

**The Effect of Using Plyometric Training on the Development of Muscle Capacity and the Level of Performance of Spiking Skill for Young Volleyball Players under 17 Years of Age**

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***Abstract***

The research aims to identify the effect of plyometric training on the development of muscle capacity and the level of performance of the crushing skill of volleyball juniors under 17 years of age, and the research sample was deliberately tested among volleyball youth under 17 years old, and registered in the Iraqi Volleyball Federation for the 2019/2020 season, The number of individuals in the research sample was (30) players, and the results showed that there were statistically significant differences between the pre and post measurement in the variables of arm muscle capacity, leg muscle capacity and abdominal muscle capacity for the experimental group in favor of the post measurement, and statistically significant differences also appeared between the pre and post measurement in The skill variables are multiplication accuracy from center 6, multiplication accuracy from center 2, multiplication accuracy from center 3, multiplication accuracy from center 1, for the experimental group in favor of post measurement

***Key words:*** *plyometric training, muscle ability, level of spiking skill*

**Introduction**

Physical education is one of the most important areas of life that relied in solving its many problems on the scientific method and the sport of volleyball, as it is one of the important types of sports in the field of physical education. It has developed and advanced thanks to the adoption of scientific methods in the fields of education and training in order to raise its various elements to reach the highest levels of competition. In order to achieve this, sound scientific planning is required to develop, develop and raise the level of all the elements contributing to physical, skill and planning performance. The volleyball matches are characterized by the rapid pace and the continuous transition between attack and defense throughout the match, which requires that all players perform the basic skills at a close level so that each player can meet the needs of his position on the field, which requires increased attention to the preparation of junior teams in all physical and skill aspects, Schematic and psychological. (Abdel-Aty, 2001) that technical skills in volleyball are the basis for developing optimal linked performance in competitions because they are to each other, so we find the crushing blow depends on the ball reaching the prepared player at the appropriate height from the future player in order to return to the hitting player, so the crushing blow is done as required and all of this leads in successive time. (Darlene, 2006), (John, 2007) that the skill of smashing is considered one of the effective offensive skills in the sport of volleyball, with its great impact on the results of matches on the one hand, and on the other hand it plays an important role in reaching the highest effectiveness to reach the offensive tactical goal at the level of High by scoring points. (Ahmed, 2015) Peter Morgan and Elaine Wadih agree that muscular ability is one of the most important special physical components in volleyball, and the importance of using it in performing the skill of devastating hitting in developing the muscular ability of the muscles of the legs, trunk and arms. (Peter, 2003) , (Eileen, 2011) Everyone believes that the exercises of the lengthening-shortening cycle positively affect the development of the muscular capacity of the abdominal and arms crushing muscles, as well as

the accuracy of the performance of the performance of the hitting skill. (Khaled, 2003) , plyometric training leads to the development of the muscular ability of the legs and arms, and leads to the improvement and accuracy of the skill of crushing striking. (Mohamed, 2003) , that the use of plyometric training leads to the improvement and development of the flying trajectory of the crushing strike in volleyball, plyometric exercises are used to improve the relationship between maximum strength and explosive power, through the best use of energy Associated with describing a type of exercise characterized by high-degree muscular contractions of Muscular ability is a result of rapid lengthening of the general muscles, and the basic practical principle for developing muscle capacity is that the shortening contraction is stronger if it occurs immediately after the lengthening contraction of the same muscle or muscle group. It is scientifically known that when a sudden rapid lengthening of the muscle occurs, it contracts immediately to resist this condition. (Ali, 2000)

### **Literature review**

Research problem and its importance: Reaching young people to the highest level of good performance in volleyball is done through the development of various physical components, technical skills and tactical aspects in a way that increases their abilities to achieve the best performance in the previous variables and how to benefit from them in matches. The level of performance in volleyball in developed countries such as Italy, the Netherlands, Brazil, the United States of America, Japan, Cuba, Argentina and Korea in recent years has reached a distinguished stage in all previous respects, due to the benefit from the results of studies and scientific research, the development of devices and auxiliary tools and the use of scientific methods in training Volleyball Junior. Plyometric exercises are one of the most widely used methods in developing muscular ability for many sports activities that require merging maximum strength with maximum muscle speed. This method contributes to overcoming the problems that correspond to the development of muscular ability and in relation to the relationship between strength and speed and directing this muscular ability in its appropriate paths increases the level of performance speed (Mohamed, 2001) Volleyball is one of the sports activities that can benefit from plyometric exercises in developing muscular capacity. (Abdel-Aty, 2003) , and the results of the studies of Ilham Abd al-Rahman Muhammad (1997) , Ali Salama Ali (2000) , Abd al-Aty Abd al-Fattah, Khaled Muhammad Ziada (2003) , and Muhammad Metwallly Bandari (2003) indicated that the use of Plyometric training has improved the kinematic performance and accuracy of the crushing strike. In light of the foregoing and through the reference survey and the results of previous studies and specialized scientific references that the researcher was able to view, this study is unique to compare the effect of both weight training and plyometric training to determine which of them is more effective, influential and rapid on developing muscular ability and on the speed of gaining skill level Good for the skill of crushing hitting fors under 17 years old, as well as to determine the importance of junior coordination between the use of the two methods with weights and plyometrics in developing muscular ability throughout the training season, with a focus on training methods related to skill performance.

*Research aim:* to identify the effect of plyometric training on the development of muscular ability and the level of performance of the crushing skill of volleyball juniors under 17 years old.

*Research hypotheses:* There are statistically significant differences between the pre and post measurements of the control and experimental groups in favor of the post measurement in developing muscular ability and the level of performance of the crushing beating skill. There are statistically significant differences between the two dimensional measurements for each of the control group and the experimental group, and in favor of the experimental group.

### **Methodology**

First: Research Methodology: The researcher used the experimental method using the experimental design of two experimental groups.

Second: Research sample: The research sample was tested in a deliberate way among volleyball juniors under 17 years old, who are registered in the Iraqi Volleyball Federation for the 2019/2020 season. Junior and (10) juniors for the two experimental control groups, the researcher also conducted homogeneity and equivalence for the two groups to neutralize them, which would affect the results. It has proven that the two samples are homogeneous and equivalent.

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Physical tests used in the research:

The following physical examinations were used:

Throwing a medicine ball to the maximum distance of the preferred arm 3 kg/cm (muscular capacity of the arms) (10:38)

- Vertical jump with a step up/cm (measuring the muscular power of the legs) (2:267)
- Sitting with lying down 10 seconds / time (measuring the capacity of the abdominal muscles) (8:139)
- 18 m/s (transitional velocity measurement) (15:18)
- Sprint test 9-3-6- 3-9 /s (measuring agility) (15:42)
- Lifting the torso from prone/cm, w (flexibility measurement) (15:42)
- Throwing the ball at the wall / number (compatibility measure) (15:42)

Skill tests used in the research:

- Accuracy of the crushing skill. Attachment (3) .
- The accuracy of the diagonal crushing beating from the center (6).
- Accuracy of the Qatari attack from the center (2)
- Accuracy of offensive strike from the center (3)
- Accuracy of the offensive linear strike from 1 position (21)

These physical and skill tests have been used extensively, and scientific coefficients have been conducted on them, whose reliability coefficients ranged between 0.70: 0.94, and their validity coefficients ranged between 0.74: 0.96, which are high reliability and validity coefficients that can be taken into account in this research. (Darlen, 2006)

*Research devices and tools:*

(Volleyballs, light weights, box, tape measure, bars of iron, medicine balls, stopwatch)

Fifth: The exploratory studies: The researcher conducted the third exploratory experiment to ascertain the vocabulary of the program and to confirm the validity of the tools used in the program, as well as to find out the appropriateness of the exercises for the study sample or not, and also to determine the time of the intermittent rest periods, and finally to determine the intensity of the exercises, the number of groups and the repetition of the exercise within each group And that in the period from 13/6/ to 20/6 /.

*The plyometric training program: The researcher divided the program into three phases, which are as follows:*

The first stage: This stage is located at the beginning of the proposed training program and consists of three weeks with three units per week of the plyometric training program. The goal of this stage is to develop endurance of muscular strength as well as prepare the player in the stages in which the intensity is raised to high degrees.

The intensity of the training load: The researcher quantified the intensity of the training load in the first phase to develop the endurance of the strength for each player separately, where the intensity of the load started from (25%: 40%) of the maximum capacity of the individual using the low intensity interval training method with an average performance speed. The time for performing one exercise was (5 seconds) . (Swardt, 2007)

The size of the training load: The researcher determined the number of repetitions, ranging from (5:8), (6) groups.

Rest periods: The researcher set rest periods of (45-60 seconds) between each exercise and the other to develop the endurance of the force, (2: 3 minutes) minutes between each group and the other, and this force is sufficient to return the heart to a part of the normal state, meaning the pulse reaches 110: 120 beats/minute, and this was confirmed by the second exploratory study carried out by the researcher to determine rest periods.

The second stage: This stage consists of three weeks, starting with the beginning of the fourth week until the end of the sixth week, and aims to raise the maximum strength of the players in addition to developing muscle size.

The intensity of the training load: The researcher standardized the intensity of the load to develop the maximum strength and increase the size and strength of the working muscles in the second phase of the proposed program for each player separately, where the intensity of the load started From (80%: 85%) of the maximum intensity of the individual using the method of high intensity interval training The speed of performance is slow, and the time for performing one exercise was (7 seconds).

The size of the training load: The researcher determined the number of repetitions, so that it ranges between (3:4) repetitions, which decreases as the intensity increases, (4) groups.

Rest periods: The researcher set a rest period (60 seconds) between each exercise and another, (3:4) minutes between each group and another, and this period is sufficient to return to the recovery stage, and this was confirmed by the third exploratory study.

The third stage: This stage consists of six weeks and is specific to plyometric training exercises and begins with the beginning of the seventh week until the end of the twelfth week, and aims to develop the muscular ability of the players, as well as the player's interest in extracting the strength he gained in the previous stages as quickly as possible, and this stage is the last stage of the program before the competition.

**The proposed training program "Plyometric"**

- The researcher determined the general principles and rules of plyometric training exercises and progression with the components of pregnancy (intensity - volume - interfacial comfort) according to what was mentioned by (Aollan, 2006) (Abdel-Aty, 2003 AD) as follows:

- The plyometric training program must be preceded by a program of establishing weights as a prelude and establishment of muscular strength, and this is what the researcher did through the first two phases "endurance of strength through weights, and the second as "maximum strength" Through weights exercises characterized by the following:

The exercises should be similar in composition to the special technical skills in volleyball.

The muscle work in it is done by the same muscles involved in the skillful performance of volleyball.

The exercises should be performed under the prevailing energy production system in volleyball.

The plyometric exercises should be performed with a high intensity and a large range of motion, as the activity of the neuro-motor units the execution of movements in the shortest time and in an explosive manner.

- The player must push the ground with a very large force at the moment of impact to obtain the largest force imposed by plyometric exercises in a short time whenever possible and with a very high contraction speed.

The depth of the bending "forced stretching" must be proportional to the level of muscle strength of the legs by controlling the height of the box on which the deep jump is performed according to the players' abilities.

Tribal measurements: Tribal measurements were applied during the period from 22/6 to 26/6/.

The basic experiment: The basic experiment was applied during the period from 27/6/ to 27/9/9 and for a period of three months "12 weeks", with three training units per week on Sundays, Tuesdays and Thursdays.

- The plyometric training group underwent a program to develop the muscular capacity of the arms, trunk and legs, starting from the seventh week, through eight plyometric exercises for the same muscle group.

- The control group underwent the development of muscle capacity using the traditional program for the same muscle groups.

Tribal measurements: The dimensional measurements were applied after the completion of the training program for the individuals of the two research samples in the period from 9/28 to 9/30. It was taken into account that all measurements are carried out as was done in the tribal measurement.

Statistical treatments: The researcher used the sta tactical package (SPSS) version (23) .

**Results**

**Table (1) the significance of the differences between the pre and post measurements of the control group in the physical variables under study**

| M | Statistical coefficients Variables | dimensional measurement |      | tribal measurement |      | average difference | Sum of squared differences | Values (T) | % improvement |
|---|------------------------------------|-------------------------|------|--------------------|------|--------------------|----------------------------|------------|---------------|
|   |                                    | x ± p                   |      | x ± p              |      |                    |                            |            |               |
| 1 | arms capacity/cm                   | 9.02                    | 1.05 | 8.32               | 1.07 | 0.7                | 5.12                       | 14.3 *     | 8.41%         |
| 2 | Legs capacity/cm                   | 51.17                   | 4.6  | 48.7               | 6.2  | 3                  | 108                        | 6.67 *     | 5.1%          |
| 3 | Abdominal capacity/10sec           | 14.5                    | 1.27 | 12.6               | 1.17 | 1.9                | 43                         | 6.78 *     | 15.1%         |

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Table (2) the significance of the differences between the two measurements before and after for the members of the control group in the skill variables

| M | Statistical coefficients<br>Variables                      | dimensional<br>measurement |      | tribal<br>measurement |      | average<br>difference | Sum<br>squared<br>differences | of<br>Values<br>(T) | %<br>improvement |
|---|--|----------------------------|------|-----------------------|------|-----------------------|-------------------------------|---------------------|------------------|
|   |  | s                          | +p   | s                     | +p   |                       |                               |                     |                  |
| 1 | Accuracy of diagonal multiplication from center 6/degree   | 8.4                        | 1.78 | 7                     | 2.05 | 1.4                   | 110                           | 14 *                | 20%              |
| 2 | Accuracy of the Qatari attack hit from the center 2/degree | 9.1                        | 1.51 | 8                     | 1.76 | 1.1                   | 41                            | 8 *                 | 7.5%             |
| 3 | Accuracy of attacking attack from the center 3/degree      | 7.5                        | 1.70 | 5.6                   | 1.64 | 2                     | 93                            | 2.38 *              | 33.9%            |
| 4 | Accuracy of linear multiplication from center 1/degree     | 8.1                        | 1.43 | 6.5                   | 1.84 | 1.6                   | 52                            | 2.96 *              | 24.6%            |

Table (3) the significance of the differences between the tribal and remote measurements of the members of the plyometric training group in the physical variables under study

| M | Statistical coefficients<br>Variables | dimensional<br>measurement |      | tribal<br>measurement |      | average<br>difference | Sum<br>squared<br>differences | of<br>Values<br>(T) | %<br>improvement |
|---|---------------------------------------|----------------------------|------|-----------------------|------|-----------------------|-------------------------------|---------------------|------------------|
|   |                                       | x ± p                      |      | x ± p                 |      |                       |                               |                     |                  |
| 1 | arms capacity/cm                      | 10.02                      | 1.25 | 8.82                  | 1.16 | 1.11                  | 13.73                         | 8.88 *              | 13.6%            |
| 2 | Legs capacity/cm                      | 57.3                       | 6.97 | 49.2                  | 7.42 | 8.1                   | 747                           | 8.1 *               | 16.5%            |
| 3 | Abdominal capacity/10sec              | 16,3                       | 1.41 | 12.8                  | 1.68 | 3.5                   | 125                           | 20.6 *              | 27.34%           |

Table (4) the significance of the differences between the pre and post measurements of the members of the Plyometric group in the skill variables under study

| M | Statistical coefficients<br>Variables                    | dimensional<br>measurement |      | tribal<br>measurement |      | average<br>difference | Sum<br>squared<br>differences | of<br>Values<br>(T) | %<br>improvement |
|---|--|----------------------------|------|-----------------------|------|-----------------------|-------------------------------|---------------------|------------------|
|   |  | x ± p                      |      | +p                    |      |                       |                               |                     |                  |
| 1 | Accuracy of diagonal multiplication from center 6/degree | 9.6                        | 0.84 | 7                     | 2.26 | 2.6                   | 76                            | 8.39 *              | 37.14%           |
| 2 | Accuracy of the Qatari attack from the center of 2       | 10.1                       | 1.29 | 7.9                   | 1.79 | 2.2                   | 54                            | 8.8 *               | 27.8%            |
| 3 | Accuracy of attacking attack from the center 3/degree    | 8.4                        | 1.35 | 5.4                   | 1.42 | 3                     | 96                            | 11.54 *             | 55.5%            |
| 4 | Accuracy of linear multiplication from                   | 9.1                        | 1.55 | 6.7                   | 1.88 | 2.5                   | 68                            | 10 *                | 35.8%            |

|                 |  |  |  |  |  |  |  |
|-----------------|--|--|--|--|--|--|--|
| center 1/degree |  |  |  |  |  |  |  |
|-----------------|--|--|--|--|--|--|--|

**Table (5) the significance of the differences between the experimental and control groups in the post-measurement of the physical variables under study**

| M<br>the exams                | The total experimental |      | The total control |      | The difference between the two averages | Values T |
|-------------------------------|------------------------|------|-------------------|------|---|----------|
|                               | s                      | +p   | s                 | +p   |   |          |
| 1 arm capacity                | 10.02                  | 1.25 | 9.02              | 1.05 | 1                                       | 2.22 *   |
| 2 The ability of the two legs | 57.3                   | 6.97 | 51.17             | 4.6  | 6.13                                    | 2.20 *   |
| 3 Abdominal capacity          | 6.3                    | 1.41 | 14.5              | 0.27 | 1.8                                     | 2.86 *   |

**Table (6) the significance of the differences between the two groups of weights and plyometrics in the dimensional measurement in the skill variables under study**

| M<br>the exams   | experimental group |      | control group |       | The difference between the two averages | Values T |
|--|--------------------|------|---------------|-------|---|----------|
|  | s                  | +p   | s             | +p    |   |          |
| 1 Accuracy of the Qatari offensive strike from the center 6 / degree | 9.6                | 0.84 | 8.4           | 0.78  | 1.2                                     | 4.14 *   |
| 2 Accuracy of the Qatari attack hit from the center 2/degree         | 10.1               | 1.29 | 8.6           | 1.051 | 1.5                                     | 2.59 *   |
| 3 Accuracy of attacking attack from the center 3/degree              | 8.4                | 0.35 | 7.5           | 0.70  | 0.9                                     | 3.64 *   |
| 4 Accuracy of linear multiplication from center 1/degree             | 9.1                | 0.55 | 8.1           | 0.43  | 1                                       | 4.34 *   |

**Discussion of the results**

**1- Disc using the results of the control group**

Table (1) regarding the significance of the differences between the tribal and remote measurements of the control group shows that there are statistically significant differences in favor of the post-measurement of the physical variables in question "arms capacity - legs capacity - abdominal capacity", which confirms the effectiveness of the "traditional" training program in improving physical variables. The research is underway and this appears from the percentage improvement percentages for these variables, and thus the researcher sees that the traditional training program has improved the physical variables under study. Table (2) regarding the differences between the tribal and remote measurements of the control group for the skill variables shows that there are statistically significant differences in favor of the dimensional measurement, which indicates the effectiveness and positivity of the traditional program in improving the skill level of the skill variables under study, and this is evident from the percentage of improvement in the dimensional measurement for these variables. From the above, the researcher believes that the traditional program has improved the level of performance of the skill variables under discussion by raising the level of muscular ability. This is evident through the percentage improvement in the table, which confirms that the traditional training program has a positive effect on the level of maximum strength.

The researcher believes that the traditional program was used to train motor skills that depend on jumping and elevation, and this was indicated by (Zaki, 2012) , (Asmaa, 2016) that there is a link between muscular strength and general physical ability, which one of its components is muscular ability, which consists of strength. and speed. Thus, the first hypothesis of the research was achieved, which is: "There are statistically significant differences between the tribal and remote measurements of the control group in favor of the post-developing-measurement in muscular ability and the level of performance of the crushing beating skill."

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### 2- **Discussing the results of the second experimental group "plyometric training"**

It is evident from Table (3) that there are statistically significant differences between the tribal and remote measurements of the physical variables in favor of the dimensional measurements, which means and confirms the effectiveness of the proposed "plyometric" training program in improving all physical variables "arms capacity - legs capacity - abdominal capacity" as is evident Of the percentages of improvement for these variables, and these results agree with what Swordt (2007) pointed out that plyometric training develops and improves strength and speed "muscular ability" and agrees with the opinion of Heidercheit (2006) , David clutch (2003) that training Plyometrics have a positive effect in developing and improving muscular endurance. From the above, the researcher sees that the plyometric training program for the experimental group has improved the physical variables under study, and it is clear from the results of Table (4) that there is an improvement in the skill variables (Qatari offensive beating from Center 6 - Qatari attack hitting from center 2 - Offensive hitting from center 3- Linear multiplication from center 1) , by comparing the significance of the differences between the two measurements before and after the second experimental group "pilometric training" for these measurements, where the results appeared in favor of the post-measurement, as well as through the indication of the percentage of improvement. These results confirm the effectiveness of the proposed training program "Plyometric" in improving the level of skill performance. The results of this study agree with the results of David's study (2003) as well as with the results of a study (Ali, 2000) . From the above, the researcher believes that the proposed plyometric training method is effective in developing and developing each of the physical variables, the skill variables and the maximum strength under study, and thus the second hypothesis of the research has been achieved: "There are Statistically significant differences between the two measurements before and after the experimental group in favor of the dimensional measurement in the development of Muscular ability and performance level of the crushing skill

### 3- **Discussing the results of the significance of the differences between the measurements of the control and experimental group of the physical and skill variables under study.**

Table (5) regarding the significance of the differences between the two research groups in the post-measurement of the physical variables "arms capacity - legs capacity - abdominal capacity" shows that there are statistically significant differences in favor of the dimensional measurements of the experimental group, which confirms and indicates that the plyometric training program has a positive effect. On the development of these physical variables, and this also appears from the higher percentages of improvement of these physical variables for this group than the higher percentages of improvement for the control group, and these results agree with the results of the study of David Clutch (2003) and the results of the study of Wilson & Morphy (2006) that training The plyometric training program leads to an increase in the ability of the muscles to contract at a faster and shorter rate during the range of motion in the joint. And from the above, the researcher believes that the plyometric training program for the experimental group has a more positive effect than the traditional training program for the control group on the physical abilities under study. It is clear from the results of Table (6) There are statistically significant differences in favor of the experimental group "plyometric training" in the skill variables, which is due to the fact that the plyometric training pr ogram has improved the level of the variable The skill variables under study are more than the traditional training program has improved for the control group, and this shows that the improvement rates for the skill variables of the experimental group are higher than the improvement rates for these variables for the control group, and this is evident from Table (13) and (10) , and these results are consistent with the results of David's study Clutch (2003) and the results of the study of Morphy (2006) of the superiority of the plyometric training group over the weight training group in the motor performance of the vertical jump and some of the motor performances of the ascent. The researcher also attributed the reasons for this improvement for this group to the improvement of the physical variables and this is evident, which in turn affected the improvement of the skill variables, and that the higher the physical efficiency, the higher the special physical and skill abilities, and this is evident from the improvement of the maximum strength resulting from the training programs used (traditional, the results of these tables indicated the superiority of the "plyometric" experimental group program over the "traditional" control group program, which confirms that The plyometric training method is better in employing the acquired muscle physical strength and skillfully. Thus, the third hypothesis has been achieved that there are statistically significant differences

between the two dimensional measurements for each of the control and experimental groups and in favor of the experimental group in developing muscular ability and the level of performance of the crushing beating skill.

### Conclusions

- 1- There were statistically significant differences between the tribal and remote measurements in the variables of the ability of the muscles of the arms and the ability of the muscles of the legs and the ability of the abdominal muscles of the control group in favor of the post measurement.
- 2- There were statistically significant differences between the tribal and remote measurements in the skill variables, which are the accuracy of multiplication from center 6, multiplication accuracy from center 2, multiplication accuracy from center 3, multiplication accuracy from center 1, for the control group in favor of the post measurement.
- 3- There were statistically significant differences between the tribal and remote measurements in the variables of the ability of the muscles of the arms and the ability of the muscles of the legs and the ability of the abdominal muscles of the experimental group in favor of the post measurement.
- 4- There were statistically significant differences between the tribal and remote measurements in the skill variables, which are the accuracy of multiplication from center 6, multiplication accuracy from center 2, multiplication accuracy from center 3, multiplication accuracy from center 1, for the experimental group in favor of the dimensional measurement.

### Recommendations

1. Using the plyometric training method to develop the ability of the muscles of the arms, the capacity of the muscles of the legs, and the capacity of the abdominal muscles.
2. Using the plyometric training method to develop the skill of crushing hitting for volleyball juniors.
3. Be guided by the plyometric training program that is being studied extensively in the field of training young people.
4. The researcher recommends develop the echo studies to improve and skills of the transmission and wall.

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