients to preserve good dental health and also enables patients or participants to make simple transactions without a third party. This paper discusses how this technology can be used in the management of patient records, holding appointments, cashless payment transactions, confidential transfer of patient reports to the specialized dentist during and after the pandemic situation of Covid 19.

Keywords: Blockchain Technology, Transactions, Dental Forensic, Dental Health Record

Introduction

Blockchain technology has become a significant electronic health care technology that helps to sustain the environment of health care. It helps to turn the bulkier paper documents into a digital archive that can be accessed internationally and helps the dentist, patients, and peers (Engelhardt, 2017). It makes simple transactions without third parties, too. These digital records are also used, particularly during the disaster, as forensic records (Greenberger, 2019). The information stored in this technology is well protected, modified and trustworthy as it can be limited by date and time. The data and transactions can be accessed globally

via this blockchain technology, as it is transparent and reduces the patient's time and expense. Blockchain technology helps to maintain a shared ledger that helps to interpret, monitor and maintain dental data (Agbo *et al.*, 2019). This also prevents the unauthorised party from accessing the patient's data that is responsible. In order to have good internal controls, better performance, productivity, reduce the risk factor and preserve the work flow cycle, this technology is built in such a way. The use of blockchain technology in dental health care and the benefits of using this technology are defined in this article. Dentist-patient transactions are also

^{1*} Department of Prosthodontics, SRM Dental College, Ramapuram, Chennai, E-mail: brinthaiei@yahoo.co.in

² Department Of Computer Science, Dr Ambedkar Government Arts College, Vyasarpadi, Chennai

³ Department of Prosthodontics, SRM Dental College, Ramapuram, Chennai

*Corresponding author

handled by a third-party company. A bank, loan, master or visa card provider is required to complete the transaction while performing digital transactions (Gordon *et al.*, 2018). Blockchain technology has come into existence to solve this problem. This helps to achieve a decentralized atmosphere without a third party (Joda *et al.*, 2019).

In the field of digitization, blockchain technology is a momentous technical breakthrough. The distributed ledger principle for the accounting of vast amounts of patient data is the foundation of this technology. This helps to redefine hospitals, institutions and departments of dentistry. The effect of this blockchain technology on financial services, development, fashion, transport, entertainment and healthcare is overwhelming (Isalamah *et al.*, 2019). This effect arises, therefore, through the enriched use of the digital world's regionalized global infrastructure. This technology connects patients, physicians, organizations and society together. The definition of this technology came into existence after the clatter of the global financial industry in 2008 (Nakamoto, 2008). This digital technology has been assisted by a system of rules that ensure the accuracy of data exchanged across billions of computers around the world in distributed calculations without the need for a trustworthy third party such as Mastercard, bank, visa card, etc. Blockchain transaction information is exchanged and open to all nodes involved in it. This attribute makes the system much more transparent than a third party's centralized transaction. For transactions, the nodes in the blockchain are more stable. The very first application which implemented this blockchain technology was Bitcoin (Patel *et al.*, 2018).

Blockchain

A blockchain is a chain consisting of a complete ledger or database of all transactions that can be publicly distributed to all users. Every single block is a data structure with a header and body (Alhadhrami *et al.*, 2017). This header preserves various bookkeeping details such as timestamp, block edition, identification of cryptographic hash, etc. There is a transaction counter in the body of the block with all approved transactions 'Figure. 1'. It was possible to restrict the number of transactions by the size of the block. The block chain's starting block is known as the block of genesis. By adding newer blocks to the already existing blocks in the chain, the chains keep-in scale. So, to be sure, blockchain technology is a worldwide technology that changes the global economic order. This will connect users from all corners of the globe and allow them to make safe data transactions (Puthal *et al.*, 2018).

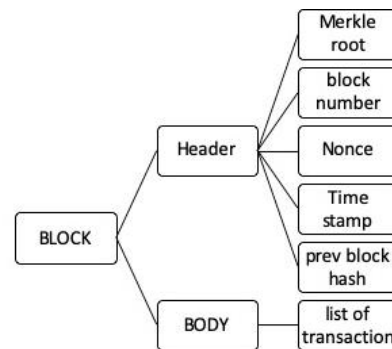


Figure 1. Parts of blockchain

Blockchain is a hybrid of two cryptographic and peer-peer networking systems. One who perpetuated this one with Bitcoin white paper was Satoshi Nakamoto (Nakamoto, 2008). This has served as an alternative to the centralized system and has lower costs, protection, few high-speed errors and failure elimination. This process does not require network participants to trust one another but it has an integrated trust mechanism that is cryptographically allowed. All the details of the transaction are directly added to the blockchain ledger and the need for third party intermediaries is removed. In the form of a chain, the blocks in the blockchain are kept together by a method called mining (Ostapenko, 2019). The pending transactions are turned into a mathematical puzzle. The miners can solve this puzzle and generate hash by using letters and numbers in the block. This hash may therefore retain the digital version of the wax seal for each cube. Block chain technologies may be public, private or consortium-based. The public blockchain can allow anyone to join, Whereas consortium blockchains accessible to a closed group of permitted members. But the private blockchain has centralized management and ownership (Witchey, 2019).

Dental blockchain

Blockchain is used not only for financial transactions, but also for automated record keeping. Oral health is said to be very critical and, according to the latest WHO survey, oral problems are one of the prevalent diseases in society since they cause discomfort, pain, mobility of teeth, gum diseases, loss of teeth, cancer, abscess, swelling, etc. So as of now the dental treatment is time consuming procedure and little expensive. Around 20% of the overall budget is spent solely on dental issues in developing countries, primarily due to poor oral hygiene, increased consumption of carbohydrates, tobacco use, etc. Via data collection, sharing and analytics, dental health information can therefore be

stored in the blockchain. Therefore, block chain cryptographic approaches will allow a secure, more efficient and effective method of maintaining the dental care record (Xia *et al.*, 2017). These records can be kept through many computers because these data cannot be altered or changed retroactively without changing all successive blocks and collusion with the complete network. Blockchain would thus have an overwhelming disruptive effect on the global economy and culture, including the exchange of data on dental health care. It also increases patient and peer trust as it offers a distributed archive of data, accountability, record irreversibility and peer-to-peer transmission.

By using distributed ledger technology, Blockchain can also be used for dental forensic purposes (Shen *et al.*, 2019). As the blockchain guarantees 1) genuineness and transparency of data transactions using information protection mechanisms like digital signature of private and public key 2) It also gives fair access privileges to all registered participants to access the records 3) it is used in decentralized environments and allows access the victim record from anywhere at any time 4) the most important aspect of this technology is that it can use immutable time stamps to monitor transactional data in chronological order.

Discussion

In 2017, dentistry acquired the first Dentacoin blockchain technology and used it for protective transactions among patients, dentists and market participants (Genestier *et al.*, 2017). The patients pay the sum for the ongoing dental care on a monthly basis through the blockchain. It also helps us remotely maintain dental records, clinical information and reviews. This blockchain has turned the paper records of dentistry into a simple digital file. This allows for simple and fast transfer of data between professions and practices. So, any dental professional can access the data with just a click of the computer by using the patient's dental name and password without waiting for records or documentation. The dentist can only update the block and duplicate the modified records through the digital network and all these entries are stamped with date and time. It also allows us to handle cash and billing worldwide. Blockchain technology is the basis of the fourth industrial revolution, according to Alex Tapscott, as it unifies and links participants (Hau *et al.*, 2021). Patients will also receive lifelong, prevention-based dental treatment with reduced costs and satisfaction.

In the digital record, the workflow is preserved, including diagnosis, care plan, type of treatment

obtained, treatment fees and examination. Blockchain operates on an asset theory that requires policies and statements; participants that includes patient, dentist, clinic and finally the other principle is transactions. The blockchain can record the events each and every time the asset, participant and transaction are made, removed or modified and can add it to the immutable audit trail on the dispersed ledger (Wong *et al.*, 2018). The data processing is redefined by various blockchain healthcare applications and helps sustain interconnections between different health sectors and health researchers. This technology offers secure dental data storage, data sharing and data control (Jaideep, 2019, Khatoon, 2020). Blockchain technology, according to Gordon and Catalini, allows patient-centered control of health care data and helps access network-wide patient recognition, management of huge amounts of health information and immutability of data (Puthal *et al.*, 2018). Shen *et al.* introduced a way to exchange health data using Medchain, using sensors and mobile applications to leverage blockchain and peer-to-peer networks (Shen *et al.*, 2019,). The blockchain could manage patient information effectively and that maintaining patient records by providing privacy and security could be a good technology (Radanovic *et al.*, 2018). Blockchain technology was a more stable and efficient method for managing medical records (Salagare *et al.*, 2020). Digital protection is said to be a major problem due to privacy breaches and hacking. However, the capabilities of blockchain technology make it promising to meet the requirements of consent management and preserve secure records. The numerous advantages were data security, removal of third parties, identification of management, transactions, decentralized network, improvement of patient trust, improvement of registered member privacy and handling of sensitive information (Lindman *et al.*, 2017).

In dentistry, this technology provides researchers, dental care professionals, and patients with various benefits. It serves as a single storage location for all dental data, helps to track customized data and to set access permissions for records at a granular level. The researchers will also collect multiple data on the disease of patients of various socio-economic, geographical and ethnic backgrounds (Tapscott *et al.*, 2016). The blockchain of dental care will enhance the development of new smart dental health provider applications that could bypass the latest dental research and improve dental treatment based on research and provide the patient with personalized dental treatment. The method of using blockchain to provide patient prescription includes patient ID, drug ID, expiry date, review date, etc.

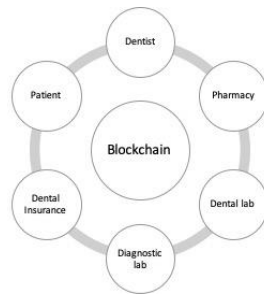


Figure 2. Blockchain communication to dentistry

Blockchain has also been involved in exchanging prosthesis information on the size, shape, shade of the teeth, type of prosthesis material to be used, prosthesis design, etc. It can be passed directly to the approved dental laboratories 'Figure .2'. If the patient needs some radiographs or laboratory tests, the information can be submitted directly via blockchain to the respective centres and the reports can be instantly uploaded or posted directly to the blockchain by the laboratories. This encourages the patient not to hold paper records and also helps laboratory individuals minimise printing and shipping costs. This helps in emergencies as it has restored patient information, which can be visualised in any part of the world at any time by any dental professional.

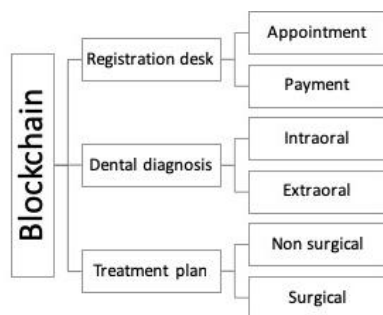


Figure 3. Schedule of dental blockchain

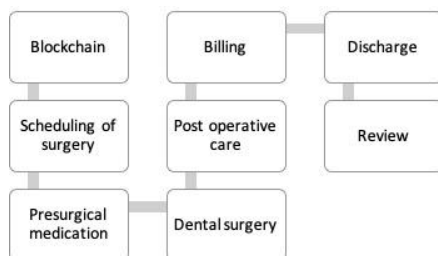


Figure 4. Patient management blockchain

The primary aim of using this digital blockchain technology is to speed up the whole process and support the patient at the earliest. The dental insurance scheme also uses this equipment and assists in payment for dental health care. The dentist will then be able to begin the procedure with the patient at the earliest because this technology helps to track the whole process through the automated system. It also helps to reduce the human error of responding manually to a request for prior authorization and to avoid misinterpretation of manually written authorization forms. The dental health insurance provider is able to assess and the insurance claim details can be uploaded to the blockchain. The patient, dentist, pharmacy and laboratory can now check the policy specifics at any moment due to this automated process. This blockchain technology helps maintain registration desk, medical approval, surgical scheduling, pre-operative diagnostic checks, consent recording, pre-operative patient care, post-operative management, billing, examination, etc. during dental surgery, and all these information are incorporated into the patient's surgical record 'Figure. 3'. The hospital visit, care plan and payment information are recorded during the entire procedure 'Figure. 4'. It also helps to quickly analyse previous surgical cases (Vazirani, 2019). This paper explores and proposes the current need for the dental health industry to use blockchain technology that helps to preserve personalized dental health, especially during and after COVID 19.

Conclusions

In health care technology, blockchain technology is emerging as a major revolution. This would maintain a permanent record for dental patients. By providing trust where no one endures unlimited access to medical data, it will boost patient's wellbeing by specifically connecting information to clinical and financial outcomes. These records may be exchanged between computer networks and registered users of a network. Globally, this technology would boost stable digital transactions. While this technology has a high impact, it has many disadvantages, such as people are not well versed with digital technology will initially struggle, and in regions with limited infrastructure and network capacity, this technology may not be used to the full extent. The overall blockchain technology is a boom for the dental sector during the pandemic scenario, such as COVID 19.

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